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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Some Views of Gas-Works Transfers.

THE paper on "The Transfer of Gas and Water Undertakings to Public Authorities," read by Mr. William Newbigging at the meeting of The Gas Institute, is a useful statement of the practice followed in such cases; and if, in advocating the general desirability of arbitration as the best and safest way of ascertaining the bases upon which gas and water transfers can be made, the author laid himself open to the suspicion of chanting the praise of "leather," the impeachment is not a very grave one. He is probably right in this contention, since, though he speaks in his paper of the "commercial value" of a gas or water undertaking, the term is really only applicable to property of this order subject to an important qualification. There is no "market overt" to which either buyer or seller can appeal as the ultimate authority for settling any dispute as to value. The transfer of gas and water undertakings from companies to local authorities is always made by "private tender;" neither party having the alternative, open to ordinary dealers, of going to public auction. The consideration that there exist instances of local authorities unable to rise to the same sense of the value of their property that is possessed by the proprietors of gas and water undertakings, has moved Mr. Newbigging to suggest a half-measure in dealing with such cases in the public interest. This is that the local authorities might acquire only the distributing portion of the undertaking; leaving the companies to supply gas to them in bulk. In this way, as he truly says, a local authority might at least obtain something which they always make a great point of—the exclusive control of the streets, and the supervision of the purity and illuminating power of the gas. This might or might not prove an attractive expedient in the estimation of the local authority; but one hardly sees where the interest of the gas company comes into such an arrangement. It could never be truly worth while for either party to "take two bites at the cherry." Such a proceeding, in order to be fair to both sides, would require the safeguard of a provision enabling it to be terminated, after a certain notice, at the option of either. This would be impossible after public money had been raised for the purpose of carrying on and extending the business. At any rate, the suggestion is a creditable one to the author of the paper; for it is no easy matter to infuse the smallest novelty into an essay upon this well-worn subject.

Upon the general question of the expediency of the transfer of gas supply to local authorities, Mr. Newbigging very prudently kept silence; but some "high lights" were thrown upon the question, in the course of the discussion of the paper, by Mr. Alderman Miles, Mr. Stelfox, and others. Time was when the JOURNAL was roundly abused for adhering to the old-fashioned notion that popular elected authorities are not the best qualified bodies for carrying on manufacturing operations. We have not changed our opinions in this regard; and now even those who hold that gas supply ought theoretically to be in the hands of the ratepayers do not pretend that the system has no disadvantages. The thing has been done in many places, and done fairly well; but it is pretty generally understood by now that, as a rule, the consumer of gas or water is no better off under a municipality than he would be under a company. The ratepayer often benefits at the expense of the consumer; but the extent of the benefit and its real value are at best problematical. It is not correct to say, as Alderman Miles did in Edinburgh, with a disregard of the facts of this matter which is almost too general to be called a fault, that the mis-called surplus profits of a gas undertaking administered by a local authority which are paid over in relief of the rates would otherwise have gone into the pockets of a small portion of the community—to wit, the shareholders in the undertaking. He must be quite well aware, if he only thinks for a moment, that shareholders' dividends are a charge of precisely the same nature as the interest upon loans and the sinking fund which every gas undertaking has to pay when it becomes what is called the "ratepayers' property." In fact, it is not the ratepayers' property at all so long as the lender of money for capital purposes has a shilling outstanding upon it. The way in which capital is procured for purchasing gas undertakings from their first proprietors, who are truly the owners, very effectually conceals the real character of the new proprietary. If the money-lender were to hold the same position

in regard to a private business or estate as he does, in thin disguise, in respect of a "ratepayers'" gas undertaking, how much of his business or his estate would the private individual venture to call his own?

People who talk about these matters ought to understand more clearly than they commonly do the fundamental difference between the conditions of a gas shareholder and a ratepayer of a town to which a gas undertaking is stated to belong. The shareholder puts his own money into the gas company; and what he gets in return is his lawful recompense for the use of it. If there is no return, he loses both recompense and principal, and there is no compensation for the loss. The ratepayer does not put a farthing into the gas-works bought in his name, but borrows the money for the purpose, and charges all expense to the consumer; and yet he holds out his hand for the "profits" of the business—meaning hereby the surplus after an amount which would have provided the original proprietor with his dividend has been applied to satisfy and repay the money-lender. If the supply is in the hands of a company of proprietors, the Legislature requires that all the profits of the business shall either be limited to a certain rate, or, if permitted to rise above this rate, shall only do so on condition that, for every extra penny so paid, threepence shall be remitted of the charge levied upon the consumer. The ratepayer, or his representative on the Corporation Gas Committee, does nothing of this kind. He makes the consumer pay the most that can be got out of him, and pockets the surplus; and if only he can point to a neighbouring borough or two where the same course is followed, he thinks himself a benefactor of his town.

A Magistrate's Indiscretion.

Last week, a Tottenham Court Road tradesman was summoned by The Gaslight and Coke Company before Mr. Hannay, the Magistrate sitting at the Marlborough Street Police Court, for disconnecting his gas-meter, and laying, or causing to be laid, a pipe communicating with a pipe belonging to the Company without their consent. There was no suggestion of fraud in the matter; the defendant having, for reasons of his own, merely moved the meter from the basement of his premises into the area, and made a fresh pipe-connection. The Company prosecuted him because they wished to make it known, in the interests of the public as well as in their own, that no alteration may be made in their pipes without their consent. Defendant's excuse was that he did not know what was the law of the matter; and, having perceived an escape of gas at the meter, he sent for a gas-fitter, and told him to do whatever was necessary, and the fitter shifted the meter. Of course, the man would not have done this except to order; and the fact of the defendant not being aware that, in ordering or countenancing such a tampering with the service-pipe, he was committing an offence, is sufficient justification for the action taken by the Company. The Magistrate thought so too, for he inflicted the substantial fine of £6, with £2 2s. costs, upon the rash householder. If this had been all, it would hardly have been necessary to mention such an ordinary case here. But Magistrates occasionally talk at large about the business brought before them; and on this occasion, Mr. Hannay is reported in one of the daily papers to have talked about the cause of variation in gas bills. This topic does not obviously arise from anything mentioned in connection with the case he had before him. He remarked that he always received a "cautious" reply —the word is probably a misprint for "courteous"—to any complaint he had had occasion to make to the Company, "but he had never yet succeeded in learning from "them why it was that the cost of gas in one quarter some-"times so greatly exceeded that of the corresponding "quarter of the previous year without there having been "any alterations in the habits of the household, or any in-"crease in the number of lights. He sometimes imagined," he went on to say, "that the Company had some means "of compelling the public to use more gas by forcing "it through the pipes with an increased pressure." This observation, according to the newspaper report, was received with laughter in Court. Now, when people in Court laugh after a remark offered by the presiding authority, they are commonly presumed to laugh with the Court rather than at it. On this occasion, there might well have been a different meaning to the laugh; for the Magistrate's remark was undoubtedly both uncalled for and devoid of sense. If Mr. Hannay's intellect had but led him to suspect the Company of doing as he suggested, it might have led him a little farther, and induced him to seek the protection of a governor. The most objectionable aspect of this magisterial utterance is the glimpse it affords of the condition of the mind of a Judge who may at any time have to dispose summarily of a question of the reliability of a meter; for, according to law, consumers' meters are only allowed to be *primâ facie* evidence as to the correctness of a gas bill. It is open to the Courts to reject, upon sufficient contradictory evidence, the indications of a meter index, and to pronounce judgment upon general reasons as to the right amount of a gas bill. Hence it is highly injudicious on the part of any Magistrate to allow observations to escape him in Court which might be construed as indicating the existence in his mind of a prejudice against an order of possible litigants, which, if indulged, would militate against the prospects of their receiving justice at his hands in regard to a particular kind of case.

Questions of Municipal Finance.

An important question of accountancy in regard to the financial statements of British municipalities has been raised by Mr. George Swainson, the Borough Treasurer of Bolton. Mr. Swainson declares, in a letter to *The Times*, that things have now come to such a pass in connection with the accounts and audit of Parish Councils, County Councils, and Municipalities, that it is high time the public paid attention to the matter. The statement has been made with truth that hitherto the public have been content to suppose that the Local Government Board exercise some sort of supervision over municipal book-keeping; but this is not the case. Moreover, Mr. Swainson remarks that Corporations will never consent to come under the audit of the Local Government as at present regulated, mainly because the system of accounts which the Board insist upon is utterly inadequate to meet present circumstances and requirements. The London County Council will have nothing to do with the system, which follows the Poor Law Board method of stating "receipts and payments" instead of employing the proper basis of "income and expendi-"ture." Mr. Swainson justly points out that the Board of Trade requirements in regard to the accounts of gas, water, and electricity supply undertakings are based upon the principle he favours; and he asks why it is that the other Government Department is so differently advised. He asserts that the recent trouble at Salford was occasioned almost entirely by failure to bring the year's income and expenditure properly into the accounts for rating purposes; and he declares it to be quite possible to have a system of municipal book-keeping which would be easy of audit, and would yet prevent such a condition of things.

Upon another point of municipal book-keeping, Mr. Swainson has recently read a paper before the Corporate Treasurers' and Accountant's Institute. This refers to the capital statements of municipal undertakings. It is the ruling of the Local Government Board Audit Department that, as municipal loans are paid off, the asset to which they correspond must be written down by an equal amount; so that by the time the loan is paid off, the asset also disappears from the books. That is to say, if a municipality have paid off £50,000 of a gas loan of £100,000, the undertaking is only entered as worth the outstanding capital sum. This is, of course, nonsensical from one point of view. Mr. Swainson argues that all assets should be entered in the books at their first cost, so long as they continue to serve the purpose for which they were created; and that all accounts relating to them should be based upon revenue and expenditure. The latter requirement is just; but as to the former, it may be objected that it would be quite as misleading if, in a corporation balance-sheet, the corporate property were always to be entered at its first cost. This might be an improvement upon the Local Government Board system of wiping out what is paid off; but it would form no better guide to the financier or the ratepayer as to the real state of the municipal finances. A town hall or a bridge may be regarded as worth to the municipality just the figure at which it was first entered in the books, so long as the structure serves its proper purpose. But in the case of these unproductive, or not immediately productive, classes of property, their cost is really a liability; so that they only belong to the community so far as they are paid for. A new road bridge, for example, will represent a liability for its cost of (say) £10,000; but it is never a realizable asset, even when paid for. In the case of a gas undertaking, however, we have the example of a piece of municipal property which is always realizable, but is not truly

worth either the amount of the outstanding capital loan or the figure at which it was originally acquired. It has a commercial and structural value; and ratepayers ought to be able to find out what these values approximately are from the annual accounts of the municipality. There is no reason for a gas company proclaiming what the directors regard as the purchasing price of their property; but there equally does not appear to be any reason why municipalities who have nothing to fear from such publicity should not tell the people what the corporate property is worth.

Mr. James Dougall, youngest son of Mr. Andrew Dougall, the Engineer and Superintendent of the Hull station of the British Gaslight Company, Limited, has been appointed Engineer and Manager of the Hoylake and West Kirby Gas and Water Company, Limited.

Honours and Appointments on the Change of Government.—Among the honours and appointments which Her Majesty has been pleased to approve, on the recommendation of Lord Rosebery, in consequence of the recent change of Government, are the following: Mr. Arthur Arnold, the Chairman of the London County Council, is to receive the honour of knighthood; Mr. R. Giffen, C.B., the Comptroller-General of the Commercial, Labour, and Statistical Department of the Board of Trade, and Colonel V. D. Majendie, C.B., the Chief Inspector of Explosives for the Home Department, are to be promoted to the rank of K.C.B.; and the Hon. E. Chandos Leigh, Q.C., the Speaker's Counsel, is to be a C.B.

Mr. Ellery's Gas Institute Paper.—We are asked by Mr. C. Stafford Ellery to correct an error as to the returns of the make of sulphate of ammonia given in the second paragraph of the paper read by him at the recent meeting of The Gas Institute, and published in the JOURNAL last week. The figures in the first column are for the year 1892 (not 1894). The report for 1894 had not reached Mr. Ellery when he was preparing his paper; but he intended to add the figures for that year, which are as follows: Gas-works, 113,634 tons; iron-works, 10,075 tons; shale works, 32,891 tons; coke and carbonizing works, 3448 tons—total, 160,048 tons. The totals for the three years will stand as follows: For 1890, 134,257 tons; for 1892, 149,826 tons; for 1894, 160,048 tons.

Groves and Thorp's "Chemical Technology."—We have received from the Publishers (Messrs. J. and A. Churchill, of New Burlington Street) the second volume of the above work, which deals with the subject of "Lighting." Reserving for a subsequent issue of the JOURNAL a fuller notice of the book, we may mention that it contains five sections, in which the following subjects are treated by the gentlemen named: "Fats and Oils," by Mr. W. Y. Dent; "The Stearine Industry," by Mr. J. M'Arthur; "Candle Manufacture," by Messrs. L. and F. A. Field; "The Petroleum Industry and Lamps," by Professor Boverton Redwood; and "Miners' Safety-Lamps," by Professor Redwood and Mr. D. A. Louis. The third volume, comprising gas and electric lighting, lighthouse illumination, and photometry—these subjects being deal with by Mr. Charles Hunt, Dr. Garnett, Professor Redwood, and Mr. W. J. Dibdin—is nearly ready for issue.

The German Association of Gas and Water Engineers.—The thirty-fifth annual meeting of this Association was held on the 19th, 20th, and 21st of June, at Cologne, under the presidency of Herr Wunderlich, of Leipsic. It was decided that next year's meeting should take place in Berlin. Among the papers read was a valuable one on Westphalian gas coals, by Herr Hegener, of Kalk. In it he reviewed the history of the winning of coal in Germany from the inception of the gas industry, with special reference to the opening up of the Westphalian coal-fields. Dr. Knublauch spoke on the subject of "Nitrogen in Coal;" especially referring to the extraction of cyanogen compounds from gas, and the conversion of hydrocyanic acid into ferro-cyanogen compounds, to the total exclusion of sulphocyanides. Herr W. von Oechelhaeuser, of Dessau, gave particulars of the gas tramway in that town. Dr. Bunte read a paper on recent discoveries bearing on gas lighting; treating particularly of the addition of acetylene to illuminating gas. He concluded that, at the present cost of production, acetylene could not compete with benzol as an enriching material. He alluded briefly to the rare earths used in the manufacture of mantles for incandescent gas lighting, to a spirit-lamp for lighting on the incandescent principle, and to the discovery of argon. Herren Hasse, Hegener, and Grahn made communications on settings of inclined retorts; and Dr. Schilling, of Munich, and Herr von Gässler, of Hanau, treated of carburetting with benzol. Dr. Bueb, of Dessau, described his observations on the congelation of aqueous and other vapour in gas-pipes, and recommended the addition of alcohol vapour as a preventive of freezing. Dr. Leybold, of Frankfort-on-the-Main, discussed the position and work of the gas-works' chemist. There were less important communications from Herren Kallmann, G. Wunder, Joly, Dr. Polis, and others; and the annual report was presented by Dr. Bunte, the Secretary of the Association. By reason of the number and importance of the papers read, the meeting of 1895 was one of the most successful in the annals of the Association.

WATER AND SANITARY AFFAIRS.

THE Parliament on which the London County Council built all their hopes with regard to the water question is now about to dissolve; and with it—according to present appearances—go the eight Bills by which it was proposed to effect an extraordinary "transfer" of more than thirty millions' worth of property. Concerning the Bills, we may venture to say we shall never see their like again. The Select Committee under Mr. Plunket have gone far enough with the consideration of these measures to make it plain that the Bills, as originally framed, required very material alteration, in order to fit them for the approval of the Legislature. If this were the case under the administration of Lord Rosebery, much more may such a result be expected under the rule of Lord Salisbury. We are fairly justified in making the assumption that the new House of Commons will be less subservient to Spring Gardens than the one which is passing away. All is now changed—or soon will be; and although the County Council may not allow the question of the water supply to remain at rest, they cannot fail to see the necessity of approaching the subject in a much more reasonable spirit than they have displayed in the past. Their favourite arbitration clause, wonderful in its structure and audacity, has been scattered to the winds. At a special meeting convened for the purpose, they have been content to substitute another clause, by which they hoped to satisfy the Select Committee, and at the same time promote their own wishes. It seemed as if their ingenuity had not been wholly unsuccessful; and there was the prospect that, with some little modification, the new clause would be accepted by the Committee. But there was another essential matter in which the Committee proposed to intervene, so as to secure justice to the Companies. Mr. Pember was pleading that the principle of placing the water supply in the hands of a County Council could only be worth anything by being universally applied, when the Chairman said the Committee would be disposed to insert a clause in the Lambeth Bill providing for the purchase of all the undertakings, and not merely part. Another announcement was also of great significance, as affecting the terms of the transfer; the Chairman saying it was the intention of the Committee that the Arbitrators should have an unfettered right to award a sum in respect of compulsory sale. The circumstance that the exercise of this right was to be purely optional, does not detract from the importance of introducing this matter of compulsory sale as something to be taken into consideration. The plan of the Council, at the outset, was to exclude the subject altogether, though the principle was partly admitted—or perhaps we might say was artfully superseded—in the new arbitration clause, by allowing the Arbitrators to award a "further sum," beyond "the fair "and reasonable value," in order to meet the cost of reinvesting the purchase-money. The Committee, however, desired that these words should be so amended that the element of compensation for compulsory sale should be brought clearly within range of the arbitration. It is also to be noted that the Committee hesitated to pronounce an opinion as to that part of the new clause which provided that, on all points, the discretion of the Arbitrators should be exercised "as fully and effectually as could be done by "Act of Parliament."

After all the deliberations respecting the Transfer Bills, just when the question seemed to be ripening towards some kind of conclusion, there came a "chilling frost," in the shape of a dissolution of Parliament. At first the Committee thought the Bills could be held over during the dissolution, and taken up again. But Mr. Plunket stated on Thursday that they had been advised to the contrary; the Bills not having reached the stage when such a course could be adopted. The case was so much the worse, seeing that six of the Transfer Bills had not even reached the second reading. The Money Bill relative to the transfer was also in arrear. Mr. Balfour Browne still indulged the hope that the Committee might leave the Bills at a stage at which they could be taken up by the next Parliament; but Mr. Plunket said there seemed no chance of this, though the Committee would meet on Wednesday (to-morrow), in case there might be a favourable change in the course of affairs. Thus it seems inevitable that an enormous expense has been incurred, and a vast amount of trouble taken, without any immediate result. We qualify our regret, despite the

excessive burden cast upon all the London Water Companies, because it seems to us that something has really been gained. It is plain that the Transfer Bills would never have been passed in the form in which they were presented. Opinions, amounting to decisions, have been expressed by the Committee, which must govern any future attempt to acquire the property of the Water Companies. Facts have been brought to light which will modify many preconceived notions in the public mind. The ratepayer has been invited to look into the pit which has been dug for him, and which he may be expected to avoid in the future. The water question no longer stands where it did; and the County Council will henceforth have to face a tribunal different from that on which they have hitherto reckoned. The Companies have no particular reason to desire that the Transfer Bills should be suspended and revived. The Bills are essentially bad; and though Mr. Plunket's Committee did their best to mend them, it was hardly possible to make them the basis of a workable scheme. The Companies have reason to regret being dragged into the conflict, seeing how much it has cost them; but, upon the merits of the case, they have lost far less than the County Council. The Council have lost heavily, and have gained nothing; only it happens on their side that the ratepayer has to find the necessary money.

Truth is sometimes spoken by accident. A few days ago, the *Daily Chronicle*, in discussing the water question, made this striking declaration: "As for the river water, "it becomes clearer every day." We were prepared to welcome the announcement, as a sign of returning sanity; but, on reading the next few words, we found that the complete sentence became merely a repetition of former vagaries. Thus, concerning "river water," we were told: "It becomes clearer every day, not merely that its sanitary "safety is doubtful, but that there is the gravest reason to "consider it an active agent in the promotion of disease." Now the "clearer" light is showing every day the very contrary of this. Mr. Shirley Murphy, by bringing the vital statistics of London down to the close of 1893, has exhibited an increase in the zymotic death-rate in that year, compared with the average of the years 1885-92. The rate is thus shown to have risen from 27·1 to 30·4 per 10,000. But in Mr. Shirley Murphy's next annual report, a different result will have to appear; the zymotic death-rate in 1894 being down to 26·6 per 10,000, which is even below the average of 1885-92. So also concerning the death-rate from all causes in London, Mr. Shirley Murphy shows that the lowest mortality in 1871-93, both inclusive, was in 1889, when it stood at 18·4 per 1000. Since then, matters have been worse, and the death-rate has been higher—becoming 20·9 in 1893. But the fact has now to be recorded that in 1894 the London death-rate fell to 17·8—a lower point than even the rate for 1889. By excluding the deaths occurring in Metropolitan institutions of persons ascertained to be strangers, the death-rate of London in 1894 is reduced to 17·4 per 1000. It therefore becomes "clearer," as time goes on, that, if vital statistics afford any test, the water supply of London is favourable to health. On what other source of information does the *Daily Chronicle* rely?

Association of Municipal and County Engineers.—The annual meeting of this Association was held at Halifax on Thursday and Friday of last week, under the presidency of Mr. E. R. S. Escott, the Borough Engineer. The members assembled in the Town Hall, where they received a cordial welcome from the Mayor (Alderman M. Booth). The annual report read by the Secretary (Mr. T. Cole) stated that the Association now entered upon the twenty-first year of its existence. During the financial year ending April 30 last, 56 ordinary members and 17 graduates joined the Association; and at its close there was a total membership of 646—a net increase of 47. The audited accounts showed a balance of £235 14s. 4d. in hand; and the invested capital at the end of the year stood at £300. The report was adopted. The President then delivered his Inaugural Address, which was followed by papers and discussions on appropriate topics. Thursday evening, the members dined together. On the following day, the rest of the papers were taken; and the remainder of the available time, as well as Saturday morning, was occupied in visiting various works in the district. Among these were the gas, water, and electric lighting works of the Corporation, where the members were received by Mr. T. Holgate, Mr. J. A. Paskin, and Mr. T. P. Wilmshurst, the Engineers, and by Mr. W. H. D. Horsfall, the Architect of the electric lighting station. A visit was also paid to the retort, fire-clay, and brick works of Messrs. Oates and Green, Limited, at Horley Green and Ellen Royde.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SECOND ANNUAL GENERAL MEETING,

HELD AT THE

QUEEN STREET HALL, EDINBURGH, JUNE 11, 12, & 13, 1895.

ROBERT MITCHELL, Esq., President.

PAPERS AND DISCUSSIONS.

[*Continued from Vol.* LXV.]

THE PRACTICE OF DISTRICTING WITH A VIEW TO EQUALIZING PRESSURE.

By F. W. CROSS, of Wellington, Salop.

In the paper about to be read to you, it is not guaranteed to introduce anything particularly novel in the way of gas engineering, or of a highly technical character. However, upon looking over the index of the past Transactions of this Institute, it was with some surprise—and, indeed, gratification—that the writer found that this subject had not been particularly dealt with; for having had a slight personal experience in the matter of districting somewhat out of the ordinary course of events, it was felt that, in taking up this question as a maiden effort for presentation to the members of the Institute, there would be one distinct advantage already gained—viz., not being handicapped with the thought that it was absolutely necessary to improve upon what had been previously said upon the subject, or under a similar title. Notwithstanding the fact that in choosing a subject this was the first impression that presented itself to my mind, you are asked to believe that, in the relation of personal experiences, it has been my endeavour to state them to the best of my ability in such a manner that may, it is hoped, prove at once both interesting and instructive, and at the same time tend to promote a discussion equal to the importance of the subject. It is proposed to lay before you a plain statement of how, during my residence in Hong Kong, we overcame the difficulties of high and low pressures in the various districts of the city, which continually forced themselves on the attention of the Manager as the area of supply expanded and the demand for gas increased.

It would at first be well to describe the topography of the area of supply; this being necessary for you to duly appreciate the advantages and disadvantages of the locality. To do this, it is needful to draw your attention to a photograph of the City of Victoria on the island of Hong Kong, as also to the street plan of the city, for which I am indebted to the courtesy of Messrs. John Bartholomew and Co., of the Edinburgh Geographical Institute; they having allowed me to enlarge their map of the city in outline. The city is built on the side of a steep hill, rising more or less abruptly from the sea-level to a height of 1800 feet. It has a frontage on the water of between 3 and 4 miles; and in the centre (where are situated the principal business houses and European residences), you will note the streets and houses rise very rapidly, tier upon tier, to a height of about 600 feet above sea-level. The Praya, Bund, or roadway fronting the water is absolutely level from end to end. While the gas-works are located at the extreme west end of the city, some large consumers are situate at the extreme east end; and it is proposed first to deal with the difficulties arising out of this difference in position, though equality in level, and the distance of the demand from the supply, which was over three miles. You will note that, while the Praya is not quite continuous from end to end of the city, the street immediately to the back of it is so; and in this street—called for the whole of its length the Queen's Road—the trunk main of the city is laid. Where the continuity of the Praya is broken, you will see that on either side of Queen's Road are situated the naval yards and military barracks; and these, as a matter of fact, divide the city into two parts—the portion of Queen's Road between being (if it may be so expressed) the link in the chain joining the west and centre of the city to the eastern portion.

From the works we start with a 12-inch main, diminishing gradually to 10-inch, 8-inch, and at the extreme east end to 6-inch and 4-inch mains; and these constituted the trunk main for the supply of gas to the several districts of the city. It is needless, and would be superfluous, for me to explain, how that, as the gas passes through

the centre of the city, where the greatest demand exists, its great and natural tendency is to fly upwards; and though at one time it was quite possible to obtain a respectable and workable pressure at the east end, ultimately the demand in the centre grew so great as to diminish the pressure at the east end to such a degree as to render the volume of supply a practically useless quantity. The supply of gas to the higher levels in the centre of the city has at all times been more or less controlled by district governors; and as the area of supply expanded and the demand increased—diminishing the pressure on the lower levels—the maximum pressure given at the works was increased to meet the contingency. There came a period, however, when it was deemed undesirable to further increase the pressure, for many obvious reasons, without some change in the mode of distribution.

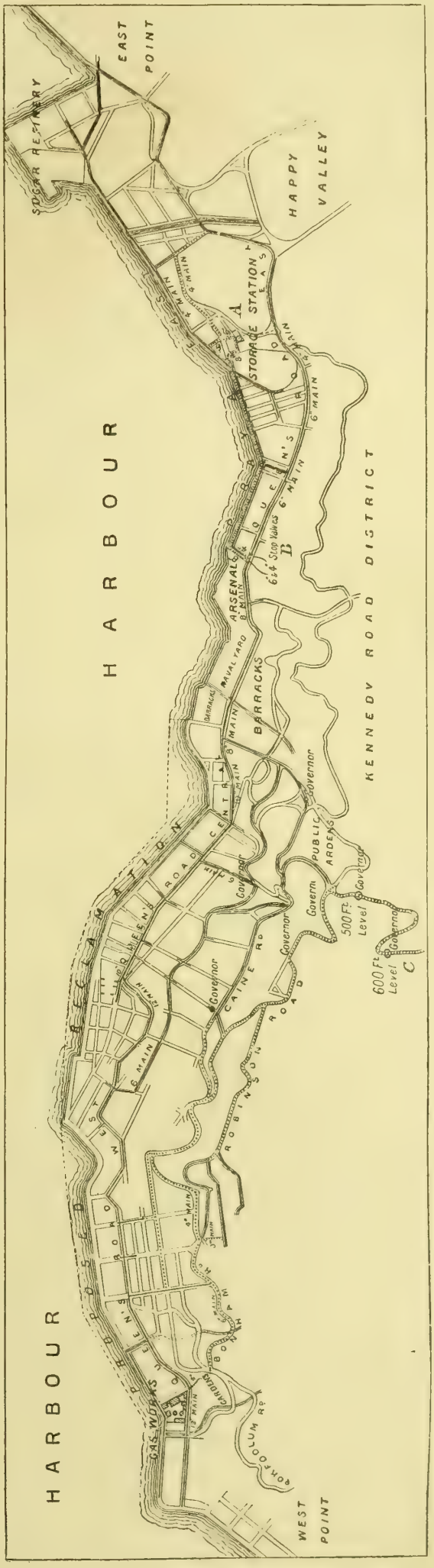
At this time, while we were giving a maximum pressure on the works of 25-10ths, the pressure at the inlet of the main supply meter of a large sugar refinery at the east end was at its maximum only 8-10ths; and this was still further reduced during exceptional draughts on the mains, which would occur occasionally, and which it was not always possible to provide for. This refinery was supplied by the Company through one large meter, fixed at the entrance of the premises; but there were subsidiary private meters for checking the consumption of each of its various departments. It can therefore be understood that at times the pressure in the different parts of the works was very low indeed; and it is not surprising that occasionally it reached vanishing point.

In course of time, this trouble of low pressure grew more and more acute; and when it became necessary to make provision for increased storage accommodation, a consideration of this matter showed that an admirable opportunity here presented itself to once for all overcome the difficulties of pressure hitherto experienced. The area of the existing works being limited and fully occupied, it was decided to erect the new gasholder in the east-end district of the city, and by means of distribution from this station—independent of, or in combination with distribution from the manufacturing station—to equalize the pressure over the whole of the lower level district.

The scheme that is about to be brought before you in its general outlines, without entering into minute details of construction, was formulated by Mr. C. R. Mead, the Managing-Director of the Company; and the works were designed by Mr. Frank Mead, of Sutton, Surrey. The whole of the extensions were carried out under the personal superintendence of the writer.

A telescopic holder, of ample proportions for future demand, was erected on a plot of land marked A on the plan, about 2¾ miles from the existing gas-works; and the mode adopted for supplying the holder with gas from the manufacturing station is shortly described. The existing 8-inch main in Queen's Road terminated at a point marked B on the plan at the junction of Queen's Road and Arsenal Street, leading to the eastern portion of the Praya. This point was a little over two miles from the works; and in passing, let me draw your attention to one of the natural advantages of this locality. As previously mentioned, when describing the topography of the district, the intervening property between this point B and the centre of the city on both sides of Queen's Road was wholly occupied by the naval yards and the military barracks—practically dividing the city into two portions, east and west, with these properties acting as a buffer between them. Here, then, was a district already formed, which only required a re-arrangement and development of the system of distribution. From the point marked B, an 8-inch main was laid along the Praya direct to the storage station; and this new portion was untapped the whole of its length—in fact, it was essentially a trunk main to supply the new holder with gas. Under many circumstances, the supply of gas to a holder erected at a distance from the works would have been conducted by a trunk main from the manufacturing station to the storage station, without any branches or connections being made. In this case, beyond the new portion of 8-inch main laid along the Praya east, the ordinary town main from the works up to the point marked B was utilized, and made to act as a trunk main for the supply of gas to the storage station.

At the storage station was erected a building containing a duplicate set of exhausters of 10,000 cubic feet per hour capacity, driven by two gas-engines—one vertical



Street Plan of the City of Victoria, Hong Kong.

and the other horizontal—each of 3 nominal horse power. The exhausters were not coupled direct to the engines, but were driven by a system of belts, counter-shaft pulleys, and riggers so arranged that, while the engines could be driven at a constant minimum speed, the speed of the exhausters could be increased or diminished at will by a re-arrangement of the driving belts. Also, by the use of loose pulleys, the engine was first put in motion and the exhauster started when convenient, and when the engineman was assured that all was in working order. The filling of the holder with gas was only carried out during the daytime, generally between the hours of 10 a.m. and 4 p.m.; the gas being drawn from the manufacturing station and forced into the holder by means of the exhauster. During the period of the operation of filling the holder, the pressure at the works was maintained at 12-10ths; and when all was at rest at the storage station, a similar pressure could there be obtained. When, however, the exhauster was started, the speed was so regulated that the inlet pressure was reduced to about 6-10ths to 8-10ths, consequent upon the draught on the mains.

To avoid risk of carelessness or inattention of the engineman, a bye-pass connected the inlets and outlets of the exhausters; and herein was inserted a patent equilibrium gas-governor, capable of being so regulated that it was a moral impossibility for the pressure to be so reduced as to interfere with the day supply to the centre of the city. To illustrate this, let me mention that on the Queen's Road level in the centre of the city a gas-engine was in use every day, generating electricity into accumulators for a private establishment. This engine required for its working that 10-10ths pressure should be maintained at the works. Twelve-tenths pressure was put on during the period of running the exhauster at the storage station; and as in response to inquiries, no complaint was made, it must clearly point to the fact that the action of the exhauster in regard to excessive diminution of the pressure was not felt in the centre of the city. It may be said that the gas-engine was not delicate enough to show any appreciable effect of the action of the exhauster at the storage station; but by careful observations made from day to day, the writer never noticed the slightest pulsation in the centre of the city, except with such a delicate light as the incandescent gas-light, which he personally overcame by an adjustment of the bye-pass governor. At the station itself, when the exhauster was in action, a slight pulsation was observed, and showed itself on the register paper; but this could be regulated to a minimum by the bye-pass governor—the minimum oscillation shown on the inlet of the exhauster being about $\frac{1}{8}$ inch.

You will note that, previous to its entry to the station, the gas had to pass through a length of over half a mile of untapped 8-inch main; and for a further distance of over a quarter of a mile—that is, in the portion of Queen's Road between the naval yard and military barracks—the connections off the 8-inch main were throughout the daytime practically unused; and the action of this long length of dead main was to greatly minimize the effect of the pulsation taking place at the storage station. Telephonic communication existed between the gas-works and the storage station; and in case of sudden storms or darkness (which were of not unfrequent occurrence) necessitating extra pressure for short periods, it was possible to immediately stop working, and direct the whole of the day pressure on the centre of the city. The gas being stored both at the east and west ends of the city, it was, of course, easily possible to distribute the same so that the pressure should be equalized throughout the whole of the district.

There were two outlet-mains from the station; the gas being controlled by a patent equilibrium governor common to both. One was a 6-inch main connected to the existing mains supplying the east-end district, which required very little re-arrangement—valves being inserted to entirely sever this district from the centre of the city. Here, then, was the first object accomplished—viz., the supply of gas to the eastern district at an equal pressure to that obtained at the works, or in the western and central portions of the city. The other outlet was an 8-inch main, which in reality acted as a bye-pass between the inlet and outlet of the holder, so that at night-time—or, in fact, at any time the exhausters were at rest—the gas could be passed from the gasholder back to the centre of the city from the same main that it had previously travelled in to the station. Here, again, the second object in view was accomplished—viz., the utility of the works as additional storage accommodation; for at time of short supply at the manufacturing station, assistance could be rendered by passing gas back from this holder to the centre of the city.

On several occasions tests were taken to notice the effect of the pressures; but previous to my leaving Hong Kong, no necessity had arisen for a continuation of this mode of equalization of the distribution. My experience, however, forced me to the conclusion that occasions would arise when an available stock of gas at the east end would be an invaluable adjunct to the storage capacity of the manufacturing station. In addition, as the area of supply expanded, this station was so situated, and the mains so arranged, as to meet the demand in a very simple manner, and at much less expense than if it had to be met by a re-arrangement of the mains from the manufacturing station.

The whole of the objects to be obtained by these arrangements will be quite apparent to my hearers; and it will hardly be gainsaid that they were secured in an expedient and most inexpensive manner. To have run an entirely new trunk main from the manufacturing station to the new storage station would have been expensive; and even then there would have been several questions to consider in deciding the merits of the two systems. Brief mention is made of one or two that occur to me.

(1) The pressure of gas in the trunk main, which would have resulted in a heavy leakage account owing to the nature of the subsoil to be traversed.

(2) The pressure given by the single-lift holders on the manufacturing station was only 4 inches, while the pressure given by the telescopic holder at the storage station was $5\frac{1}{2}$ inches when cupped.

(3) The system of a direct trunk main would not so easily have adapted itself to the return of the gas to the centre of the city and the equalization of the pressure over the whole of the district.

The supply from this station was started on Jan. 1, 1893; and the writer only had about three months' experience of the working before leaving Hong Kong. During this period, the station was used more or less simply as a storage station, and for the supply of a portion of the eastern district, which took about 12,000 to 13,000 cubic feet per 24 hours.

In January, the horizontal engine worked during 17 days for $88\frac{1}{4}$ hours, while the vertical engine worked during 12 days for $51\frac{1}{2}$ hours; and the consumption of gas by the engines for the whole of this period was 6500 cubic feet, inclusive of work done in pumping water into the gasholder tank, &c. The working was more or less experimental for the first month or so; but in February, the results improved. The horizontal engine worked during 11 days for $44\frac{1}{2}$ hours, while the vertical engine worked during 12 days for $57\frac{1}{4}$ hours, with a consumption of gas for the whole of the period of 3900 cubic feet, inclusive of work done in pumping. These working results may, upon analysis, appear to be somewhat negative; but it must be remembered that they were for the first two months of working, more or less experimental, and particularly while a Chinese engineman was being trained to his duties. There is no doubt, however, that since then, as the working became more regular, and as the engineman became more accustomed to the apparatus, greater efficiency has been obtained, and greater economy exercised in the working. This is borne out by the fact that, from information received since this paper was written, the figures for the corresponding months of January and February, 1894 and 1895, give the consumption of gas per 1000 cubic feet pumped—viz., January, 1894, 8·92 cubic feet; February, 1894, 8·57 cubic feet; January, 1895, 6·25 cubic feet; February, 1895, 6·41 cubic feet. The attendance required was simply a Chinese engineman at $15 per month, and a Portuguese or Eurasian night watchman at $16 per month; and but for the fact that in Hong Kong it was needful to employ a night watchman to protect the premises, this service could be dispensed with by the use of an automatic pressure-changer attached to the governor.

Let me now draw your attention to a further matter having a bearing on the subject of districting and equalization of pressures. During recent years, the Peak and hills above the city of Victoria have been developed into building sites, and a large number of European houses erected thereon. In addition to private residences, two very large hotels have been built; and in 1889, when

building operations were being carried forward to a large extent, the Directors agreed to my proposition to carry gas to this increasing suburb of the city. Our supply at that time extended to a height of about 600 feet above sea-level; the mains for the last hundred feet in height, though considerably more in length, being principally of wrought iron. This wrought-iron piping was taken up, and a cast-iron main laid in its place; and from a point just above the last residence on the hillside (marked C on the plan), the main was as far as practicable carried almost straight up the side of the hill, with a rise varying from 1 in 2 to 1 in 4, to the "Gap" about 1200 feet above sea-level. From this point it branched off in two directions—a 3-inch main running in the direction of the Peak to the west, and a 4-inch main to the east, which was a more level district, and more thickly built upon. The main supply of gas at this time came from the centre of the city, and, as previously mentioned, was controlled by district governors on its ascent to the higher levels.

To control the direct supply to the Peak, we had one governor fixed at about the 500-feet level, and another at the 600-feet level; these being used to control the gas and give the necessary pressure to the houses on these levels. From the governor on the 600-feet level, the gas was unobstructed in its ascent right away to the "Gap," or 1200-feet level; but it was there controlled by a governor previous to its branching off east and west to the districts of supply. During the first year or so of the supply of this new district, we experienced a certain amount of trouble in adjusting the pressures and the flow of gas to be given by the governors; but this was nothing beyond what had been anticipated. Gradually, however, a fairly heavy winter consumption developed itself in this new district; and at the same time the consumption on the 500 and 600 feet levels had been gradually increasing. Then our troubles came faster; and complaints were made as to insufficiency of pressure on these comparatively lower levels—especially so at or about the dinner-hour, between 7.30 and 9 p.m. This had to a certain extent been foreseen; but it was hardly expected to come so quickly. The question had to be met, however; and in carrying out this object, the writer was enabled to partially execute a scheme for generally equalizing the pressure on the higher city level, as also to avoid making such a heavy drain on the supply to the centre of the city.

From the works situate at the extreme west, we carried a 4-inch main through some gardens to a height of about 200 feet. This main ascended very rapidly—and, in fact, in some portions of its length it was quite vertical; and the gas therefore reached the top at a very good pressure. Here it entered into a 6-inch main, and was carried along a slightly ascending road for a distance of about three furlongs; and where it again commenced to rise, the 6-inch main branched off to 4-inch and 3-inch mains—the 4-inch main continuing on the level, and the 3-inch main making a gradual ascent till it reached the 500-feet level, where it joined the direct supply to the residences on the higher levels and to the Peak. Here the gas received its first direct check since it left the works, by the governor on the 500-feet level; and after regulating the governors on the 500 and 600 feet levels, corresponding to the alteration in the nature of the supply, no further great trouble was then experienced. The 4-inch main mentioned was carried along at about the 300-feet level—replacing old and smaller mains—till it joined a 4-inch main already laid on this level above the centre of the city; and, by a more circuitous route, also furnished a supply of gas to the mains leading to the higher levels and to the Peak. Other subsidiary mains were laid about the same time and provision was made to form a system; but what has been described embodies the main features of the scheme.

As showing how the development of the Peak district affected the supply to the lower or intermediate levels, it may be mentioned that the increase in consumption for several years was as follows:—

12 months, 1889 to 1890, consumption per consumers' meters was						482,600 c. ft.
12	,,	1890 ,, 1891	,,	,,	,,	660,900 ,,
12	,,	1891 ,, 1892	,,	,,	,,	1,788,900 ,,
9	,,	June 1, 1892, to Feb. 28, 1893	,,	,,	,,	1,936,200 ,,
12	,,	Feb., 1894	,,	,,	,,	2,622,000 ,,

Thus on all the levels the pressure was more or less equalized and controlled from either the manufacturing station at the west end or the storage station at the east.

As time progresses, natural expansion of the European residential locality will no doubt take place upon the higher levels to the east of the city, on the Kennedy Road district—this being more or less foreshadowed by the schemes of the local government—and then by means of a branch from the 8-inch main to the east of the city (west of the Military Barracks), or by a direct main from the storage station at the east end (provision for which has already been made), this new district may be fed without disturbing the pressures maintained on any portion of the existing system.

In preparing this paper, the fact has not been lost sight of that the experiences given refer exclusively to Hong Kong; and the same difficulties might not apply to some towns in this country. At the same time, there are probably localities in Great Britain and other parts of the world somewhat similarly situated to what has been described; and if what has been written proves of any slight assistance to my professional brethren, or is sufficient to provoke a discussion at this meeting, the writer will feel quite satisfied in this his first appearance on the stage of The Gas Institute.

Discussion.

Mr. W. R. Chester (Nottingham) said that the author, having a peculiar district to supply, had adopted certain means for equalizing the pressures of the higher and lower levels; and he spoke in certain places of a patent equilibrium governor. It would be interesting to know what that governor was; and how it answered the purpose. A district such as Mr. Cross described seemed to be admirably adapted for the distribution of the gas from one central station; and he (Mr. Chester) thought it would be found that the establishment of an additional storage station was only a mitigation of the difficulty of supply, and not a permanent remedy. Putting down an additional storage station at the extreme end of the district would undoubtedly enable the Company to tide over the difficulty of short supply during the hours of greatest demand for a time. But as the consumption continued to grow, it would be necessary to enlarge the mains on the lower levels; and he believed if this had been done in the first place, instead of constructing an extra storage station, it would have cost less, and have been more effective. The cost of substituting a 12-inch main for an 8-inch and a 4-inch would not amount to much more than £4000 for the whole length of four miles; and he did not think the cost of the storage station could be much less than that. Again, a second station involved the addition of certain permanent charges to the cost of distribution, beyond interest—such as the charge for an engine-man, a night watchman, &c. These together could not be much less than the equivalent of the interest on £1000 of capital; and if this were added to the expenditure for the provision of the gasholder, &c., he thought the money could have been more advantageously spent on the original works and the enlargement of the trunk mains. The difference in level which Mr. Cross had to contend with—1800 feet—was no doubt extraordinary; and it was a matter of interest to all to note the way the difficulty had been overcome. He congratulated Mr. Cross on his first appearance as the reader of a paper before The Gas Institute.

Mr. Cross, in reply, said the equilibrium governor was one of Cowan's; and it answered admirably. With regard to the suggestion that the supply might have been sent from the works by a rearrangement of the mains at the west-end station, he could only say that the area of the city in width was absolutely limited—it must expand in length; and, therefore, with the storage station at the extreme east end, if the demand should grow very great at the extreme east, it simply meant a new trunk main from the west end to supply more gas than could at present be drawn through the town live mains.

THE COMBUSTION OF COAL GAS FOR FUEL PURPOSES.

By Vivian B. Lewes, of the Royal Naval College, Greenwich.

Nothing is more remarkable in the history of gas than the improvements which have taken place during the past twenty-five years in the methods by which light can be developed by its use; and, whereas at the beginning of this period it was considered to be a good performance if a

burner developed 3 candles per cubic foot of gas consumed, at the present moment it is possible to develop nine times this amount of light from the same quantity. The reason for the extraordinary activity which has taken place in this direction is probably due to the threatened rivalry of electric lighting; and it can hardly be claimed that the perfection of methods for the consumption of gas for fuel purposes has kept pace with its consumption for illumination. At the present time, the most important problem for the future of gas manufacture is how best to popularize gas as a fuel, and to convince the public of the enormous advantages which they would gain by the adoption of it for general use in place of solid fuel.

From the point of view of health, cleanliness, convenience, and comfort, everyone is, I think, agreed that gas is immeasurably superior to coal for fuel purposes. Not only would the general adoption of coal gas as a fuel do away with the heavy pall of smoke which hangs over a big town, and prevents the sun's rays from carrying out the beneficent work which Nature intended them to perform, but it would also reduce to a minimum the number of fogs from which a big town suffers, and would in this way quickly reduce the death-rate due to lung diseases; and the best energies of the gas industry should undoubtedly be devoted at this period to popularizing gas as a fuel, as by so doing not only can the gas industry be increased to enormous proportions, but also because of the hygienic improvements which would follow its adoption.

In order to bring about these much-to-be-desired results, every improvement in the method of burning coal gas which may be produced should claim the attention of the manufacturer of gas-stoves; and the object I have in view in this paper is to, as far as possible, discuss in what direction any improvement may be possible. Although we owe much to the magnificent enterprise of our leading gas-stove manufacturers, it would be sheer folly to suppose that we have reached anything like finality in our methods of gas consumption.

The only point which militates against the use of gaseous fuel in all big towns is the assumption that it is much more expensive than solid fuel; and if the thermal units developed by the ordinary bituminous coal and by coal gas be calculated out, coal has a very substantial advantage. Taking a fair sample of bituminous coal, its composition will approximate to—

Carbon	80·0
Hydrogen	5·0
Sulphur	1·5
Moisture	4·0
Nitrogen	1·5
Oxygen	5·0
Ash	3·0
	100·0

And the calorific value will be 8020 thermal units.

The composition of London coal gas approximates to—

	Volume.		Weight.
Hydrogen	52·0	..	9·6
Unsaturated hydrocarbons—			
(C_2H_4)	3·0	..	7·7
(C_6H_6)	1·0	..	7·1
Saturated hyrocarbons (CH_4)	34·0	..	49·9
Carbon monoxide	5·0	..	12·8
Nitrogen	4 5	..	11·5
Carbon dioxide	0·0	..	0·0
Oxygen	0·5	..	1·4
	100·0	..	100·0

And the calorific value of such a gas will be equal to 11,918 thermal units; or, roughly speaking, weight for weight, the value of the coal is two-thirds that of gas as a fuel. Taking the specific gravity of London coal gas at 0·4, 1000 cubic feet would weigh 32 lbs. Taking now 2s. 8d. as the price of the gas per 1000 cubic feet, we find that it costs us 1d. per pound; while the average cost of coal in London is about 10 lbs. for 1d., or 0·1d. per pound.

The thermal value of the coal, however, is only two-thirds that of the coal gas; so that we may say that, for equal thermal values, in round figures, the coal is seven times cheaper than the illuminating gas. This would probably be the line of argument taken by the scientific coal merchant. Any arguments based upon the thermal units which a fuel is capable of developing, although of value as constituting a standard of comparison, are misleading and valueless when we come to apply them to every-day practice. A carefully constructed calorimeter may bear out your theoretical deductions, but your boiler and your fire-grate certainly will not; and it seemed to me of the greatest possible importance to the gas industry that an attempt should be made to see what the ratio between coal gas and coal really is at the present time, and also to ascertain to what degree of efficiency our gas-stoves have attained, and, if possible, to note the direction in which improvements could be made.

To make any such determinations of value, it was necessary to carry out the experiments with every care as to exactitude in measurement of the gas consumed, and of the increase in temperature, and yet to have the conditions such as would be found in practice. The room selected for the experiments was 17 ft. 4 in. by 15 ft. 7 in., and 11 ft. 1 in. high; giving a cubical capacity of 3032 cubic feet. It had three windows and one door—the latter being opened twice in the hour, to allow the observer to pass in and out during the test; this and all other operations being conducted in such a way as to make the tests strictly comparative.

All the stoves tested were fitted exactly as they would be arranged when fixed by an experienced gas-fitter—*i.e.*, the opening of the fireplace was closed by a metal plate, through which the elbows from the gas-stoves passed; and thermometers were arranged in various parts of the room, so as to give the temperatures at various distances from the stove from the floor-level and each two feet up to the ceiling.

My first intention was to apply to the various makers for samples of their stoves for testing; but I finally came to the conclusion that it would be fairer to obtain them as sent out into the market. Mr. George Livesey kindly lent me a selection of those stoves which experience had shown him as most in demand with the public. These were—

Fletcher's B.R. 12, Complete "Hong Kong" and "M.P."
Richmond's "Gordon" and "Majestic."
Wright's "Queen Ball" and No. 2884.
Davis's "Kent" and No. 1 LSN.
Main's "Princess" and No. 458.

In the testing of these stoves, the gas supplied to them was carefully measured by an accurate meter; and the temperatures in the room were taken every hour over a period of five hours. Two tests were in this way taken of each stove; but only one test was taken on each day, so as to allow the temperature of the walls, and atmosphere of the room, to reach its normal condition again. The tests for each stove differed but little amongst themselves; and the results taken were the mean of two sets of tests.

These tests, extending as they did over a period of nearly three months, form an enormous mass of figures, and represent the efficiency of most of the stoves at present used in England. But as the publication of these figures might have an injurious effect upon trade interests, I feel that it would be better to leave it in the hands of the Council of the Institute as to whether they should be published or not. If it is decided that it is judicious to publish them, they will be arranged as an appendix to this paper in the Transactions. But I may state that out of the eleven stoves tested, four gave results not very widely separated, while of the remaining seven, there are only two really unsatisfactory, and give 50 per cent. less than the best stove.

The result given by the best stove was an increase in temperature of 6·5° Fahr. in the first hour, and a total increase of 13° Fahr. in five hours, for a consumption of 200 cubic feet in the five hours, or an average of 40 feet per hour, which is equal to 1° Fahr. rise in temperature for each 15·4 cubic feet of gas consumed, or practically speaking 2° Fahr. for each pound of gas.

Consuming bituminous coal in a grate of the ordinary construction, and of the kind used in certainly 90 per cent. of our homes, it required an average of 7 lbs. of coal an hour to raise the temperature to the same extent as with the gas-stove.

Under these conditions, therefore, 35 lbs. of coal give in a room the same warming effect as 200 cubic feet or 6·25 lbs. of coal gas. In other words, 1 lb. of coal gas does the same amount of heating as 5·6 lbs. of coal—the gas costing 1d. and the coal only a shade over ½d.

The initial consumption of coal to give the necessary increase in temperature is greater than with gas; and the saving in waste of fuel secured by being able to turn off the gas when the temperature is too great, or when the fire is done with, practically obliterates the difference in cost, when intermittent (not continuous) heating is required; while with rooms used only for an hour or two in the day, gas is really far cheaper than coal as a fuel.

In order, however, to thoroughly popularize gas, we

ought to strive to burn it in such a way as to develop the greatest possible heating power from it, and to at any rate make it equal in cost as a fuel for continuous heating to coal burnt in the ordinary grates. Nor must we lose sight of the fact that, with the best forms of open grate using solid fuel, the coal consumption can be reduced from 7 to 4 lbs. per hour to give the same effect as the 40 cubic feet of gas consumed in the best stove, which would make the gas three times as dear as coal.

Before attempting to consider how this can be done, it will be well to gain an idea as to the causes of the loss of heat with gas-stoves, and how far these can be overcome. When a room is being warmed by any form of stove, heat escapes by—(1) Hot products of combustion going up the flue. (2) Absorption of heat by the walls of the room. (3) Hot air removed by ventilators, and cool air brought in. (4) Leakage from doors and windows. The last three factors of loss are due to the room itself, and will act practically equally with solid or gaseous fuel; while the amount of heat escaping up the chimney is largely dependent upon the construction of the stove.

Whatever views may be held on the subject, I myself feel very strongly that the idea that some forms of stoves can be used without being attached to a proper flue is not only most dangerous to health, but also militates against the use of gas as a fuel, by encouraging the idea that gas-stoves are unpleasant and unhealthy as sources of heat. It cannot be insisted upon too strongly that a gas-fire, whether used for heating or cooking, must be connected with a flue; as the products of combustion are just as deleterious, if not so dirty, as those given off by the combustion of solid fuel. To gain an idea of the percentage of heat lost by the flue, the gas-stove before used was placed in the centre of the room; and the sheet-iron elbow being removed from the opening at the back of the stove, the iron rim soon became sufficiently heated to enable the escaping products of incomplete combustion to burn there with a blue flame. The consumption of 200 cubic feet of gas in five hours raised the temperature of the room 35° Fahr. above the initial temperature; and as an increase of 13° Fahr. was obtained when the stove was in its proper position, and connected with the flue, this showed that practically nearly two-thirds of the heat which could be utilized for warming the room escaped up the chimney.

It must not be supposed that the whole of this lost heat is due to heated gases, which could be made to give up their heat before being finally discharged into the chimney; as wherever you have an atmospheric gas-flame employed to heat substances like asbestos in a gas-stove, a considerable percentage of inflammable products of incomplete combustion escape unburnt. They are, to a large extent, responsible for the flame which is found burning at the exit flue of a gas-stove; and if the gas be passed through chambers in which the heat contained in the flame is given up either to radiating substances or the air, and so brought back into the room, these products of incomplete combustion simply escape unburnt up the chimney and are lost.

In order to obtain an approximate idea of the amount so lost, the stove was once more connected with the flue, but by a thin iron pipe, which was $1\frac{3}{4}$ feet in length from the front of the plate closing the fire-grate space and the back of the stove; and it was found that the extra heated surface thus provided brought the efficiency of the stove up to more than 75 per cent. of the loss before noticed—the unaccounted-for loss being mainly due to unconsumed products of incomplete combustion.

Having now gained an idea as to the efficiency of the stoves at present used, it becomes possible to consider how this efficiency can be increased. It is, I think, now thoroughly recognized that it is impossible to do away with the products of incomplete combustion as long as the heating flame is brought in contact with any surface cooler than itself. In other words, the only way to get complete combustion is to allow the flame to burn itself out without contact with any other body; and the only form of stove in which, as far as I know, this has ever been attempted, was one in which flat luminous flames were burnt in the top of the stove, and the light and radiant heat were reflected out into the room by a concave copper reflector placed below the flames. But the small amount of heat radiated by a luminous flame burning under ordinary circumstances was so small that this stove was never very efficient.

Many forms of stoves which heat the room rapidly depend upon either hot-air chambers or a certain length of flue between the stove and the flue, in order to utilize a proportion of the heat which would otherwise escape up the chimney. But such stoves have two important drawbacks. In the first place, the thin iron of which the flues or air chambers are composed soon gets heated to a high temperature; and under these conditions carbon monoxide, which is the most deleterious of the products of incomplete combustion, freely diffuses through it, and escapes into the room—vitiating the air, and quickly giving rise to a feeling of oppression and headache. This principle, therefore, should only be used for stoves in which flame burns unchecked, and where, consequently, the combustion is perfect. Secondly, the largest part of the heating is effected by warming the air of the room, and not by radiant heat, which is wrong. Radiant heat does not directly raise the temperature of the air, but is radiated to the floor, walls, and furniture in the room, which again slowly part with their heat to the air in contact with them, and to the inhabitants, so that the walls and solid matters in the room are at a higher temperature than the air.

Apart from its being much more healthy to breathe cool than hot air, there is another important point to be considered. The normal temperature of the body is 98° Fahr., 36·8° C.; and this temperature is maintained by the slow-combustion processes going on in the body. By the laws of radiation, a heated surface parts with its heat more or less rapidly according to the temperature of the surrounding bodies; so that if a person be sitting in a room filled with warm air, but near a wall colder than the air, his body will rapidly part with heat by radiation to the wall, and a sensation of chill is the result. But with an open fire this is never the case, as the radiant heat from the fire heats the walls of the room to a temperature higher than that of the air. When, however, a room is heated by means of warm air, the walls not being heated in the same proportion, though the air may feel warm, the walls remain cold; so that the heat of the body would pass by radiation to the walls, and give rise to a chill.

A good gas-stove should not depend too much for its heating effect upon discharging warm air into the room, but should distribute a considerable proportion of its heat by radiation, and so raise the temperature of the floor and furniture in the lower parts of the room. Most of the gas-stoves tested complied with this requirement—notably the three best ones; the floor and the first 2 feet above the floor-level being at a higher temperature than the next 6 feet, while, as might be expected, the hottest air was next the ceiling.

On now attempting to discover methods of improving the service of our gas-stoves, one's thoughts naturally turn to regeneration, the application of which to illuminating flames marked the first step in the great advance which has taken place during the last two decades. The genesis of modern forms of regenerative lamps really sprang from using the principle in the construction of a gas-stove; and it is fully realized that the greatest drawback to a regenerative burner is the enormous amount of radiant heat it emits.

It can readily be proved that, as the temperature of a luminous flame is raised, the amount of heat radiated by the incandescent carbon particles increases at a far greater ratio than the heat of the flame itself; so that, by raising the temperature of the flame by only (say) 150° C., you will enormously add to the power of heat radiation. I have made experiments on this point, and find that a flame on being raised 256° C. in temperature, by regeneration, emits 250 per cent. more radiant heat—90 per cent. of this, however, being radiation from the heated regenerator. The 256° C. increase was a rise of 20 per cent. in the temperature of the flame; but this was sufficient to give 166 per cent. increase in the heat radiated. It is manifest, therefore, that much may be hoped from an introduction of the principles of regeneration with gas-stoves.

Mr. Siemens, who introduced the first practical form of regenerative lamp, also applied regeneration to gas-stoves, which are largely used on the Continent. In the gas-stoves made upon this principle, the gas is burnt in the upper part of the stove in a row of small isolated jets; and the products of combustion are led down through a pocket of sheet iron, in contact with the walls of which the air to supply the flame is made to pass. The heated air causes regeneration of the small flames, which give a

most brilliant light, and radiate a very large amount of heat, which, falling upon a suitable reflector, is directed over the floor and lower part of the room. The stove has thus the cheerful appearance which is one of the great charms of the open fire; while the heat is communicated to the apartment in the same way. The flames being out of contact with any cooling surface, combustion is complete, with the result that there is no carbon monoxide to leak through the metal sides, and the stove is absolutely free from smell.

Having obtained a large and small stove of this construction, I tested them under identically the same conditions as the English stoves. To my surprise, I found that the efficiency was nearly two-and-a-half times as great; the 200 cubic feet of gas consumed in the German stove giving a rise of temperature of 31° Fahr. as against the 13° Fahr. yielded by the best English stove with the same consumption of gas. Comparing this with bituminous coal, we find that 80 cubic feet of gas, or 2½ lbs., are equal to 35 lbs. of coal or one-fourteenth the weight. The coal, however, only costs one-tenth the price of the same weight of coal gas; so that, making allowance for this difference, coal gas is substantially cheaper than coal burnt in the ordinary form of grate, when regenerative gas-stoves are employed.

The introduction of the regenerative principle for lighting purposes practically increases threefold the amount of light obtainable; and it would appear probable that, when properly applied for heating purposes, an increase nearly as great may be obtained.

Regenerative stoves, moreover, made on the principle of those to which I have just referred, are free from many objections which militate against the ordinary form of stove; and the absorption of heat from the products of combustion is rendered so perfect that they can be discharged into the flue at a temperature of 200° Fahr. It is advisable, however, not to carry the cooling of the products to quite this point, as it leads to condensation of the water in the regenerating chambers, which have, therefore, to be fitted with syphon overflows to keep them clear. If the escaping gases are brought down to between 300° and 400° Fahr., no condensation takes place, and the temperature of the escaping products is sufficiently high to give a brisk draught in the chimney, and so make the stove almost as good a ventilating agent as an open fire.

As I before pointed out, it is unwise to attempt cooling the products of combustion from an ordinary gas-stove, because of the presence of carbon monoxide, which leaks through the iron plates; but wherever complete combustion of the gas can be ensured, the more the cooling of the products, the higher will be the heating efficiency.

I think that, at the present moment, a practically new factor in the combustion of coal gas has been introduced, which will mark an epoch in the consumption of gas for heating purposes. When we mix air with coal gas in a Bunsen burner, diffusion has practically no time to complete the admixture of air and gas in its passage up the tube to the point at which it is burnt. So that we are practically consuming small streams or layers of coal gas, which are side by side with similar layers of air; and, although the result is a certain acceleration of the combustion, that acceleration is very small compared with what could be obtained by other methods which would give complete admixture for combustion. In order to ensure the greatest intensity of heat which is entirely dependent upon the rapidity of combustion, we must have the particles of gas and the particles of air which are to enter into combination side by side; so that when ignition takes place, the particles can instantaneously combine without having to search for the body with which they have an affinity. In a blowpipe, we achieve a certain increase in temperature by blowing an excess of air under pressure into the centre of a gas-flame; the inrush of a larger quantity than is really needed rendering the combination of the particles of air and the particles of oxygen in the air more rapid. But such an arrangement has the drawback that, at the same time that you are putting in a large quantity of oxygen, you are increasing in four times that ratio the supply of inert nitrogen. This has to be heated to the same temperature as the flame, and cools it down to an enormous extent; the difference between the temperature of an ordinary atmospheric blowpipe and an oxy-gas blowpipe being due to this fact.

M. Denayrouze—an illustrious member of the French Gas Institute—having realized this fact, has made an atmospheric burner in which, after the gas and air are mingled in the ordinary way, they can be churned into a condition of complete admixture by a small fan driven at a high rate of speed, in a chamber situated a small distance below the point of combustion.* The effects which are gained by this process are really remarkable, and will enable us to obtain, from coal gas and air, temperatures far above those which we have before considered possible. The temperature of such a flame is so high that it is impossible to measure it by thermo-couples by the same method that we can employ with an ordinary Bunsen flame; and we have to rely upon the intensity of incandescence which it can produce in order to judge of the increase in its heating power. If we take an ordinary Welsbach burner and mantle, with the chimney on, in order to increase the uprush of air, it is stated that we obtain with London coal gas a light of 12·5 candles per cubic foot of gas consumed; but on using the same mantle with the Denayrouze burner and with London coal gas, we develop a light of not less than 27 candles per cubic foot of gas consumed, without the use of a chimney. In other words, the incandescence is more than doubled; and I have had burners in my London laboratory, which will consume 9 cubic feet of gas per hour, and give as much as 250 candle power.

I saw this burner first in Paris, where it was developing 25 candles per cubic foot of the Paris 14-candle gas. I was so surprised at the result, that I imagined I must have made some mistake in my translation from Carcels and litres to candles and cubic feet. So I induced M. Denayrouze to let me have some of the burners over at my London laboratory, where I found that not only were these results thoroughly confirmed, but that the increase in the quality of the gas augmented the light by 2 candles per cubic foot of gas consumed. It must be borne in mind, moreover, that this burner requires no chimney, and that the fan which does the mixing is driven by a small electric motor only requiring 0·25 ampère at 4 volts. The amount of electricity used is thus excessively small; and where electric power is not available, the fan would be quite as well driven by clockwork. The fan is used entirely to mix the gas and air, and is so arranged that the pressure at the burner is extremely low. It seems to me that the adoption of this principle, or some modification of it, may prove as great an advance in the efficiency of our consumption of gas for heating and cooking purposes as it undoubtedly will be in lighting.

In conclusion, I think that the gas manager must at the present moment feel certain that, instead of the gas industry being practically moribund, as our electric rivals would have us believe, it is really only in its infancy, and that the improvements in heating and lighting which the next quarter of a century will bring forth, will even eclipse the magnificent record of the past two decades.

Discussion.

The President said this had been a most interesting and valuable paper; and he hoped they would have a good discussion, so that the subject might be thoroughly threshed out.

Mr. Denny Lane asked Professor Lewes if he thought the mantle of the new burner would last as long at the high temperature shown as at the lower one.

Professor Lewes said he had not had the mantle burning a sufficiently long period to say. He simply used it to demonstrate the temperature of the burner by the intense incandescence of the mantle.

Mr. Norton H. Humphrys (Salisbury) said he had been extremely interested in the explanation given by Professor Lewes of the Bunsen burner. It cleared away difficulties which he had noticed for some time past; and very possibly others who had to use these burners had observed the same thing. Sometimes in heating a crucible, one burner was found to be much better than another. For instance, he had one particular burner for this purpose which really seemed to give a much better result than any of the others; but he had never known why. This explanation, about the more perfect or better mixture of the air and gas, seemed to clear the matter up. The question he wanted now to ask was with regard to the flame. It was pointed out that, in the ordinary Bunsen burner, the gas and air burnt side by side; and that, by

* For an illustrated description of this burner, see our "Register of Patents" for June 11 last, p. 1256.—Ed. J.G.L.

getting a better mixture, a better result was obtained. He (Mr. Humphrys) would ask whether the combustion was incomplete in the ordinary burner, and whether some of the better effect obtained was not due to more complete and better combustion?

Mr. T. N. Ritson (Kendal) desired to thank Professor Lewes for his admirable paper, which had brought up an old subject in altogether a new fashion. He should be very glad indeed of further information with regard to the German stoves mentioned in the paper. He found that, with English-made stoves for bedrooms, the noise they emitted when burning was a very great drawback; and in many cases he had to take out gas-fires simply on account of the hissing noise. Anything which would obviate this objection would certainly be a step in the right direction. He had drawn the attention of stove-makers to the matter; but the objection still seemed to exist.

Mr. D. Bruce Peebles (Edinburgh) said he was much disappointed that his friend Dr. Ferguson, the respected head of the Edinburgh Institution, was not present that morning; because he, as a student at Heidelberg under Professor Bunsen, was the first to bring from Germany to Scotland a Bunsen burner. It would have interested him very much to have heard the admirable lecture given by Professor Lewes, and to have seen the experiments in which the Bunsen burner took such an important part. In connection with the use of gas in heating stoves, he should like to refer to one point—viz., the absorption of heat by the walls of houses, whereby an enormous amount of heat was wasted. For the last 18 or 20 years in his house, he had had a warming apparatus; and a good deal of fuel was used. But still they could not get hot water as readily as he liked. About a month or six weeks ago, he covered the tank in the upper storey of the house with felt; and the great economy and increase of heat resulting from the simple application of a non-conducting material was extraordinary. It occurred to him whether something of the same kind could not be tried for houses—whether it would not be an advantage to put a non-conducting material, such as slag wool or something of the kind—on the walls of the rooms, instead of the ordinary plaster, so as to reduce the absorption of heat.

Mr. W. Carr (Altrincham) asked if they might be allowed to see the flame of the French burner apart from the hood. He felt quite bewildered by the mass of information contained in Professor Lewes's paper and the lecture which had preceded it; and he was quite unable at the moment to discuss the former.

Mr. C. S. Ellery (Bath) said Professor Lewes's was a most important paper; and he thought there must be some practical outcome from it. There could not possibly be this large increased efficiency, where mechanical appliances were brought into play, without some effort being made to introduce them into stoves. He should like to ask Professor Lewes whether in some degree the same effect might not be brought about by lengthening the passage through which the gas and air had to travel. When the tube of a Bunsen burner was cut down too short—out of proportion to its area—the flame lit back, and there was incomplete combustion; and it occurred to him (Mr. Ellery) that, if the tube were lengthened considerably, the gas and air would have a longer travel, and the mixture might become more complete. They must all be pleased to see the possibilities of improved lighting as well as heating under these new conditions.

Mr. Stelfox said it was no doubt a most beautiful lamp. He assumed it was so arranged that, when the gas was turned off, the action of the motor also ceased.

Professor Lewes said that was so. The motor was arranged to be driven according to the pressure and quality of the gas.

Dr. Stevenson Macadam (Edinburgh) said that he had been greatly pleased with the paper, and in no important sense could he profess to hold different opinions to those which had been so clearly expressed by the author of it. He was very pleased indeed to find Professor Lewes had alluded so prominently, in the first part, to the necessity of having flues in all gas-stoves, whether for cooking or heating purposes. Every gas manager knew the necessity for this; but the popular mind still required to be educated. It was very common to find stoves introduced into the rooms of dwelling-houses—especially bedrooms—and no arrangement made for ventilation. Consequently, gas-stoves had a bad name. He had been very much interested in the light of the new lamp just shown. There appeared to be a decided advantage undoubtedly in the more thorough mode of mixing the air with the gas. Whether this result could be achieved by the method suggested by Mr. Ellery, he did not know; but there could be no doubt, from the appearance of the light and the records of Professor Lewes's experiments, that there was a great increase in the luminosity of the flame. At first, he (Dr. Macadam) was inclined to think that possibly there might be a great danger in mixing the air and gas together—provided, of course, there was a considerable gas and air space in the lamp—as there might be a tendency to explosion, especially if these lamps were placed in the hands of comparatively ignorant people in ordinary households. A large amount of new matter had been brought forward in Professor Lewes's paper, which would require very careful consideration; and the main object of such papers and discussions following thereon was to encourage research, and to obtain new facts. There was no doubt that Professor Lewes's interesting experiments must, in the long run, conduce directly and indirectly to great improvements being made in both lighting and heating by gas.

Mr. Alderman Miles (Bolton) said it would be impossible to speak in adequate terms of the way in which Professor Lewes did all his work; and therefore it ill became him to say that he felt a little disappointed on just one point. The Professor made a very pertinent and strong reference to the heating-stove introduced by Mr. Siemens in Germany, and had given an exhibition of the Welsbach light. But they would have been delighted to see the stove referred to; for it seemed to him that in that stove, if it were going to be a commercial success (as he had no doubt it would be), they, as gas managers, were going to reach the millennium so far as heating by gas was concerned. It appeared to him a marvellous statement to make; and its far-reaching character could easily be understood when they heard from Professor Lewes that a stove had been introduced which would be practically as economical as coal. When such a thing was introduced into England, there was bound to be a revolution in the heating of rooms. He should like to know whether there was a likelihood of seeing this stove actually in work within eighteen months or two years; for he was sure it would be hailed by gas managers with the utmost cordiality.

Mr. Denny Lane said if 15 or 20 feet of gas per hour were consumed in an ordinary burner at the height of 6 or 7 feet above the floor of a room, no inconvenience was found to arise, provided there was sufficient ventilation; and he should like to know if they had gas-stoves carrying their flues within the room, and delivering the products of combustion at the height of 7 or 8 feet above the floor, whether that would not do away with the necessity for having the flues connected with the external atmosphere. Unless there was some difference in the products of combustion, it appeared to him that, if they were evolved at the same height as they were in the ordinary lighting arrangements, the inconvenience would be in a great measure got rid of.

Professor Lewes, in reply, said that Mr. Humphrys had opened the discussion by some very pertinent remarks on the Bunsen burner. He asked really what difference the perfect mixing of the gas and air made in the flame. Suppose they took an ordinary Bunsen burner flame, Mr. Humphrys asked: Did the imperfect mixing bring about imperfect combustion? No; it really brought about a great length of travel before the combustion was completed. If one took the imperfect mixture, it would be found that the flame was 6 to 7 inches in length before one got the constituents of the coal gas and the oxygen of the air, with their strong affinities, discovering each other, and getting duly "wedded" into the products of combustion. But the difficulty which they experienced merely lengthened the flame, and did not in reality affect the ultimate combustion. Do away with this difficulty; bring about a thorough admixture by means of a small fan rotating at a high speed; and the flame would be found to be at once shortened down to nearly half the size. There was the great secret in the increase of temperature—the longer the flame, the greater the dissipation of heat. It was intensified both by increasing the rapidity and decreasing the size; and for this an enormous increase in the heating effect was obtained. In the ordinary burner, this admixture took place imperfectly; and he (Professor

Lewes) was not at all sanguine of increasing the mixing by increasing the length of tube. There were one or two points upon which they were a little hazy; and chief of them all was that wonderful law of the diffusion of gases. They had all been taught that gases diffused into one another inversely as the square roots of their densities. But that was a purely proportional function, which did not tell one anything about the absolute rate. They often thought it possible to pass gas into a holder, and for diffusion to do an enormous amount of work in a very small amount of time. He had had this idea upset on many occasions. If one took a small holder and put in two gases of different densities, they would mix fairly quickly; but increase the holder to double the size, and the diffusion would take—not double the time, but six times as long. Increase the holder until it reached a half-million size; and everyone knew there would be a layer of dead gas at the top after perhaps six weeks with the holder going up and down all the time. In this case, the diffusion in some unaccountable way had ceased to be that rapid factor in mixing the gas that they were apt to reckon upon. In sending any gas through a Bunsen burner, it was manifest that the gas and air must pass in at different rates of flow. That was manifest because the air was under ordinary atmospheric pressure, and the gas under a pressure of 1 inch or 1½ inches, and being delivered through a small orifice. There was, therefore, a distinct rush of gas, and a slow flow of air round it. But when one had two sets of molecules—one moving at one pace, and the other set moving at another—it was much more difficult to bring about the diffusion which would lead to complete mixture. When he first saw the Denayrouze burner, he had an idea that it would be possible to utilize the rush of gas in the burner itself to run a little fan to work a motor which would mix the gas and air. But on trying experiments on this point, it had been found that the rapidity of mixing was not sufficient to complete it. The quicker the motor travelled, up to a certain point, the more perfect the mixture, and the more perfect the result. He did not think there would be any danger of explosion for this class of burner. With regard to stoves of the regenerative type being introduced within two years, he did not know how long they had been introduced into Germany and Austria; but he thought he had seen them in certain parts of Austria for two years at least, and perhaps more. It was seeing them, and noticing the wonderful amount of heat coming out of the reflecting surface, that attracted his attention. When he first saw them, he thought it was the old form of luminous-flame stove. Then he noticed that from the reflecting surface there was a great deal more heat coming than was obtained under ordinary conditions; and, on looking into the matter, he found that they were regenerative stoves. He thereupon obtained the samples which he had tested. He did not think there were any on sale in England; but there was not the slightest difficulty about getting them or making them. His hope certainly was that if the German manufacturer could make a stove of this efficiency, the English manufacturer would not be very long before he also did it. The first point was to bring out the fact that efficiency could be increased in this way. Mr. Denny Lane's question immediately afterwards would suggest that point. If there were a cluster of flat-flame burners just above one's head, no trouble was experienced from the heat. But if there was a big Wenham or any other form of regenerative burner just above the head, a distinct cause of oppression and heat would be felt. With regard to Mr. Lane's question, as to the possibility of doing away with flues if the products were discharged into the air above a height of 6 feet, his advice was: Do not do anything to keep alive the idea that a flue could be dispensed with. There must be a flue, because with ordinary stoves the gas-flames were burning, and not giving complete combustion. Directly the flames were interfered with, there was incomplete combustion, which played havoc with health. Of course, if regenerator burners were used, in which complete combustion was taking place, and the products were nothing but carbon dioxide and water, these could be allowed to go into the room above a certain level, and there would only be the same amount of oppression as if the same amount of gas were burning from open burners. But as there were very few English stoves which did this, he did not think it advisable to give any colour to the idea that it was safe to do without the flue. [Professor Lewes then proceeded to explain further the action of the lamp by first stopping the motor, to show that the mixing of the air and gas was not going on. A much longer flame was thereby produced. He then removed the mantle so as to show the difference between the burner without the fan and with it. On increasing the rate of the motor, the flame became shorter, and of much greater intensity.]

Dr. Macadam asked if, when the light was burning in this way, there was any tendency to strike-back.

Professor Lewes said the rate of the motor was regulated so as to give a mixture just above the point at which it would strike-back; all chance of this being, however, prevented by the form of the burner, and by a guard of wire gauze.

THE TRANSFER OF GAS AND WATER UNDERTAKINGS TO PUBLIC AUTHORITIES.

By William Newbigging, of Manchester.

It may be thought by some that, as this is an institution of gas engineers, any mention of matters relating to water is out of place. But, as you are well aware, many of the members of the Institute are engineers, managers, and secretaries, and, in the case of a few fortunate ones, even shareholders and directors, of joint gas and water undertakings. Furthermore, as an advocate of the gas and water works wherever practicable—and especially in towns of moderate size—being under one and the same management, I think I need hardly make any apology for coupling the two together in the paper which I have the honour and pleasure to submit to you.

The advisability of a local authority acquiring the undertaking of a water company is rarely questioned, even if the amount to be paid for the concern is a somewhat onerous one; and when it is considered that to every person water is a prime necessity, and that to a large extent the health of a community depends on a pure and bountiful supply of that commodity, it is not to be wondered at. About the acquisition of a gas undertaking, there is considerably less unanimity of opinion; though it will be conceded that a supply of gas for lighting, heating, cooking, and motive power purposes, at a reasonable rate of charge, is only second in importance to a supply of cheap and pure water.

A public authority having allowed a company to "bear the burden and heat of the day," in the shape of the risks which are run when establishing and working up a new business, and seeing with a jealous eye the success of the company, begin to ask themselves the question—"Why should we not acquire the undertaking, and appropriate the profits in relief of the rates, or in a substantial reduction in the prices?" A praiseworthy inspiration no doubt, but one requiring careful consideration.

Having instructed their officers to prepare a statement giving the particulars of the working and cost of similar undertakings to their own which have been so transferred, they are apt to feel astonishment at the amounts that have been paid to the companies owning such works. After some consideration, however, their astonishment gives way somewhat, and they begin to take a reasonable view of the matter. They remember that the company has had granted (or should have had granted, if those in charge of the undertaking have exercised foresight) statutory powers from Parliament, giving it practical immunity from competition. They also remember that, during the years of trade depression, the company has not only been able to keep its head above water, but whilst other trading concerns were sinking round about, it has been paying substantial dividends, and the business has been a constantly growing one.

Looking back on the career of gas and water undertakings generally, they have nearly all been successful; and the promise of the future, except to a few timid shareholders—and those without a real knowledge of things—is to-day as bright as, if not brighter than, ever it has been. Hence it is easy to understand that, in nine cases out of ten, shareholders in a gas or water undertaking are reluctant to dispose of their property; and they are the more reluctant now-a-days when it is so difficult to find a safe security yielding a return anything like equal to the dividends they are receiving from their present investment. The shareholders are quite willing to let well alone; and, whilst satisfactorily fulfilling their

statutory obligations, to rest content in the knowledge that they are in possession of a thoroughly sound security. However, if the public authority of the district in which the undertaking is established seem determined to acquire the property—and the newly formed District Councils are bestirring themselves in this direction—it behoves those in charge of gas and water undertakings to put themselves in a position to enable them to state on what terms they are willing to dispose of their property.

Whether the undertaking is gas or water, the principle adopted of arriving at the commercial value is the same. With a statutory undertaking, the maximum dividends allowed under the company's Special Act on the called-up capital, are taken as a basis; and these are multiplied by a certain number of years' purchase. In the case of a non-statutory company, the average maintainable yearly profits are taken; and these are usually such as appear in the latest published year's accounts. Of course, if anything should have occurred of an exceptional nature during the year—whether in the shape of an unusual increase or decrease in the price of coal, or an expensive lawsuit, or any other similar but abnormal occurrence—this should be taken into consideration, and a deduction or addition made as the case may be, until the fair maintainable profits of the year are arrived at. Having ascertained the amount of the maximum dividends, or the year's profits, as the case may be, it is necessary to answer the question which naturally arises: Is the undertaking in a condition to maintain these profits? This necessitates an inspection of the works by one qualified to give an opinion.

It sometimes happens that a public authority and a company are able to agree on the amount of the purchase-money; and to an outsider this seems to be very desirable. But it is not always as desirable as it appears on the surface, looking at it either from the seller's or the purchaser's point of view. When a transfer at an agreed price takes place, the public authorities are apt to find themselves saddled with a works which, in addition to having cost them a large sum, require an immediate outlay for plant to meet the demand for gas or water as the case may be. On the other hand, when a thorough investigation has been made—and it is here that the advantage of a reference to arbitration shows itself—the condition of the undertaking as a whole, and the state of the producing and distributing plant, as well as the financial details, are thoroughly inquired into; and any deficiencies are brought to light and allowed for in calculating the value of the undertaking. Then, again, when the plant is found to be largely in excess of general requirements, and there is a prospective value to be taken into account, an addition is made to the calculated prices. Nothing should be taken for granted, as is often the case when a lump sum is agreed on. A reference to arbitration is generally the cheapest in the long run, even when the cost of such reference has to be paid.

Having arrived at the fair maintainable profits, or the maximum dividends, it is necessary to determine the number of years' purchase which should be asked for an undertaking. I have purposely avoided giving a table of the number of years adopted in the case of transfers that have taken place of recent years, as such a table might be more misleading than otherwise. Suffice it to say that, for statutory companies, they range from 25 to 30 years in the case of gas, and as high as 33 years in the case of water. For non-statutory gas and water undertakings, the number of years ranges from 20 to 25, according to circumstances. It will readily be granted that a statutory undertaking, being a more stable investment, is able, and ought, to command a higher price than a non-statutory company. In past times, the average number of years' purchase was less; but owing to the cheapness of money, and the consequently greater difficulty of finding another equally good and profitable investment, the number of years' purchase has risen considerably. Now, by multiplying the yearly profits, or the maximum dividends, by the number of years' purchase, the commercial value of the undertaking is ascertained.

The winding-up expenses are paid by the purchasers. If a reserve fund has been accumulated, it is retained by the vendors, unless otherwise agreed. The responsibility for the repayment of borrowed capital, when the interest is made a deduction from the profits, is assumed by the purchasing authority. The value of the stock-in-trade—such as gas, coal, tar and liquor, fire-clay goods, and other stores, in the case of a gas undertaking, and of water in stock, coal, and general stores in the case of a water undertaking—usually taken over by the purchasers at a price fixed by valuation, is in addition to the amount of the umpire's award.

A compulsory purchase clause in a Special Act is assumed to add about 10 per cent. to the ascertained value. Seeing that the amount of the umpire's or arbitrator's award is not given in detail, but a lump sum is stated, it is impossible to know—unless one is actually the umpire or one of the arbitrators—what is in their minds when making an award. So that it is not always possible to determine whether any sums claimed by way of additions for compulsory purchase, winding-up expenses, and compensation to officers, are included in the award. In such event, the amount of the latter item is left to the generosity of the shareholders.

Such is, in brief outline, the *modus operandi* of arriving at the commercial value of a gas or water undertaking. It should be borne in mind, however, that an accurate estimate demands a careful inquiry; and it is well, before venturing to negotiate, to seek the advice of those whose long and varied experience enables them to advise on the best course to pursue.

The purchasers of such works are, of course, the public authorities, as representing the ratepayers; and they are naturally anxious to pay as small a sum as possible for the undertaking. If it is a water undertaking, there is not so much to pick at as is the case with a gas undertaking; and the state of the works, with a hint or two that the purity of the water is not all that it might be, that an immediate expenditure is necessary, together with any financial misdoings, are about the sum-total of the statements made to depreciate the value of the concern. A gas undertaking has usually to bear the brunt of a much more severe attack. Added to the charges above mentioned, it is pointed out that, since the electric light came more generally into use, it has had the effect of lowering the market value of the shares, and consequently the total value of the undertaking; also that the recent improvements made in oil-lamps, and the greater cheapness of oil, have made this a more formidable rival than before; and that the fact of the profits depending to a great extent on the price of coal, and that in recent years the price of labour has increased, the profits are not likely to be as much in the future as in the past. Such, as a rule, are the arguments used to depreciate the value of the undertaking; and it is necessary to refute them.

Has the electric light in any single instance been detrimental to the interests of a gas company? On the contrary, it has stimulated the gas companies to greater efforts; and they have increased their consumption in directions which at one time were hardly dreamt of. I refer more particularly to the increased consumption of gas in the daytime, and for the hundred and one purposes to which gas is applied, and may now be said to be indispensable. No; the electric light may in some instances have caused the market price of the shares to droop a little, but it has in no way altered the real, substantial value of a well-managed gas concern. The recent improvements in oil-lamps (and they were much needed) are to be commended; but the advantage that oil possessed—in that people were able to pay for it as they used it—has been counterbalanced by the introduction of prepayment meters. The enormous demand for these is a proof that people prefer gas to oil, if they can pay for it by small instalments. So much for oil. As regards the price of coal, and the labour question, these are factors which influence the success of every undertaking, whether railway, gas, or electric light. All these statements are brought forward with a view to reducing the value.

A concern burdened with a heavy capital, on which maximum dividends are being paid, is not able to sell gas or water as cheaply as one with a smaller capital; and it is the possibility of being in a position to lower the price, amongst other reasons, that tempts a public authority to take steps to acquire such an undertaking. They know that the cheapness of these necessaries—gas and water—is an aid to the prosperity of the town, as it induces people to come to the neighbourhood, not only to reside, but to establish various works where the cheapness of gas and water is a *sine quâ non*.

Many men, acting as the representatives of the public, hesitate to take the responsibility of investing a large

amount of money in a gas undertaking, which, however differently we may think, they consider more or less speculative. And thus many undertakings which ten years ago could have been acquired for a comparatively small sum, have doubled in size, and the possibility of their being taken over by the public authority is more remote than ever.

In a case of this kind (and I know several such), it may be suggested that steps might be taken to acquire the distributing portion of the undertaking; the company retaining possession of the works up to the inlet of the governor—the governor and all the distributing plant forward to the inlet of the consumers' meters, to be in the hands of the public authorities themselves. The amount to be invested would not then be as large as if the whole undertaking were taken over. A price would be fixed for (say) 16-candle gas. If the public authority wished to have gas of a higher illuminating power, then the company to supply it at a proportionately higher price. A laboratory and photometer room would be established at the works, near to the outlet from the governor. This room would be under the control of a competent examiner, whose salary would be jointly paid by the gas company and the public authority, and whose reports as to the quality of the gas supplied by the Company would be accepted as conclusive. He would have no control over either the manufacture or distribution. I need not elaborate such an arrangement. I know well the objections to it; but they are not insuperable. It would at least give the public authority that which they are so anxious to obtain—viz., exclusive control of the breaking-up of the streets, the purity, and the illuminating power of the gas. The gas company, freed from the expense of collecting accounts, and the outdoor work generally, would supply the gas in bulk at a price agreed on, leaving the rate charged to the consumers to be fixed by the authorities. If, in course of time, the latter, having gained confidence and the requisite knowledge, decided to become manufacturers of gas, as well as distributors and purveyors, a sale and purchase of the manufacturing part of the undertaking could be arranged.

Discussion.

Mr. J. Hepworth (Edinburgh) said that everyone would be glad to see Mr. Newbigging following in the steps of his father; and he hoped that both their names would in future frequently appear in the Institute's "Transactions." He could not help thinking that a good deal of the father's wisdom was condensed in the son's paper. The case had been very fairly stated indeed with regard to what should happen when there was a transfer. A good many present probably were not anxious to see such transfers; but these things were sometimes forced on their notice. It was well, therefore, at all events, to be forearmed; and anyone having read this paper would be informed as to the method which ought to be adopted when a transfer was under consideration. It was very desirable in all such cases that proper advice should be sought—no doubt they would all agree with that assertion; but he did know of two instances (one a year or two ago) where a works was actually agreed to be sold for what any competent person would have said was at least £10,000 to £15,000 below its value. In this case, if the company had but consulted those who really knew what the value of their concern was, they would not have made such a glaring mistake. But it might be, although it was not so likely to occur, that the mistake would have been the other way; and the public authority might have been, by the absence of information, induced to pay a larger sum than the value of the undertaking. There was, therefore, great value in the suggestion made by Mr. Newbigging, that a competent opinion should be sought before any transfer took place. With reference to the last paragraph in the paper, in which it was suggested that they might perhaps some day come to an arrangement whereby a gas company should be the wholesale manufacturers, and the local authority the retail dealers—though he feared the local authorities would scarcely feel complimented by the suggestion—he thought they would hardly like to assume the humble position of being merely distributors of gas. He did not want to see this suggestion take shape, for the reason that at present those who had to do with gas undertakings and gas companies had quite sufficient difficulties with the local authorities; and he thought that these would be magnified (and could not be lessened) under such an arrangement. He feared it would lead to a constant source of irritation. But there was another and more important question than the comfort of the engineer involved. What would be the ultimate value of the undertaking when the works as well as the distributing plant were eventually severed? He could imagine what Mr. Newbigging's answer would be—namely (that given in the former part of the paper), that it should be so many years' purchase of the profits or dividends. But he feared that, when making an estimate of the value of an undertaking after it had been thus severed, there would be a very great divergence of opinion as to its value; and an arrangement of this kind would not work well from that point of view. A great deal of responsibility, in his opinion, attached to engineers who had acted in recent years in arriving at the value of gas undertakings. He had in his mind certain members of the profession who had in a most unaccountable way depreciated the value of a gas undertaking in the interest, of course, of the clients by whom they had been retained. He could not understand how a man who was imbued with the right view of the value of the class of property by which he earned an honourable living, could persistently try to depreciate the value of the undertaking in the eyes of others. It led to this, that, when the parties came to an arbitration (or rather before that), the public authorities had such a poor conception of the value of the undertaking that, when the works came to be transferred, there was universal heartburning or disappointment because the award was so large. This had arisen solely because the persons who were consulted by the local authorities advised them so injudiciously, and so persistently depreciated the value of the undertaking, that it became most difficult either for the engineers on the other side, or for the persons for whom they acted, to get them into a reasonable attitude again. This had led to an innovation in this year's legislation. There had been two or three Bills in Parliament this year with reference to the transfer of gas and water undertakings (but especially gas) in which a clause had been inserted—for the first time he believed—to the effect that the undertaking should be purchased by the local authority as an undertaking to be purchased by agreement, and not under compulsion. Another clause had been introduced, that the stock-in-trade should be classed as part of the undertaking. Again reference was made to the expense of the transfer; and there had been an attempt even to put this expense on the person who was disposing of his property, and doing it unwillingly. He (Mr. Hepworth) was glad to see that these clauses had been very successfully fought in the present session; but he did not know whether they would be fought so successfully next year. As yet no Bill (so far as he knew) had been passed containing these injurious clauses. He hoped the paper would prove useful in giving information on these points, and put gas managers on their guard against depreciating their property unduly.

Mr. Herbert Lees (Hexham) said one or two difficulties occurred to him with regard to the suggestion for transferring the distributive portion of the works to the local authority and the retention of the manufacture by the company. It would require two managements; and in a large proportion of works, two managements would mean a less salary and presumably an inferior class of management. With regard to the breaking-up of streets, he was not quite sure that the greatest friction occurred where the streets were under the control of the gas company; and it was quite possible that there might be as much friction between two departments of the local authority as between the gas company and the local authority. He had places in his mind where such diversities of opinion prevailed. Then came the question of reducing the price of gas, with the view to increasing the consumption; and difficulties would likely arise there in this way. The company would retain its profits on the manufacture; and the local authority would have its profit from the price it charged over what it paid. But there would still be the power on the part of the local authority that there was now, to transfer a considerable amount from the rates to the profits; and this would necessarily keep up the price of gas, and prevent that increase of consumption which reductions in price might bring about. The company would have no control over such a proceeding; and consequently the consumption would be kept down. When the whole works was under one control, he thought, these

matters could be much better arranged; and there would be a greater incentive to please and educate the consumers, and to increase the consumption of gas.

Mr. J. Stelfox (Belfast) said the author had not given any definite opinion as to the desirability of these transfers taking place, but had rather confined himself to the methods to be observed in case of such transfer occurring. There had always been a considerable doubt in his (Mr. Stelfox's) mind whether, after all, corporations were the right parties to conduct manufacturing industries. The openness of the committee in many ways—especially when there were many persons who took pains to find out what was going on—was often a great obstacle; and there were very few businesses which could be conducted with the publicity given to proceedings in committees. He had at times told some of his friends that, if they had to go down to sell their linen with the lowest price they were prepared to take (on an emergency) displayed on the front of their hats, there would be very little advantage in going on 'Change. There were certain advantages in corporations having gas-works. The main one was that they could borrow money cheaply; and in most corporations the amount standing against them for interest was very low as compared with the dividends required to be paid to shareholders in companies. That was the principal inducement to a corporation to undertake the acquisition of gas-works; and any such inducement would be completely lost if Mr. Newbigging's suggestion were adopted, of the manufacture being continued by the company, and the distribution taken over by the corporation. On the other hand, there was this objection to corporations: Mr. Newbigging spoke of the desire for pure water and pure gas; but he (Mr. Stelfox) was afraid that corporation gas was sometimes adulterated with politics, which it was much better to keep out of any manufacturing concern. At the same time, there could be no doubt that, seeing that money could be had so much more cheaply by a corporation, there would always be an inducement to acquire these undertakings. With regard to the services of a consulting engineer being obtained, he thought they were very useful if they could only assume the standard Mr. Hepworth had set up. In such cases, a consulting engineer should not be necessarily a partisan, but go in for fairly ascertaining the value—not being retained (as solicitors usually were retained) to make the very best case they could for their clients, irrespective of the justness of their claims.

Mr. Alderman Miles (Bolton) said he understood Mr. Newbigging to say that, in his opinion, fewer transfers from gas companies to corporations would be made in the future than in the past; and in that opinion he (Alderman Miles) entirely agreed. He had noticed a disposition on the part of local authorities of late years to "fight shy" of taking over gas undertakings, for more than one reason —mainly, he thought, because they were very strongly imbued with the idea that electricity would supersede gas. As to whether it was desirable for a local authority to take over the works of a gas company, that was a matter on which there would always be differences of opinion. Having had experience in both capacities, he thought it was a good thing for the community at large, generally speaking, to take over the works of gas companies. In his experience, in a town where the works were under the old company and they had taken a portion of land for extensions immediately contiguous to the public park of the town, and there began to erect some immense gasholders, there was a great outcry from the inhabitants; and public meetings were held against the outrageous conduct of the company. They all knew the friction which was going on between gas companies and local authorities with regard to the breaking-up of streets. Now immediately upon the transfer of the gas company to the corporation, the corporation set about completing the extension of works near the public park; and not a single word of complaint was heard from any portion of the inhabitants. It had been said that practically there might be a considerable amount of friction between the various departments of a local authority with regard to the opening of streets; and he was disposed to agree with that. But it was remarkable, when they knew that the gas-works belonged to the town, how careful they were to avoid making any public outcry about them. All these difficulties were kept rigorously confined to the four walls of the committee-room. The gas-works with which he was acquainted—which were acquired something like 22 years ago from a company—had given in relief of the district rates a sum equal to £200,000 out of their profits. It might be said: "But what had the price of gas been all this time, or what would it have been if the works had been in the hands of the old company?" He believed he was right in saying that the price of gas, and the arrangement of the works, were equally well-managed under the corporation as they were under the company; and instead of the shareholders who only formed a small portion of the community being benefited to the tune of £200,000, the money had gone into the hands of the ratepayers at large. He did not know that, if he were a gas manager at the present moment, he should wish to be transferred from a company to a corporation. He had seen cases, much to his regret, where, the moment the transfer had been made, the manager's or engineer's life had been made anything but pleasant; and this was one of the worst features of corporation management. The members of the corporation, on committee, thought they had a perfect right to attack public servants on every conceivable opportunity, and sometimes without just cause. But still, on the whole, he thought where the works were transferred, it would be an advantage to the general public —not that he expected to see many such transfers in the future. Gas property was now in such a prosperous condition as he had never known it in his experience; proving clearly that the works were generally well managed, and a sound and good property.

Mr. Newbigging, in reply, said he was pleased with the criticisms which had been passed on his paper. In writing it, he had simply stated such facts as he thought would be of use and interest to those who had had no practical experience of such transfers. Whether transfers of this character were a benefit to the public generally was somewhat beyond the province of the paper; and on that point he had not expressed any decided opinion. But he might say that, judging by the success which had attended the working of concerns so transferred during the past ten or fifteen years, they had in the majority of cases benefited in a pecuniary sense. It was, however, very questionable whether they had altered their position at all as regards improved lighting. In this respect, the companies, with very few exceptions, were satisfactorily fulfilling their obligations. Some of the points raised by the various speakers were deserving of a much better answer than could be given in a merely impromptu reply. He had, however, quite sufficient material out of which to form another paper; and this he hoped to have the pleasure of putting before the Institute on another occasion. As one of the younger members of the Institute, he had cheerfully responded to the invitation of the Council to prepare a paper; and he need hardly say how highly he appreciated the honour.

The Association of Gas Engineers of Austria-Hungary.—The fourteenth ordinary general meeting of this Association was held on the 24th and 25th of May, at Salzburg, under the presidency of Herr C. Bauer, of Vienna. In the absence of the Mayor, the members were welcomed to Salzburg by his deputy, Herr Mayer. The post of Treasurer, rendered vacant during the year by the death of Herr G. Grotz, had been filled by Herr Göhring, whose place on the Committee was taken by Herr Kelsen. These appointments were confirmed for the ensuing year; and the three retiring members of the Committee, as well as the Auditors, were re-elected. It was decided that next year's general meeting should be held at Buda-Pesth. Thanks to the able editorship of Herr M. R. von Pichler, seconded by the exertions of the publisher, Herr O. Mohrstedt, the *Gastechniker* (the official organ of the Association) brought in a small, but satisfactory profit. Herr Nachtsheim, of Vienna, who is the Honorary President of the Association, in his introductory address, reviewed the progress of the gas industry, and the more recent applications of gas. He was followed by Herr F. Lux, who gave an interesting address on "Acetylene;" showing, in a small experimental plant, the production of the gas from calcium carbide. Herr Nachtsheim then read a paper on "Gas Tramways;" referring especially to the Dessau installation, which has proved so marked a success. Cooking by gas received attention at the hands of Herren C. F. Schweickhart and F. Horadam, who exhibited the appliances of their respective firms—the Water, Lighting, and Heating Company of Vienna, and Messrs. F. Siemens and Co. Herr Blum, of Berlin, made an interesting communication on a new gas-hammer and Reuther's condenser. A prize of 100 florins was awarded to Herr Nachtsheim for his paper on the "Gas Tramway." It was decided to include in future the current topics of water supply in the proceedings of the Association; and the meeting then closed with a vote of thanks to the President.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 49.)

BUSINESS on the Stock Exchange during the past week was, on the whole, rather quiet; and despite some little tendency to irregularity at times, prices ruled firm almost throughout the list. One of the most noteworthy things is the pace at which all first-class stuff is being forced up; and the movement is thoroughly genuine, owing to the impossibility of employing money elsewhere. Consols were done at 107½ *ex div.* on Thursday—a record price, but one which is not likely to remain a record long. Home, Colonial, and American rails rose freely; and the Foreign Market did pretty well. The change of Government at home seems to have made a good impression. The Money Market was but little affected by the settlement, which operation was got through without inconvenience. In the Gas Market, transactions were decidedly below the average; and on some days things were very quiet indeed. There was a marked tendency to rise in price; and, in one or two instances, the upward movement was accentuated to a remarkable degree. Gaslight "A" opened rather sluggish at first, and changed hands at 277½. But it rapidly developed great buoyancy, and rose by big steps, until on Saturday it took a jump up to 290—a difference of no less than 12½ between the opening and closing prices. Not much was done in the secured issues; but anything offering was readily taken at nice figures—the debenture stock being especially good. There was very little business done in South Metropolitans; but it is interesting to note that on Wednesday the "B" was at 301½—a price which returns about £3 19s. 8d. for money. It is a new "record" for the ordinary stock of a Gas Company to beat a 4 per cent. price. Nothing was marked in Commercials. The new stock was inadvertently put down on Wednesday; but the erratum was corrected the next day. Suburbans and Provincials changed hands but little, as usual. But prices were very good; and Brentfords marked a substantial rise. The Continental Companies were more than usually inactive; but Union made a considerable advance in price. Among the rest, Bombay and Melbourne were the only ones to vary. The Water Companies were for the most part quiet; but almost every one had a considerable rise in quotation.

The daily operations were: Gas opened unchanged on Monday, and remained without much sign during the day. New River Water rose 5. Tuesday also was a quiet day; but Gaslight "A" advanced 3. East London Water was ½ higher. There was even less doing on Wednesday. But the tendency was all on the rise; and Continental Union improved 5. In Water, East London and West Middlesex gained 3 each. Thursday's business was mostly in Gaslights; and the "A" rose 2. On Friday, transactions in Gas were at their lowest—only three bargains being marked; but Gaslight "A" and each Brentford issue advanced 3. In Water, New River improved 5. Saturday was quite active; and prices were excellent. Gaslight "A" rose 2; Melbourne bonds, 1. In Water, Lambeth advanced 2½; and East London and West Middlesex, 2 each.

ELECTRIC LIGHTING MEMORANDA.

A Combined Electrical and Water Supply Undertaking—Destruction by Fire of the Sardinia Street Supply Station—Electric Lighting in the City of London—A Question of Interpretation.

As an illustration of the desire of electric lighting engineers to discover a practicable way of supporting a central electric lighting station by some auxiliary business, a paper recently read at Cologne by Herr Luhn, upon a combined water supply and electric lighting installation recently put in operation at the village of St. Lazarus, near Posen, is not without interest. It appears that the inhabitants of this district (numbering 3000) wanted a better supply of drinking water than their private wells afforded; and this was found on a spare piece of public land. Thereupon it seems to have occurred to somebody that an electric lighting plant could be tacked on to the water pumping station; and this was accordingly done after a highly ingenious and most scientific plan by which steam power sometimes pumps water, and sometimes drives a dynamo and charges a battery of accumulators, which again are capable at a pinch of pumping water, actuating a set of air compressors to give more head to the water supply in case of fire, or keeping incandescent lamps going when the main engine is not working. The streets are lighted by arc lamps; and everything is highly satisfactory—to the electrical engineers and contractors who carried out the work. Fortunately, in the nick of time, a large customer for water was secured in the Railway Company; and since then the sale of water has covered the entire cost of working. This is very lucky for the villagers, since the electrical portion of the combined installation cost £3750 out of a total expenditure of £5000. How long the water consumers will remain content to pay the bill for everything, remains to be seen; but the bare statement of the facts is instructive as illustrating how matters are likely to stand when electric supply is combined with another enterprise.

On the evening of Monday last week a destructive fire broke out in the Sardinia Street station of the Metropolitan Electric Supply Company, when the generating plant and distributing connections were totally destroyed. The premises consisted of a large building of several stories; and the fire broke out with great violence somewhere in the upper portion, and defied all efforts to deal with it. With the usual malignity of Fate, the mischief happened just as the plant was being made ready for the evening's work, which comprised the lighting of a large number of places of public entertainment, hotels, restaurants, and clubs in the West End. It is stated that, although the general supply of current from the station was stopped in consequence of the fire, the interruption was only of a few hours' duration, owing to the Company's system of trunk mains, which enables the various stations to help each other in time of need. Unfortunately, however, the local connections being destroyed, it was impossible to immediately connect up all the distributing mains; and it was half-past eight o'clock before the theatres and other of the most important consumers in the neighbourhood of the Strand were lighted as usual. Others had to wait until next day. Accidents will happen; and it would be unfair to exaggerate the importance of this disaster. But, for all that, it would not be surprising if the occurrence were to induce some of the inconvenienced consumers to reconsider their lighting arrangements. If the present breakdown at Sardinia Street had occurred two or three hours later in the evening, the annoyance to the public would have been far greater, and might not have been without an element of danger.

The City of London Commissioners of Sewers have decided to carry out the experimental street lighting mentioned in this column last week, at a cost of £386. At the same time, they directed their Streets Committee to consider the desirability of experimenting also with incandescent gas-lamps. It is not too much to expect that every possible discouragement which the electrical party in the Commission can bring to bear upon the Committee, will be applied to prevent this direction from having any practical effect. It is something, however, that the Commission have been prevailed upon to recognize the fact that the last word has not been said for gas in connection with street lighting. Plenty of experimental proof has already been given that, for a very small additional outlay, the gas lighting of the City of London might have been greatly improved. But the local Electric Lighting Company was the child of the Mansion House; and although the period of gestation was remarkably prolonged in this case, there is reason to surmise that some of the civic nurses made a good thing out of the happy event when it did come off. So we do not hope to see the incandescent gas-burner taken further notice of by the Streets Committee. The recent debate on the subject of the further electrical experiment furnished an opportunity for a member of the Commission to draw attention to the circumstance that the City is paying £12,500 for the electric light, as compared with £4464 for gas under the old system. And yet there are rumours that the Electric Lighting Company are not happy.

As was expected would be the case, faults are being found with the proposed new Board of Trade regulations for electric supplies. It is complained that the use of small arc lamps for lighting shop exteriors will be prejudiced by the requirement that all such lights shall be suspended at a height of not less than 10 feet from the ground. The employment of this description of arc lights for the purpose named is stated to be increasing, on account of their superiority in regard to economy and effectiveness to the large incandescent electric lamps which are also used for the same purpose. The question here depends upon what is meant by the term "small" in connection with arc lamps. Many attempts have been made, without permanently good results, to reduce the size of arc lamps so that they shall only give the light of 100 candles or so. Such lamps might without inconvenience to the public be used in front of shop windows, in proper screened lanterns, at a less height than 10 feet from the pavement. But if by a "small" arc lamp a light source of what is called in the trade 1200-candle power is intended, there is good reason for the proposed regulation. It is further complained that the requirement that arc lamps are not to be used "in situations where there is any danger of the presence of explosive dust or gas" might be interpreted to prevent their employment in many factories and interiors, as well as wherever gas is also used. This is rather a straining of the point; because it can hardly be the intention of the Board of Trade to forbid the companionship of electric arc lamps and gas-burners in the same building. It will be as well, however, to have the matter cleared up; since experience shows that the official mind is prone to take official regulations very literally after they are once adopted by authority.

The Deimel Light Company, Limited, are introducing two novelties in the form of a shadowless gas-light and a combination arrangement for lighting and cooking. The former consists of an ordinary burner in a white porcelain globe, which is attached to the bracket by the side, and not supported in the usual way; and consequently there is no shadow cast by the globe-holder. The other novelty is a movable pedestal lamp, fitted with a framework support for a shade or a kettle, so that it can be utilized in offices, bedrooms, chambers, or elsewhere, for both illuminating and culinary purposes. The lamp is connected with the gas supply by means of india rubber tubing.

"PRO BONO PUBLICO."

One of the differences between the proceedings of the two national societies representing the British gas industry at their respective annual meetings of the present year has consisted in the circumstance that, while engineering topics mainly engaged the attention of the May meeting, that of June was the occasion for the publication of several novelties dealing with the utilization of gas by the consumer. This was particularly observable in the exhibits of the respective meetings. Not a single new burner or other appliance of the kind was in evidence at the professional gathering at the Royal United Service Institution; and the only communication relating to the application of gas (as distinct from its manufacture and other questions for the engineer and manager) brought before that meeting was Mr. George E. Stevenson's memoir upon the "Modern Gas-Engine." On the other hand, The Gas Institute meeting had before it several more than usually interesting and important novelties, appealing as much to the notice of the gas-consuming public as to the sympathetic study of technicians. The Penman oxy-coal-gas incandescent light for lantern and other uses, the holophane diffusing globes, and the Denayrouze improvement of the incandescent gas-burner, were actually shown in full operation in the hall of meeting in Edinburgh; and the much-needed improvement of gas heating-stoves was brought before the members in a suggestive manner that can hardly fail of the proper effect of stimulating makers of these articles to look a little farther than the immediate market. It is one of the functions of associations of gas managers to supplement the technical press in regard to the publication of new and improved methods of using as well as making and distributing gas; and it cannot be gainsaid that this purpose was fulfilled in respect of the matters and appliances already named as forming part of the business programme of the Edinburgh meeting.

It appears to us, however, that the task that should be recognized as falling to gas companies and their representatives, organized or otherwise, in regard to the education of the public in the art of making use of illuminating gas to the best advantage, goes beyond anything that can be efficiently done at these annual meetings. Never a year passes without bringing some new fruit of the ceaseless energy and remarkable ingenuity of the large and growing order of inventors who know that there is almost infinite opportunity and scope for their talents in this field of labour; while the stock of knowledge, in the possession of skilled technicians, of what already is and can be done, and available as the starting boundary from which new departures can be hopefully made, is enormously large. This information might and could easily be made much more fruitful than it is, if means were systematically employed for communicating it to the non-technical world. It is a commonplace of all science teaching that the cause of mechanical progress owes much to the initiative of amateurs, who often think of improvements and means of effecting them that would never occur to trained minds. On the other hand, a tremendous amount of effort, time, and money are continually being wasted by enthusiastic amateurs through their ignorance of considerations with which the technician is necessarily familiar, though in the ordinary way he keeps his knowledge to himself. The amateur of invention does not consult the professional as to what is working in his mind, for fear lest he might be forestalled in bringing it out; and so he goes on labouring at problems upon data which may, for all he knows, contain an absurdity fated to vitiate the issue. And, after all, after the technician and his unattached colleague the amateur have done their best, and effected an improvement competent to make the life of the ordinary citizen easier, to save his pocket, or to increase his chances of a prolonged existence, the citizen is left to make acquaintance with what has been done for him by means equally at the command of the charlatan and the fraudulent trader.

Much of this is inevitable, so far as the fortunes of new inventions are concerned. The proprietor of a meritorious invention may be a benefactor of the community in the second place; but in the first place his aim is to benefit himself. For attaining this end, he must rely upon himself; and it is no part of the duty of the State or of any public organization to help a member of the community who cannot or will not help himself. At the same time, it is possible and right for the community, or for a specially interested section of it, to encourage well-doing on the part of individuals. However, to recognize this as a principle is one thing; to carry it into sound practical effect is another. There is that which goes by the name of encouragement, which does not encourage; while the best and most fruitful encouragement may pass under another name, and only be recognized for what it is by those exceptional members of the community who are endowed with the gift of the seer. In the mechanical and industrial world, for instance, we know what is usually termed the encouragement of research and invention by the State or by a society. It commonly amounts to the offer of money prizes for success in achieving ends which would be attended with sufficient recompense for those who should be able to compass them in a legitimate and businesslike way. This is a sheer misuse of the term. There might be something to be said for it if prizes were awarded as compensation to those innovators who, without attaining to the end themselves, cleared the way for others, or to whom Fate had denied the ordinary financial reward of industrial success. For this reason, we do not countenance the idea of gas companies offering prizes for meritorious novelties relating to the conduct of the industry; nor are we contemplating for the moment the different question of the endowment of research. What we have in mind is something more easy of practical realization.

The idea is that in London and the largest centres of the gas industry, and for smaller places by a group of gas undertakings associated for the purpose, a new and distinct office might be created, which may be described as that of Inspector-General of Lighting and Gas Utilizing Appliances. The holder of such an office would, of course, be responsible to the engineer or general manager; but he need not necessarily belong to the ordinary gas-works staff. He should be a gentlemen of some scientific training; and while competent to specify and criticize ordinary gas-fitters' work, he should occupy himself mainly with the scientific and artistic side of gas lighting. It should be his care to look after opportunities for vindicating gas lighting in connection with new buildings, and accordingly to cultivate a relationship with architects and all public bodies, the managers of institutions, and the large shopkeepers and factory-owners. A good deal of tact would be required of an occupant of this office; but it should not be impossible for him to win confidence in himself as an adviser on points of lighting and cognate subjects that is not readily reposed in a purely gas-works official. It would be an important branch of his duty to take note of all suggested improvements of gas appliances; and to make use of the means of disseminating information among the people provided by lecture agencies and evening classes, for creating an interest in the matters committed to his charge. It would not be judicious to constitute him an apologist for the gas company or undertaking, or an opponent of any other system of lighting. All that is really required in this connection is that the truth about gas should be kept before the public. There would then be less of the opening that has hitherto existed in every community for the reception of false impressions in regard to matters of gas and other lighting. The Inspector would not write to the newspapers for the purpose of carrying on any controversy; but a prudent use of the "interview" and other means of keeping an active and enlightened local press acquainted with real facts of which its conductors are too often ignorant or careless need not be despised. In London alone there is ample employment for several suitably endowed professional gentlemen of the order we have indicated; and the principal cities throughout the United Kingdom could easily afford one apiece. Others, as already observed, might share the services of such an officer. Though the direct gain to a gas undertaking from the establishment of the new department might not often be traceable, yet indirectly, and in the long run, it is to be believed that it would pay very well indeed.

There is another way, in a sense connected with the foregoing suggestion, by which greater interest could be created in those subjects allied to lighting which are of such great practical moment for gas consumers. The study of practical optics might be encouraged in university colleges by the offer of prizes to students, the endowment of lectures, and similar measures that could be concerted between the teaching authorities and gas-works administrators. We do not speak here of the teaching of gas engineering or technics; but simply of the better cultivation of the science of optics as related to the practice of artificial lighting and illumination. Breadth of scope should characterize all efforts of this kind, which would be "throwing bread upon the waters." There could be no ordering of the shape in which the return should come. So far as we know, the gas industry has done little or nothing to assist the cause of scientific teaching. The teaching of the technics of the industry itself has only been spasmodically attempted. But even these tentative and occasional efforts have had great effect; and the standard of acquirement is now much higher among the very youngest recruits of the profession than was formerly held necessary. It should be the next task to educate the gas consumer; and this can perhaps be most hopefully attempted indirectly. We have on a previous occasion suggested a somewhat similar encouragement of art in regard to the design of gas-fittings by students.

It is the more essential that the instruction of the gas consumer should not be abandoned, by reason of the commercial turn that has been given to the now well-worn educational device of the last decade—the exhibition of gas appliances. Like all other industrial exhibitions, sectional or international, these occasional local displays of gas-utilizing apparatus have become simple devices for commercial advertisement, and have no more weight with the public than a trade circular. It is high time they were at least supplemented by something less identified with crude commercialism. The more immediately profitable they are, the less educational are gas apparatus exhibitions of the modern variety likely to be. They continue to serve a useful purpose in their way; but the purpose is something very different from that higher work which we suggest should be taken in hand in the manner indicated in this article—or, at least, in the same spirit. We do not insist upon details—the whole idea being but a mere suggestion, with only sufficient form given to it to render the conception intelligible. The great *desideratum* is to throw open, more patently than is

at present the case, the vast store of information which the best technicians and men of science unquestionably possess in regard to the practice of artificial lighting. It may, of course, be had now for the asking; but then those who need it most do not ask for it, but go on their way, wasting their money, and buying such knowledge as they ultimately acquire in the most costly and tedious of all schools—that of experience. Gas engineers may think, upon reading these lines, that since we are writing only concerning things that they know all about, it is unnecessary to evoke any other agency for providing and disseminating information. But how often is a gas manager consulted about the lighting of a public hall, or even of a public street, in the town he serves? These things are none of his business; and even granting him to know all about lighting, he has too much else to do to be always running after architects and public bodies with the object of seeing that they get money's worth for what they spend on gas. So, for one reason or another, it is quite exceptional to hear of skilled advice having been taken in regard to the lighting of (say) a railway station, a town hall, or even a line of thoroughfare.

It is unnecessary to cite additional reasons to show why the cultivation of the science of gas lighting is as worthy an object of the solicitude of a gas company at the present juncture as the pushing of the sale and hiring out of gas-stoves. The rent of a gas-stove shop in a fashionable quarter of a large city would pay the salary of a Chief Inspector of Lighting, and neither outlay would be felt by a gas company, while it might be difficult to say off-hand which would prove in the long run the more profitable investment. Both enterprises might be described as the outcome of an aggressive policy; and, in these days, industries that are not aggressive only too often turn out to be stagnant or degenerating. The gas industry in itself is all right, and likely to continue in prosperity; but on this very account it might well do a little more to help and secure the goodwill of the public that pays for all.

Gas Cylinders.—Professor Boys, Professor Harold B. Dixon, Dr. Dupré, the Rev. F. J. Smith, and Professor Unwin, who, as already mentioned in the JOURNAL, have been requested by the Home Department to inquire into, and report upon, the manufacture, filling, and use of gas cylinders, commenced their inquiry on Monday last week at the Home Office. Professor Unwin was elected Chairman. In the afternoon, these gentlemen visited the works of Brin's Oxygen Company, Limited. The inquiry was resumed on the following day, when Mr. Coxeter, Mr. J. Ralph, and Colonel Majendie laid their views before the Committee.

Sulphur in Oils.—Messrs. W. Fox and D. G. Riddick have been carrying out some tests of various oils, for the purpose of ascertaining the quantity of sulphur contained in them; and the results were given in a recent number of the *Chemical News*. The method adopted was to burn the oils by means of a floating wick, such as is used for night-lights, and condense, in a sulphur-testing apparatus, the vapours given off, in the same way as with coal gas. The experimenters found that Russian mineral oil (·908 sp. gr.) contained 20·5 grains of sulphur per gallon; Russian burning mineral oil, 10·3 grains; American do., 16·3 grains; American water-white mineral oil, 8·1 grains; American burning safety mineral oil, 14 grains; and Scotch mineral oil for gas making, 49·8 grains.

The Permeability of Earthen Dams.—As there has always been considerable discussion among engineers as to the permeability of earthen dams, interest attaches to some experiments recently made by the Boston (U.S.A.) Water Board, to obtain definite information on the subject. The matter is mentioned in the *Engineering Record*. The trials were conducted on the dam of the most complete reservoir ever constructed by the city authorities; and it was found that the leakage was at the rate of 60,000 gallons a day, or less than half the quantity passing through the dam of another reservoir. By means of a series of vertical pipes built into the dam at different points of its cross section, it has been found that the water-level in the embankment does not extend into the dam below the line of the core wall. The water percolates easily through the fine material placed against the up-stream face of the core, following the rise and fall of the impounded water in the reservoir, with a loss of head of about 1 foot only.

Gas-Engines for Pumping Sewage.—The Urban District Council of Rhyl have lately carried out a considerable extension of their sewerage system; and, in connection therewith, they have constructed an elevated reservoir, having a capacity of more than 380,000 gallons, for holding the sewage preparatory to its being discharged into the sea. The sewage is conveyed to the pumping-station, which is situated inside the gas-works; and within the buildings there are provided six engines for working the pumps. Two of the larger ones are each capable of lifting 300 cubic feet of sewage per minute (2,700,000 gallons per day) into the reservoir. The two intermediate engines can lift 45 cubic feet of sewage per minute. One of the larger engines would suffice to deal with the storm water, and one of the smaller ones with the ordinary sewage; but the second one provided in each case is for use in the event of a breakdown. There are two other gas-engines, which are used for working a screening apparatus—also in duplicate. All the engines were erected by Messrs. Crossley Bros., Limited.

NOTES.

The Cost of Producer Gas for Power Purposes.

Mr. W. H. Booth recently contributed to the *Electrical Review* a special article on the cost of producer gas, with reference to some statements of a Belgian manufacturer of steam-engines—Mr. Bollinckx—which were calculated to prejudice the rapidly strengthening case for the superior economy of gas-engines as compared with steam motors in general use. Mr. Bollinckx contended that producer gas cannot be madé for less than 1c. per cubic metre, or about 2¾d. per 1000 cubic feet; and upon this basis he built up his argument. Mr. Booth has obtained from Mr. B. W. Thwaite a counter-statement that, in his every-day practice, the volume of producer-gas made per ton of slack may be taken as 123,600 cubic feet, consumed in a gas-engine after the rate of 90 cubic feet per brake horse power. At this rate, one ton of coal will yield 1373 brake horse power; and taking the slack as worth 5s. per ton, the cost of fuel gas would be brought down to 0·171 centime per cubic metre. With the foregoing figures, the consumption of fuel per brake horse power per hour is seen to be 1·63 lbs. This is the fuel consumption without any attempt at the recovery of anything from the inevitable wastes. Mr. Booth goes on to argue that this way of working is not allowed in these days in regard to the steam-engine, which is provided with a condenser, a feed heater, and other agents for economy. He accordingly asks whether, and how far, similar economies can be practised with gas-engines. In this connection, so far, no attempt has been made to employ any parallel to the economizer or feed heater. In a gas-engine, with producer plant, there are three great sources of waste—the cooling of the producer gas; the exhaust from the working cylinder; and the water-jacket. If, as suggested by Mr. Thwaite, the producer condensers could be cooled by the air on its way to the producer, and all the heat carried back into the latter, a maximum additional duty of 43·5 per cent. would be realized per pound of fuel. Then there is the possibility of recovering residuals from producer gas. Lastly, the water that cools the gas-engine cylinder might be compelled to return to the producer, in the shape of steam, all the heat it absorbs. These economies would mean an increased fuel duty of 50 per cent; and, in conjunction with the return from recovered residuals, would reduce the fuel consumption to an equivalent of ¾ lb. per horse-power-hour—a figure with which the steam-engine cannot possibly compete.

The Efficiency of Primary Batteries.

Dr. Henry Morton has found it desirable to explain in *Cassier's Magazine*, for the benefit of those who are likely to be deceived by the promises of inventors of primary galvanic batteries for use in lighting and other purposes, the ultimate possibilities of these appliances. He observes that some recent publications and other intimations indicate that, with the general revival of business, there are likely to be brought before the public various schemes in which electric energy, derived from galvanic batteries, will be relied upon as the source of power. Reference is only made to the class of batteries which long experience has proved to be the most efficient in supplying large currents, excluding those of the Leclanché type which yield only feeble currents. In all these batteries, the energy is derived from the combination of zinc with dilute sulphuric acid. Thus the amount of the energy obtainable can be expressed in thermal units. The oxidation of the zinc and the solution of the oxide in dilute sulphuric acid do the work. Nothing can be added to this—no arrangement of parts or the employment of one material or another in other parts of the cell, or for any other parts of the reaction, can add to the duty, while there must always be some sources of loss. The ultimate theoretical duty of zinc consumed at the rate of 1 lb. per hour is stated by Dr. Morton at 0·35 with the Smee cell, at 0·55 with the Daniell, at 1·06 with the Grove, and at 1·14 with the Poggendorff battery. Of course, says Dr. Morton, if we could use some other and more efficient reaction than that between zinc and sulphuric acid, some gain might be secured. But nothing of the sort has ever been accomplished; nor, from what is known of the combining or thermal equivalents of the available elements, is much to be expected in this line. At all events, it may be accepted as a certain fact, that in any known form of galvanic battery the round figure of 1 lb. of zinc per horse power per hour is an outside figure for efficiency; and when anyone asserts that more than this has been secured, there is certainly some mistake or fraud.

A New Selenium Photometer.

Professor Minchin has made a preliminary report to the Royal Society upon the result of his experiments, carried out at the Observatory of Daramona House, County Westmeath, upon the photo-electric measurement of starlight. The method employed in the experiments for determining the intensity of the light which reaches the earth from the stars and planets, consists in ascertaining the electrical energy generated by such light in certain photo-electrical cells; the square of this electromotive force being proportional to the energy of the incident light. In these cells, the surface on which the incident light is received is formed by depositing a thin layer of selenium on a surface of clean aluminium, and immersing the sensitive layer in a glass cell filled with œnanthol. The seat of the reaction is

the surface of contact of the liquid and the selenium. An examination of a seleno-aluminium cell with the various portions of the spectrum of lime-light shows that it is sensitive to all the rays from the end of the red, and below it, to beyond the violet —the maximum effect being produced in the yellow; but the magnitude of the effect does not vary very greatly until the violet is reached. In this respect, the seleno-aluminium cell differs from all other photo-electric cells, which are sensitive mainly in the blue. The energy incident on a photo-electric cell has been found to be proportional to the square of the electro-motive force generated. If one candle held at a certain distance from the cell gives a difference E of potential between the poles, two candles close together will be found to give a difference $E\sqrt{2}$. Or if a candle is tried at different distances from the cell, the difference of potential will be found to vary inversely as the distance. It would appear from this statement that Professor Minchin has been able to improve the selenium photometer.

Water-Meters versus Pumps.

Mr. Charles E. Bolling, the Superintendent of the Richmond (Va.) Water-Works, is greatly in favour of the general introduction of water-meters. The experiment is being tried in Richmond; and Mr. Bolling has recently reported that 95 per cent. of the consumers who use meters have saved largely in their water bills, and are pleased. It has often been found that the first bill after a meter has been fixed is a heavy one, which at once arrests attention, and the trouble is investigated. By this means leaks have been discovered which were secret, and had been going on for years. The works pumped last year a million gallons of water per day less than during the preceding year; and the pressure in the city was better. Mr. Bolling maintains that measurement is the only equitable method of charging for water. To avoid complaints, he would place a meter on every service, and charge according to the present rates up to a certain consumption—any extra to be charged for by measurement. Unless more meters are fixed, more water will have to be pumped. The Richmond City Council are at present opposed to the meter system. But Mr. Bolling declares that the meters economize pumping; and he sees no reason why water should not be paid for like gas—by measurement.

TECHNICAL RECORD.

WESTERN (U.S.A.) GAS ASSOCIATION.

(*Continued from Vol.* LXV., *p.* 1378.)

Mr. Allen S. Miller, of New York, read a paper on "Metal Gasholder Tanks." He remarked that the site for the gasholder was usually selected without reference to the suitability or otherwise of the ground. Even if satisfactory at first sight, and after testing by bore-holes, it was no uncommon thing for unexpected springs, quicksands, or boulders to be met with in the course of construction; largely increasing the cost and the difficulty of making the tank sound. He then proceeded to show that the risk of such inconvenience and loss could be avoided in the first place, not merely without extra cost, but with some economy. If a steel tank was put down, instead of a masonry one, the outlay for excavation would be saved, and that for the foundations greatly reduced. The cost of excavation ranged from 1s. to 3s. 4d. per yard, according to circumstances—such as the size of tank, facility for disposing of the spoil, extent of pumping required, &c. Brickwork would cost £2 to £3 12s. per yard, according to locality; a mason laying 1000 to 1500 bricks per day in mortar made of one part by measure of Portland cement to three of sand. No figure could be given to indicate the cost of stone. Quoting from actual facts, in one case the cost of a brickwork tank, 102 feet diameter by 21 feet deep, was about £3350. A similar tank in another locality cost £3780. The outlay on a tank of equal size in steel was about £2400, exclusive of foundations. A brick tank 82 feet diameter by 20 ft. 8 in. deep, cost £2200; but a steel tank of similar size, less than £1600. Taking nine tanks of steel, ranging from 57 feet to 125 feet diameter, and from 19 feet to 31 feet deep, he found the cost varied from 3·3d. to 3·7d. per cubic foot capacity. Brickwork tanks would cost 30 to 60 per cent. more. Certainly the expenditure for maintenance was greater in the case of steel; and more steam would be required in frosty weather. The extra cost of this was shown by calculations to amount to about £50 per annum. Against this it might be said that masonry tanks often required repairing. As to durability, he saw no reason why steel tanks should not last indefinitely; proper care being taken to grout the bottom. He summed up the advantages of steel, as compared with masonry tanks, as affording a possibility for making a close estimate, giving absolute tightness, saving of time in erecting, and saving of cost; the extra cost for maintenance being more than covered by the interest saved on capital. He had just witnessed the completion of a steel tank 190 feet diameter by 50 feet deep; and it proved perfectly tight. The plates in the bottom course were the largest ever rolled in America; being 1¾ inches thick, 4 ft. 4 in. wide, and 24 ft. 9 in. long.

Mr. Clark thought that, with careful workmanship, it was as easy to make a tight masonry tank as a tight steel one. The latter was quite as difficult to repair as the former. When a masonry tank was once properly finished, it required no further attention at all; and he had yet to be convinced that it was not possible to make a sound job. Many of those that were now leaky could easily be made tight and firm; and if a good coat of asphalte was put all over the interior in the first place, so much would not be heard about leaky tanks. So far from requiring less, he thought steel tanks required more foundation; as there was less likelihood of getting a good bed at the surface than 20 or 30 feet below. Mr. Forstall had observed that a 50-feet steel tank required more steam to keep the ice out than a 125-feet masonry tank. Mr. Humphreys considered the facts warranted the claim that it was easier to make a tight tank of steel than of masonry. The remarks made by Mr. Clark about foundations did not always hold good; they had all heard of heavy weights being put upon floating foundations. By simply levelling the surface, it was practicable to provide for very heavy weights by a proper arrangement of concrete foundation; whereas by excavating, all sorts of soil were met with, which might or might not cause great trouble. If there was any doubt as to the site, an iron or steel structure should be chosen.

Mr. Miller, in the course of his reply, said he claimed that a steel tank required less foundation than a masonry one, because the weight of the iron or steel used was very much less than that of the brick or stone. There was a great difference between the weight of iron plates and thick masonry walls. As to foundations, of course, in some cases, there might be swampy ground on the top; but in many others, there was a good surface and a bad substratum. As to repairs, everything was in favour of the steel; as it was easier to caulk or set up a strained joint, than to repair a cracked wall. Side leaks in a metal tank could be stopped from the outside without pumping out; but in any case care was required in laying the bottom.

Mr. G. H. Harper, of Altoona (Pa.), read a paper on the "Advantage of the Metric System;" producing the well-known arguments in favour of a universal system of weights and measures, as compared with the various standards of different countries. The unit of linear measure should be an aliquot part of the circumference of the earth; and when applied to length, breadth, and thickness, it should give the standard for linear, square, and cube measure, whilst the unit of cube measure in distilled water should furnish the standards of weight and capacity. The commerce of over 400 millions of the world's population was to-day carried on under the metric system; but Britain and the United States held, not only to complicated Government systems, but also to many "customs of trade" measures or weights.

Mr. Clark thought there was no doubt as to the advantages offered by the metric system, which was gradually being adopted for scientific purposes all over the world, and would no doubt eventually come into universal use. Mr. Thompson said that the American Metrological Society had been agitating in favour of this movement for 23 years; and he quoted extracts from pamphlets issued by the Society. He concluded by proposing—"That this Association authorize the use of the metrical system in its reports and transactions, and that it join the American Metrological Society as an Association." Mr. Forstall seconded the proposition; and it was carried. Mr. Greenough questioned whether the metric system had made much progress during the last 15 or 20 years; and he thought it would be a long time before it came into general use. Mr. Miller said there was another side to the question. The inch was largely used in Germany and France, for gauges, taps, bolts, and such things, because the metrical system was found unsuitable for shop practice. While useful for the scientific portion of their proceedings, he thought it would not do for the commercial and practical part.

Dr. Slocum, of Pittsburgh (Pa.), read a paper on "Acetylene," illustrated with experiments. In the course of some historical notes on the discovery of calcium carbide, he mentioned that corresponding nitrite compounds had also been found, which evolved ammonia by contact with water. Speaking with some practical experience, he put the cost of the calcium carbide at 3d. per lb.; so that at present it was outside practical considerations. He enlarged on the suitability of acetylene for use as a standard of light; and promised further information on this head at a future date.

A paper entitled "Experience with Foul Gas," was read by Mr. J. T. Lynn, of Detroit (Mich.). The author described the difficulties caused by a fracture in one of the division-plates of the purifier centre-valve, which rendered it impossible to avoid passing foul gas. The water in the station meter and gasholder tank became quite foul and black; and the complaints from the consumers were so numerous, that he was obliged to fit in a new centre-valve at once, although this happened in the middle of the winter. He had to run lime water into the gasholder tank, in order to purify the water; and an unexpected effect of this course was that the inlet-pipe—which had been bye-passed for some years, on account of its leaky condition—was rendered sound, and put into use again. Though in this case, the bye-pass between the inlet and outlet had proved useful, he did not at all approve of the use of such an arrangement as a permanent thing. He proceeded to argue in favour of systematic testing at the purifiers, and of apparatus of ample size, according to the kind of coal used. This consideration was frequently overlooked altogether;

but as a matter of fact, there was great difference in the proportion of sulphuretted hydrogen evolved from various coals, and even from successive consignments of the same kind of coal.

The next paper was entitled "Recuperative Furnaces as applied to Bench Firing; their Operation and Results." The author was Mr. J. A. Faux, of Pittsburgh, who commenced by describing the difference between a full-depth and a half-depth furnace. He said that the steam used at the base of the furnace should be first superheated by being caused to circulate through pipes surrounding the ash-pit; thus securing a considerable saving of heat without extra expense. The superheated steam was also useful in its effect upon the mineral matter in the fuel, which would be converted entirely into ash, and not burnt to clinker; and another advantage was the facility it afforded for controlling the temperature in the generator. The combustion chamber should be sufficiently large to prevent any flame from passing into the flues. The chemical action should be completed at this stage, as the flues, or possibly the chimney, were not the proper place for combustion to occur. In ordinary furnaces, more than half the fuel was wasted; and especially was this the case when bituminous coal was used as fuel. With regenerator furnaces, any kinds of fuel could be used, including those of a very inferior class. When using bituminous coal, care must be taken to secure the complete combustion of the volatile hydrocarbons. At present, 100 lbs. of slack coal had been carbonized with 11 lbs. of the inferior coke afforded by it; and the author argued that it would be possible in theory to reduce this to 8⅓ lbs. Bearing this in mind, it was rather startling to find that many ordinary furnaces required 25 lbs. or more of fuel per 100 lbs. of coal carbonized. In conclusion, some figures were quoted which went to show that very high yields are only secured by an excessive use of fuel.

Mr. G. Osius, of Detroit, was the author of a paper on "Ammoniacal Liquor." He made the astonishing statement that, out of nearly 1000 gas-works in America, only about 150 utilize the ammonia, and that the quantity run to waste by the remainder would be equal to over 7,000,000 lbs. weight of 20 per cent. liquor. With this waste going on, large quantities of ammonia were imported. He proceeded to consider how it would pay to utilize the ammonia; and whether there would be risk of over-production if all of it was put on the market. Even for works as small as 7 million cubic feet per annum, it was worth while to put down a plant for concentrating ammoniacal liquor; and an incidental advantage would certainly be that the purifying capacity of the liquor would be fully utilized—economizing the cost of purification, and improving the quality of the gas. No inconsiderable quantity of light tar at present went to waste with the liquor; and all this would be saved. As to the question of over-production, he enumerated the various uses to which ammonia was applied. During the last two years, no less than 26,000,000 lbs. had been imported, and the demand was increasing; so there was plenty of room for disposal of all the ammonia they could save, and also for that from coke-ovens and blast-furnaces as well. The present production was about 30,000,000 lbs. of sulphate of ammonia, the whole of which was absorbed for agriculture alone.

Mr. James Somerville opened the discussion by arguing that, whether utilized or not, it was cheaper to take out the ammonia in the washers and scrubbers than in the purifiers; and also that the purifying capabilities of the liquor should be fully utilized. At present, he realized 1s. 8d. per ton of coal carbonized for his ammonia. All tar should be extracted before the gas reached the purifiers. Mr. Forbes said he lately commenced the utilization of the ammonia; and he could support all that had been said in the paper. Mr. Young had taken up the concentration of liquor; and though there was some trouble at first, he was now doing well with it, and was satisfied with the pecuniary results. He found that the product must be tested by distillation or acid, and not by the hydrometer; as if a considerable proportion of sulphur was present, the results by specific gravity would be much too high. Mr. Clark asked for some recent experiences in the use of limed coal for increasing the yield of ammonia. Mr. Osius, in the course of a reply to several questions, directed attention to the importance of properly storing the strong liquor. If this was not attended to, there would be great loss.

A contribution on "The Best Method of Introducing Gas-Engines" was received from Mr. E. G. Cowdery, of Milwaukee, describing the course he had lately taken. First he collected accurate details from users of gas-engines, as to work done and cost of gas. This was printed in pamphlet form, and distributed to every user of power in the district. Meanwhile, the local agency for all engines not otherwise represented was secured. The pamphlet led to inquiries and orders; and the profits on the sales nearly paid all the expenses. Later on, there was a local industrial exhibition; and he exhibited a 12-horse power gas-engine driving electrical machinery, and gave away 10,000 copies of a "Gas-Engine Primer." He followed up with liberal advertising and personal canvassing; aiming chiefly at large users requiring 50 horse power and upwards. He commenced operations in November, 1893; and the result of the first year's work was the placing of 20 engines, representing an aggregate of 148-horse power, in addition to 47 previously in use. A new edition of the pamphlet was issued last January; and there had been a steady demand for engines ever since. This showed that it paid to go to some trouble and expense in making known the truth about gas-engines. The selling price of these appliances was, however, much too high; and gas associations should see if anything could be done in the way of getting them reduced. A 25 per cent. cut would still leave good profits, and yet it would double the sales.

(*To be continued.*)

THE USE OF GAS AND OIL ENGINES FOR WATER-WORKS IN GERMANY.

Some time ago, Herr Max Munzel read a paper, at a meeting of gas and water engineers at Lansberg, on the subject of the employment of gas and oil engines in connection with the supply of water. He has since dealt with the subject in an address to the Cologne section of the German Society of Engineers; and an abstract translation of his remarks appeared in a recent number of the *Engineering Record*. From this the following particulars are taken.

Ten years ago, only the steam-engine was considered available for pumping when a suitable water power could not be found; but to-day engineers are no longer so restricted, and are able to use gas-engines for such work. The amount of the necessary power is hardly a hindrance to the employment of the latter; since motors of 200-horse power, and higher, can be bought. The use of more than this power in German water-works practice is exceptional; and in the 85 pumping plants mentioned in the statistics compiled in 1894 by the Society of Gas and Water Engineers, only five had pumps of more than this power—viz., Zurich, Hamburg, Dortmund, Augsburg, and Barmen. In those cities and towns where it is impracticable to operate the motors with the ordinary lighting gas, they can be run by gasoline and petroleum. The leading advantage of the gas-engine is that it needs no boiler and chimney, and thus saves space—an important matter in some places. As regards safety and durability, it is equal to the steam-engine; while so far as superintendence is concerned, the gas-engine has the advantage. One man can look after a number of motors and pumps if arranged in a single room; and his duties are not difficult—consisting principally of starting and oiling. A steam plant of moderate size requires an engineer and fireman, and possibly a coal handler. Another advantage of the gas-engine is its availability for immediate service. After lighting a single gas-jet, the largest pumps may be put in operation in four or five minutes, which is of great importance in case of a fire or extraordinary demands for water. This also warrants the construction of smaller water-towers, since the engine supplying them can be run intermittently, as often as desired, without any loss of gas during the time it is still. Steam-pumps can only be kept ready for use by maintaining a fire under the boilers all the time, which necessitates a constant expense for fuel and attendance. These considerations also point to the value of a gas-engine as a reserve in a steam-plant that runs normally at or near its maximum capacity. Pumping by gas-engines is also advantageous to a gas plant, as the harder pumping occurs during the daytime, when the demand for gas is otherwise slight; while less water is required during the evening, when more gas is needed for illumination.

The authorities of Duren selected gas-engines in 1884 to operate the new water-works—being the first to introduce the system. The innovation made a wide impression; and in the same year, the city of Quedlinburg replaced its steam pumping plant with one operated by gas-engines. In 1886, Rottwill and Coblenz made the same change; Furth and Peine followed in 1887; and Carlsruhe and Munster in 1888—the last employing producer gas because illuminating gas was not supplied easily. These early plants have now been running for six to nine years, with satisfactory results. The works in Quedlinburg, Furth, Coblenz, and Carlsruhe are after much the same plan as the one at Duren. According to the report on the Quedlinburg Gas and Water Works for 1885-6, the cost of fuel for raising a million gallons of water was about £3 15s. with coal, and only about £2 with gas.

The water-works of Carlsruhe offer an example of the advantageous union of steam and gas pumping plants. The former is the older; and the gas-engines are installed within an annex to the original building in such a manner that all the machinery is in a single room, and under the supervision of one engineer. The increase of the plant by two gas-pumps has required no addition to the number of employees, and but a slight increase in the extent of land occupied. The water-level of the suction and the limited available space led to the selection of deep vertical pumps. The ground plan of the annex is only 54 feet by 33 feet. It contains two sets of pumps, each of a capacity of 55,000 gallons per hour, raised to a height of 154 feet. The two 50-horse power engines make 140 revolutions a minute; and the pump-cranks, 38 revolutions. The pump-pistons are 13·4 inches in diameter, and have a stroke of 32 inches. From the air chamber common to both pumps, a 20-inch pipe leads to a junction with the force-main of the steam plant, and with the 24-inch pipe to the water-tower. An 18-inch pipe branches out from the first-mentioned line between the air chamber and the junction; so that water can be pumped through it directly to the distributing-pipes, if so desired.

In all these early plants, the power was transmitted by means of gearing; and though this has served its purpose, an attempt has been made in more recent plants to avoid its use, especially because of the troublesome noise. The gearing was principally necessary on account of the great difference in rotary speed of the motors and pumps. In recent years, there has been an essential improvement in the construction of pumps; and there is no longer any difficulty in securing power pumps which will run at 60 to 80 revolutions a minute without jar or noise. This uniformity of operation is secured in several ways; that which the officers of the Deutz Gas-Engine Works have found best being a combination of three single-acting plunger pumps.

The water-works at Leer and Treuen may be taken as representative of small plants using belt connections. In both there are two-cylinder pumps with single-acting plungers driven by cranks, making an angle of 180° with each other; the effect of this construction being to cause a delivery similar to that of a single double-acting pump. This arrangement has the advantage of combining unusually good access to the valves with great firmness. The crosshead is cast in a single piece with the plunger, and moves in guides formed by a prolongation of the walls of the cylinder. A fast and a loose pulley are carried on the shaft between the main bearings; the former serving also as a fly-wheel. Specially good results are obtained with belt connections compared with gearing, when the pumps are lower than the motors, as in this case, because it is possible to use horizontal pumps, and avoid entirely the weight of a vertical plunger. Each motor has a capacity of 10-horse power, which can be increased to 11-horse power later if the project of supplying water to Emden, 15½ miles distant, is carried out. The plungers are 5·2 inches in diameter, and have a stroke of 12 inches. At 72 revolutions a minute, each pair of pumps delivers about 8450 gallons an hour to a height of 197 feet. A combined air and suction chamber serves for the entire plant. From the suction chamber a 7-inch pipe runs to the well; and from the air chamber a pipe leads to the water-tower—a tank supported on four columns of wrought-iron pipe, in which the rising pipes are placed. The engine-room is only 36 feet by 25 feet; and the entire pumping-station measures but 67 feet by 36 feet.

At the Treuen Water-Works, the motors and pumps are on a level. In this station there are also two independent sets of machinery, with engines of 12-horse power each, and double pumps with an hourly capacity of 6330 gallons each, raised to a height of 287 feet. The plungers have a diameter of 4·6 inches, and a stroke of 12 inches. The suction and force mains are 6 inches in diameter. In other respects the plant at Leer and Treuen are similar. The pumps have annular spring valves of bronze, with cast-iron seats and two rings. They operate easily and without shock, even at high speeds, on account of the careful arrangement of the suction and air chambers. The gas-engines have incandescent tube igniters, and make 180 revolutions a minute. They are easily started by hand, by throwing the belts on the loose pulleys of the pumps; and directly they run properly, the belts are shifted to the fixed pulley.

The triplex pumps have shown in practice that their theoretical advantages are mechanically obtained. The uniformity with which they absorb energy—the variation in a revolution being about 20 per cent.—actually produces smooth running of the belt without the aid of special fly-wheels. The first works using these were built at Göttingen in 1892; and the result was so successful that they have been installed ever since by the Deutz Gas-Engine Works for large plants. The Göttingen pumping-station was constructed to help out the older gravity supply. The pumps take water from a well about 260 feet from the station, and deliver it to a tank about 1 86 miles distant, at an elevation of 153 feet. A 10-horse power engine and a triplex pump, having a capacity of 7900 gallons an hour, were first set up; but the building was designed to accommodate a second set of machinery when it became necessary, which was in the following year. This latter set consists of a 12-horse power motor and a pump, with an hourly capacity of 14,900 gallons. The pump-room is about 36 feet long and 26 feet wide. There is a single combined suction and air chamber for both pumps, and a single 8-inch force-main. The smaller pump has a 4-inch suction-pipe; and the larger pump, one of 6 inches. Both have a stroke of 12 inches, and run at 75 revolutions a minute; the engines making 180 revolutions. The plungers of the pumps are 4 inches and 5·6 inches in diameter for the smaller and larger sets respectively.

The pumping-station at Meissen cost £6000 in round figures, which includes the outlay for the building, motors, and pumps. The works at Constance are much like those at Meissen in arrangement. The engine is of the single-cylinder type, of 23-horse power, and makes 160 revolutions a minute. The pumps make 75 revolutions a minute, and deliver 38,000 gallons of water an hour to a height of 82 feet. The plungers are 8·8 inches in diameter, and have a stroke of 12 inches.

The plant at Wolfenbuttel, which was started in November, 1894, has a jack shaft, by which it is possible to drive either pump by either engine. The machinery is located at the base of a round stone water-tower, having a clear inside diameter of 39·4 feet at the bottom. The wrought-iron tank is built according to the methods advocated by Professor Intze. Each of the triplex pumps delivers hourly 26,400 gallons of water to a height of 148 feet. The plungers have a diameter of 7·4 inches, and a stroke of 12 inches; and they run at the rate of 75 revolutions a minute. The engines have a capacity of 25-horse power each at 170 revolutions, while the intermediate shaft runs at 125 revolutions. Fast and loose pulleys are carried on both the pumps and intermediate shafts. One man can turn the fly-wheel of an engine when the belts are thrown on the loose pulleys; and as soon as it comes to speed, the belts can be shifted to throw either pump into service. If both pumps must be operated, the second engine can be started from the first by means of the intermediate shaft.

All the preceding works have motors running with illuminating gas; but those using producer gas, gasoline, or petroleum, are arranged in much the same way, and drive the same kind of pumps. In deciding between the last three types of motor, the most important factors are the size of the proposed plant and the availability of the crude fuel. As a rule, the most economical plants using not more than 12-horse power are those with gasoline or petroleum motors; while for works requiring more than this power, the advantage lies with producer gas. The fuel employed in the generation of this gas is either anthracite or coke; and the works at Munster and Basel may be taken as examples of plants employing it. At Munster it was adopted on account of the distance of the pumping-station from the gas-works; while at Basel it was chosen because of the unusually low price of coke.

The Munster works were built in 1888, and contained originally a 30-horse power motor, which was duplicated in 1890. Each set of pumps delivers 30,000 gallons of water an hour to a height of 177 feet. The gas-generating plant consists of two producers and two boilers (half the plant acting as a reserve), with the necessary purifiers and gasholders. The plant is located in a well-ventilated room adjoining the engine-room; so that all the apparatus is looked after easily by one man. The well is in the engine-room, and has such a depth that a deep-well pump is necessary. This is of the duplex type, with differential pistons. The motor makes 140 revolutions a minute, and the pump axle 30 revolutions. The entire plant, including the producers and a coal-shed, is 65 feet long and 49 feet wide.

The system at Basel is still in course of construction, and supplements the older steam plant. A two-room addition was built at the station, to contain the pumping machinery and the generating apparatus; and a gasholder has been erected near. The new plant is to contain two independent sets of pumps, each capable of delivering 95,000 gallons of water an hour to a height of 308 feet; but at present only one set will be installed. The gas-generating room contains three producers and two small steam-boilers—one producer and one boiler being in reserve. The engine has two cylinders, and a capacity of 210 brake horse power when supplied with illuminating gas, and 170-horse power with producer gas. The pump is of the same sort as those at Meissen and Göttingen—a single-acting triplex pump, with the cranks arranged at angles of 120°. Spring annular valves, with five rings and a lift of 0·4 inch, are employed. Below the suction-valves there is a long suction chamber; while there are large pressure-caps over each pressure-valve, as well as a large wrought-iron air chamber. The plungers have a diameter of 10·4 inches, and a stroke of 28 inches. The pump-shaft makes 60 revolutions, and the engine 140 revolutions a minute; and the belting consists of ten cotton ropes, 2 inches in diameter.

This is the largest water-works system yet installed by the Deutz Gas-Engine Works; and it is the first in which the friction coupling has been omitted. This coupling was formerly necessary in order that the engine might be started; but at Basel a little barring engine of 8-horse power has been installed, which is worked by a water-moter, and is powerful enough to bring the engine to a speed of 20 revolutions a minute, provided the bye-pass of the pumps is opened. When the engine has been run at this speed for a few revolutions, the ignitions become regular, and the speed increases until the proper rate is attained—the barring engine being automatically stopped meanwhile. Finally—the bye-pass valve is closed, and the pumping begins. A connection is made between the city gas-mains and the gasholder; so that, in case the plant has to be started on short notice, it can be run with illuminating gas during the interval (one to two hours) needed to heat the producers and boiler.

Gasoline engines are as easy to manage as those using illuminating gas. When the apparatus is filled, a few turns of the fly-wheel will start the engine. The type made at Deutz has electric igniting apparatus; and the gasoline reaches the cylinder in a gaseous form, and not as a liquid. The oil-engines cannot be started so quickly as those using gasoline. The back cylinder head has to be warmed some time, so that the oil entering the cylinder will be vaporized by the hot surfaces, and a good explosive mixture produced. For supplying water to a single building or a group of buildings, the motor and pump are erected together. The plungers are connected to the shaft of the motor, and make as many as 250 double strokes a minute. The valves are provided with springs; and the suction and air chambers are designed so that this high speed can be maintained without noise or shock. Such combinations are in use in small plants where the head rises as high as 230 feet.

For larger installations, the general arrangement does not differ from that of the gas-engine pumping-stations. The plant

at Rothenburg, where the population is about 7000, has horizontal belt-driven pumps placed somewhat lower than the main floor of the building. The engines are of the single-cylinder type, each having a capacity of 10 brake horse power at 180 revolutions per minute. Each engine has a separate gasoline apparatus, placed in an annex to the main building. The pumps are of the kind used at Treuen, and each delivers about 5800 gallons an hour to a height of 295 feet. The plungers have a diameter of 4·4 inches, and a stroke of 12 inches. The plant at Hohenstein uses oil, as the pumping-station is about 2½ miles from the city; and this fuel can be most easily transported to it. The pumping-station was built to supplement a supply from springs. The average quantity of water furnished is 6600 gallons an hour, delivered against a head of 170 feet. The bulk to be delivered may be varied, without altering the speed of the engine, by changing the stroke of the pump-plungers; the crank-pins being adjustable along the cranks for this purpose. The engine has a capacity of 6 to 8 horse power at 200 revolutions per minute; and it drives a two-cylinder pump, having plungers 5 inches in diameter and of 12 inches maximum stroke. The works at Nierstein (population 3500) and Obercassel (population 2000) are still smaller; and owing to the depth of the suction water-level below the surface, and the long plunger-rods, it was impossible to avoid the use of spur gearing. The Nierstein works have two single-acting pumps, with three suction and discharge valves of hard rubber held down by springs. The plant is operated by a 4-horse power motor, and lifts 4000 gallons an hour to a height of 144 feet. At Obercassel, a triplex pump is driven by an 8-horse power engine, which lifts 6600 gallons an hour against a head of 230 feet.

The Bavarian Bureau for Water Supply designed the plant for Markt Presseck in Oberfranken, a place of 1100 population. The water has to be raised to an elevation of 400 feet; but the quantity is small—only 2300 gallons an hour. The plant consists of a 6-horse power gasoline engine, belted to a differential pump with plungers having a diameter of 4 and 2·8 inches, and a stroke of 12 inches. The fixed wheel on the pump-shaft is built heavy, to act as a fly-wheel, and thus make the load on the engine more steady than would otherwise be the case.

In comparing the duties of steam-pump plants, the number of foot-pounds of work done per unit of fuel burnt is often taken as the basis of comparison; and in gas-engine pumping plants, the number of foot-pounds per cubic foot of gas may be used similarly. The variation between the thermal value of illuminating gas in different cities is probably less than that between the thermal value of different coals; so the comparison on this basis is probably more accurate than that of steam-pumps. The following table gives the approximate duty in foot-pounds of gas-engine plants:—

Name of City.	Number of Engines.	Horse Power.	Number of Cylinders.	Duty, Foot-Pounds.
Duren	Two	40	Two	46,300
Quedlinburg . . .	Two	15	One	48,100
Coblenz	Three	40	Two	52,800
Furth	Two	40	Two	52,800
Carlsruhe	Two	50	Two	51,400
Kettwig	One	15	One	46,200
Eimbeck . . .	Two	10	One	47,100
Bingen	Two	12	One	51,000
Göttingen	One	10	One	51,400
Göttingen	One	12	One	51,400
Meissen	Two	50	Two	66,800
Constance	One	16	One	69,700

The plants in the above table are arranged in the order in which they were installed; and it will be noticed that there is a fairly constant gain in the duty. Those first installed had too large engines; while the improvement in the more recent plants is due principally to the use of better methods of connecting the pumps and engines, although various alterations in the design of the motors also contributed to this result. At the Munster works, it was found that about 187 lbs. of coke and 450 lbs. of anthracite were used in ten hours; so that the duty of the plant per pound of fuel is about 747,000 foot-pounds. The consumption of coke in the steam-boiler of the Munster plant is stated to be nearly three times greater than it should be. The gasoline motors at Rothenburg have a duty of about 1,600,000 foot-pounds per pound of gasoline. The plant at Hohenstein had an average duty in 162 days of 1,720,000 foot-pounds per pound of petroleum.

An Electric Lighting Act for India.—A Bill has been prepared by the Bengal Government to facilitate and regulate the supply of electricity for lighting and other purposes in Calcutta; no power in this respect being at present possessed by them. If passed, the Bill will enable the Government to grant licences for the supply of electric lighting within any part of the city. The Bill closely follows the Electric Lighting Act of 1882; the Local Government being substituted throughout for the Board of Trade. The definition of Calcutta is taken from the Calcutta Municipal Act of 1884; but power is given for extending its provisions to the Howrah Municipality. The necessary powers for breaking up streets, &c., have been adopted for the most part from the Gas Works Clauses Act, 1871.

REGISTER OF PATENTS.

Gas Motor Engines.—Griffin, S., of Bath. No. 13,298; July 10, 1894.

This invention relates to gas-engines in which two motor cylinders are mounted (in combination), side by side, with their axes parallel, and working with the ordinary double cycle, so arranged as to impart an impulse to the crank-shaft alternately from each cylinder at every revolution at full power.

Hitherto such engines have been arranged with two independent pistons and connecting-rods; each piston and connecting-rod actuating a separate crank attached to the same shaft. But to dispense with the extra complication and weight involved in this arrangement, the patentee proposes to mount two single-acting double-cycle cylinders side by side in a water-jacket, with their axes parallel—the cylinders, together with their pistons, being somewhat longer than usual, in order to afford ample guiding surface and rigidity in working. The two pistons are rigidly connected together at or near their outer ends, by means of a light strong crosshead, at about the centre of which (advantageously equidistant between the two pistons) is jointed a single connecting-rod, attached in the ordinary way to a suitable crank and shaft. The shaft may be arranged to work either in a line with, or at right angles to, the bisection of the axis of the cylinders.

One modification consists in mounting two such combinations, side by side, with the bisections of the cylinders at right angles to the crank-shaft, in such a manner that the connecting-rod of each pair of cylinders will actuate a separate crank. The two cranks are advantageously combined with the same shaft; being set at an angle of 180° with each other—opposite. The valve-gearing is so arranged that an impulse takes place in one cylinder of each combination or pair alternately in succession, at full power; each crank thus receiving an impulse once in every revolution. By this means, increased power is obtained, with steadiness of running and freedom from cyclical variation; the reciprocating parts being at the same time balanced.

According to another arrangement, two such combinations as previously described are mounted opposite each other, with the axes of the cylinders in line; the bisection of the combined cylinders being either in line with, or at right angles to, the crank-shaft, as convenient. The connecting-rod of each pair of cylinders actuates the same crank; an impulse being imparted to it twice in each revolution, at diametrically opposite points. Ignition takes place in one cylinder of each combination or pair alternately in succession at full power, as has been already described.

Generating Combustible Gas.—Thwaite, B. H., of Finsbury Pavement, E.C. No. 13,385; July 11, 1894.

The essential characteristics and qualifications of this invention are described by the patentee as follows: It is found by experience that, in order to permanently fix the hydrocarbon gases from semi-bituminous coal, these gases should be compelled to flow under pressure through a column of incandescent coke, or other carbonaceous fuel. To effect this essential condition continuously, and without involving any reversal action, he provides two vessels connected together in their upper portion by a flue so arranged that the heated gases and flame from one vessel pass into the adjoining one. Each vessel has a specific function to fulfil. In the first vessel, the inception of fuel combustion and its continuance is established in such a way that part of the heating effect of combustion is, by the passage of the flame or highly-heated gases through the fuel in the second vessel, transferred to the column of fuel in the second vessel; and the newly-fed fuel in both vessels has its hydrocarbon gases driven off, and they (along with the carbon monoxide gases from the first vessel) descend through the incandescent fuel in the second vessel. The fuel incandescence is obtained by the partial combustion of the gas and the complete combustion of part of the solid fuel in the first vessel. In descending through the incandescent fuel, the following effects (thermic and chemical) take place: First the volatile hydrocarbons are gasified and converted into a condition more or less permanent. The carbon dioxide produced by the partial combustion of the gas, as well as the complete combustion of part of the solid fuel in the first vessel, is converted (in contact with the incandescent carbon in the second vessel) into carbon monoxide. Any water vapour or steam flowing into the second vessel is decomposed in passing through the column of incandescent fuel in the second generator; the oxygen forming, with the incandescent carbon, carbon monoxide, and the hydrogen being set free.

In one arrangement, the depth of fuel in the first vessel is maintained of such dimensions that, when a powerful air blast is established under the fire-grate, a portion of the air passes through the fuel, and consumes part of the gas generated by the partial combustion of the fuel in the first vessel. The effect of this combustion in the first vessel, raises the temperature of the part of the first vessel above the level of the fuel, as well as the fuel in the second vessel (through which the treated gases have to descensionally pass), to a high temperature—the fuel in the second vessel being raised to the equivalent temperature of visible incandescence. In adopting this arrangement, the first vessel is made much shallower than the second vessel. Indeed, it may be merely a fire-grate, in which the fuel is entirely consumed—relying for the production of a combustible gas on the passage of the products of combustion through the incandescent fuel contained in the second vessel.

Instead, however, of employing a shallow layer of fuel in the first vessel, and in order to obtain the necessary temperature of incandescence in the second vessel, the first vessel may have such a depth of fuel as to enable a regular character of gas to be generated in the first vessel. Part of this gas is consumed by the introduction, under pressure, of a certain proportion of atmospheric air, introduced either directly over, or merely under the surface of the fuel in the first vessel. The flame resulting from this combustion passes immediately into the second vessel, through the fuel of which it descends, raising the temperature of the vessel, and the fuel contained in it, to high incandescence. The chemical and thermic effects of the action of gasification are as described for the first arrangement of the invention.

The chemical principles underlying the non-reversal cycle of power

gas production are described by the patentee as follows, neglecting the diluent nitrogen:—

First, at the grate—

$$C + 2\,O + H_2O = CO_2 + H_2O.$$

Second, above the grate—

$$CO_2 + H_2O + 2\,C = 3\,CO + 2\,H.$$

The oxidation of the hydrocarbons adds other constituents, as follows: For simplicity, let the ratio of C to H_4 represent the constitutional character of the hydrocarbons, then $CH_4 + 4\,O = CO_2 + 2\,H_2O$. In the passage of these gases through the fuel, raised to incandescence by the effect of the oxidation of the hydrocarbons, the following recarbonizing action occurs:—

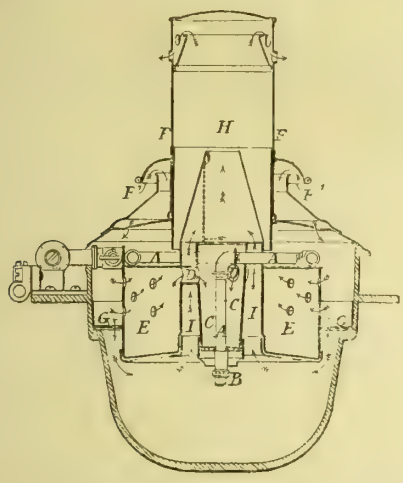
$$CO_2 + 2\,H_2O + 3\,C = 4\,CO + 4\,H.$$

So that the final result is—

$$(3\,CO + 2\,H) + (4\,CO + 4\,H) = 7\,CO + 6\,H.$$

Regenerative Gas-Lamp.—Allison, C. A.; communicated from C. Assi and L. Genès, of Paris. No. 7446; April 11, 1895.

The essential feature of this invention consists in the employment of a conical chamber or tube, tapering from the top downwards, and through which the central gas-pipe passes. The chamber is open at the bottom; and below it the burner is arranged. It is closed at the top; but near the top it is provided with radial passages, communicating with a chamber to which air from the outside of the lamp is admitted. The products of combustion from the flame pass up the chimney, through a space left between the conical tube and the outer passage last referred to.



The illustration shows a method of applying the invention to existing railway-carriage lamp-casings, by inserting the lamp from above into the ordinary casing carrying the glass.

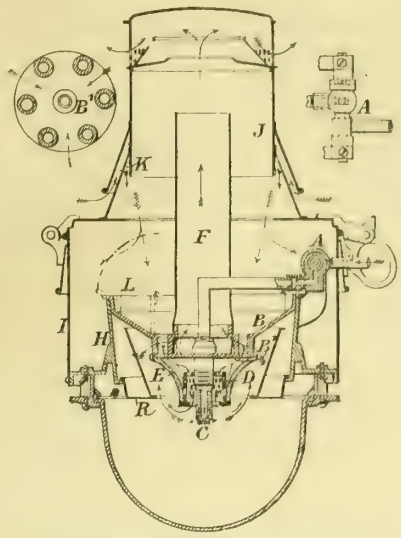
A is the gas-pipe, which passes down the centre of the lamp and terminates in the burner B. Surrounding the vertical part of the pipe is a conical chamber C, tapering from the top downwards—the bottom being open—and below which the burner is fixed. The top of the chamber C is closed, as shown; while near the top one or more (preferably three) radial passages D are provided, communicating with an air chamber E of annular form, the outer wall of which is provided with perforations. Air enters the outer casing F of the lamp at F^1, and passes into the chamber E through the perforations; thence, through the radial openings D, into the chamber C; and down to the top of the flame of the burner. A portion of the air also passes down outside the chamber E, through perforations in a plate G, which supports the chamber; and so to the underside of the flame. The products of combustion pass up the chimney H, through the space I between the conical chamber C and the air chamber E. The top of the lamp is hinged, so that it can be turned back to ignite the lamp; while for cleaning the glass, the heating chamber and reflector can be removed from above, by turning them back on the hinge-joint of the gas-pipe.

Regenerative Gas-Lamps.—Lamp Manufacturing Company, Limited, of Leonard Street, City Road, and Welch, W. H. I., of Bow. No. 8317; April 26, 1895.

This invention relates to overhead regenerative gas-lamps of the kind described in patent No. 123 of 1893; and it has for its object "the construction of lamps of this kind in such a manner as to give great facility of access for lighting and cleaning."

The gas is supplied through a joint A (of ordinary construction) supported on fixed pins, which enter holes in its ends. The gas-pipe is attached to, and passes through, the centre of a dished-piece B, the upper part of which is connected to its lower part or disc B^1 by several tubular bosses. On the gas-pipe, which extends down to the burner C, is screwed a perforated hollow cone D, which presses an inverted hollow conoid E up against the disc B^1. All these parts, and the gas-pipe from A, as well as the chimney F, which rests on B, can be turned upwards on the joint A as a hinge, giving free access to the parts below. The glass globe may be hinged in the usual way; but as access is had from above, it may be fixed (as shown) by a ring to the stationary part H, into the upper mouth of which fits the upper rim B, which forms a lid or cover to H.

The reflector R has attached to it a conical shell projecting up from it. It also has a lip resting on an inwardly projecting lip at the lower part of H. The outer casing of the lamp consists of a lower part I, which is stationary, and has hinged to it (and fastened by a catch) all the upper part J, which is provided in the usual way with shielded apertures for ingress of air and egress of the products of combustion. On releasing the catch, the upper casing J can be turned back on the hinge and the gas-pipe and parts attached to it can be turned back on the joint A. The reflector R and its conical shell are then lifted out; and free access is given to the interior of the glass for cleaning.



The reflector being replaced, the burner being lighted, and the parts B D E being turned down into the positions shown, the lamp operates as follows: Part of the air entering at the shielded apertures K passes down to perforations, by which it enters the globe to supply the underside of the flame, and part passes through the perforated cone D, to supply the upper side of the flame. The products of combustion ascend, and pass inwards through the intervals separating the bosses to the chimney F. As the parts are highly heated by the products of combustion, the air reaches the flame at a high temperature, causing "complete combustion and great brilliancy of light."

APPLICATIONS FOR LETTERS PATENT.

11,513.—Maynes, J., and Watchurst, C. L., "Separation of gases." June 13.

11,550.—Gurd, W. J., "Automatic lighting devices for gas-stoves." June 13.

11,565.—Wadsworth, G., and Liddle, S. W., "Coin-freed gas-meters." June 14.

11,571.—Snelgrove, W., and Goyne, R. F., "Water-pipes." June 14.

11,577.—Shadbolt, R. G., and Broadhead, J. W., of the firm of Messrs. R. Dempster & Sons, Limited, "Enriching coal gas." June 14.

11,625.—Moul, H. E., "Atmospheric gas-burners." June 14.

11,668.—Botley, C. F., "Incandescent gas-burners, &c." June 15.

11,703.—Haddan, R., "Giving warning of the presence of escaped gas in rooms or the like." A communication from J. Serra and Co. June 15.

11,709.—Hewitt, J. T., "Steam, air, and gas rotary engines, and exhaust and compression pumps." June 17.

11,722.—Phipps, T. L., "Preventing water-pipes bursting from frost." June 17.

11,726.—Perlich, A., "Burner for spirit-gas incandescent light." June 17.

11,758.—Torre, C. D., and Mancini, F., "Instantaneous automatic electric lighter for all kinds of gas-burners." June 17.

11,783.—Rossbach-Rousset, F., "Acetylene gas-lamp." June 17.

11,814.—Shand, W., "Gas cooking-stoves." June 18.

11,815.—Terrace, J. B., "Improved Bunsen flame." June 18.

11,820.—Gardner, H., "Combining air and gas for incandescent lighting purposes." A communication from La Société Française de l'Héliogène. June 18.

11,848.—Lake, H. H., "Utilization of combustible gas." A communication from E. N. Dickerson. June 18.

11,866.—Hibbert, T., "Water-service stopcocks, or attachments therefor." June 18.

11,887.—Gardner, H., "An incandescent irradiator for gas without the preliminary admixture of air." A communication from La Société Française de l'Héliogène. June 18.

11,888.—Gibbons, W. P. and G. B. A., "Charging gas-retorts." June 18.

11,925.—Melhuish, A. G., and Beaumont, C., "High-speed gas or hydrocarbon engine." June 19.

11,981.—Hacker, H., "Gasholder frames." June 20.

11,987.—Tee, H., "Gas and like pendants." June 20.

12,019-20.—Hersey, S., and Kirkham, Hulett, and Chandler, Ltd., "Washing or scrubbing gas." June 20.

12,035.—Phipps, T. J., "Cutting off gas or electric current at any desired time." June 20.

12,061.—Hooker, C. E., "Protector for self-lighting gas-burners and self-lighting gas-caps of all descriptions—for example, Duke's self-lighting gas-burner." June 21.

12,092.—Denayrouze, L., "Gas heating and cooking apparatus." June 21.

12,131.—Pennink, J. M. K., "High and low pressure gas-generator." June 22.

12,134.—Dunolly, A., "Automatically charging gas-retorts with coal." June 22.

Reductions in Price.—The price of gas at Sudbury (Suffolk) has been reduced 3d., and at Lavenham 10d. per 1000 cubic feet, as from the 30th ult.

Extension of the Scarborough Gas-Works.—At a special meeting of the Scarborough Gas Company last Wednesday, a resolution was passed authorizing the creation of new ordinary 5 per cent. stock for the purpose of raising the additional capital of £60,000 required for extending the undertaking.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Southwark Bridge Explosion.—The South Metropolitan Company's Profit-Sharing System.

SIR,—Having resolved to appeal, nothing can be said by me in relation to the Southwark Bridge explosion, except to make the statement that it was given in evidence that the Company did not know the City Contractor had opened and improperly filled in the ground until after the accident.

A statement is also necessary on another subject referred to in this week's JOURNAL. Your correspondent who objects to our system of profit-sharing—or perhaps I should say to our use of the words—makes the strange mistake in assuming, as others who might be expected to know better have done before, that the whole amount appropriated under that heading should be added to "carbonizing wages." You have shown his error by stating that all the Company's employees participate—that is, all, from the chief officers through all grades down to the humblest labourer in regular employment who accepts our agreement (as nearly all do), have their part in the profit-sharing, in the shape of a certain percentage, dependent upon the price of gas, on their salaries and wages. The only men ineligible are those employed casually, chiefly in the retort-houses, and the winter stokers who are engaged for less than three months. So far, therefore, from the whole amount of £12,435 10s. 9d. entered as "profit-sharing" being paid to the carbonizing men, they actually receive less than one-third of that sum. This is paid to them annually in addition to their wages. The wages are at the rates current throughout London, and it amounts to a little over 1d.—say 1¼d.—per ton of coal. Your correspondent may add this to the 2s. 7d., and make out of it what he pleases.

GEORGE LIVESEY.

South Metropolitan Gas Company, June 29, 1895.

Carburetted Water Gas.

SIR,—I have noticed with interest the correspondence which has been going on in the JOURNAL relative to the above. Having had twelve months' practical experience in the manufacture of water gas, where both systems were in use, I have no remarks to make on the advantage of the one over the other. But by the knowledge I have gained in America, I come to the conclusion that its sole success depends more on the manipulation of the machine than the design. I should have understood the "M.W.P." machine to be a double superheater type, quite as much as the Humphreys and Glasgow, but a combined. Where the "double" comes in, I fail to see. If the oil were sprayed on the fuel-bed in the generator, then I should say the term "double superheater" might be correct in Humphreys and Glasgow's setting.

ALFRED G. BROWNING.

Manchester, June 27, 1895.

The Inflammability of Terebene.

SIR,—A small fire having occurred at these works a short time ago, the cause of which could not be traced, and some painters having been at work on the premises at the time, I was led to make the following experiments, the results of which may prove interesting to some of your readers. I moistened a piece of rag, 3 feet square, with a mixture of terebene, linseed oil, and turpentine—materials which are in constant use by painters. The rag was then rolled up into a ball, with a thermometer placed in the centre; and, on being left, the following were the results: During the first hour, the temperature rose from 20° C. to 87° C., and the rag began to fume; in the next hour, the temperature increased to 310° C.—the rag fuming strongly; while half an hour later the rag was burning, the temperature being 360° C.

Whether or not these results indicate the cause of the fire, you may possibly consider them of sufficient importance to be made known in the interest of those who use terebene, and who may not be aware of its inflammable nature in conjunction with certain other materials.

T. WILTON, Manager,
The Gaslight and Coke Company's Tar and Ammonia Products Works.

Beckton, E., June 26, 1895.

Sloping Retorts at Brentford.

SIR,—The credit of bringing the inclined retort system to its present efficiency should certainly be shared by the engineers of provincial gas-works, who were the first to adopt it on a large scale. Mr. T. Banbury Ball, of Rochdale, erected and worked the first installation, consisting of five beds of seven through retorts in 1890. These gentlemen advocated and adopted this method of carbonizing; and, at their own expense, they introduced many improvements which I see are now embodied, and claimed as original, in the last installation at the Brentford Gas-Works. The introduction of: (*a*) 24½ and 26 inch ⌂ section retorts, (*b*) taper retorts, which are certainly necessary for rapid discharging, together with (*c*) the addition of the lug on the mouthpiece for holding the coal stop, and several other details that go to make the system a success, were all working in the provinces before either the Bow Common or the new installation at Brentford was started.

Having myself been connected with the erection of the majority of the inclined retort plants now working in England, I am able to substantiate my statements by reference to dates and the names of the gas-works in which these improvements were working prior to their introduction at Brentford.

I notice Mr. Van Vestraut, in your issue of the 4th inst., says that royalty is being paid on the patent of Morris and Van Vestraut, No. 16,489 of 1889, for charging three or more tiers with one telescopic shoot. This shoot was discarded after working on the experimental bed at the Southall Gas Works, and Mr Ball introduced the three single charging shoots (which were not telescopic). This is, at present, the recognized method.

As nobody seems to have cleared up the last paragraph in Mr. Husband's paper with reference to the drawings, I may say that the Automatic Coal Gas Retort Company, Limited, received from Mr. Morris drawings of the measuring chambers, tanks, &c., which were then working profitably at the Brentford Gas-Works; and, therefore, Mr. Morris is entitled to the credit of designing the "powder flask" method of charging inclined retorts. It was from these particulars, with an improvement of my own embodied, that patent No. 20,709 of 1892 was prepared and applied for, in the names of Van Vestraut and Graham.

In conclusion, I would say, in justice to the engineers who have adopted this system, that not only at Brentford, but in every case, these gentlemen have given every opportunity of inspecting the plants they have erected, at all times supplying information *ad lib.*, and continue to do so.

MAURICE GRAHAM.

Lime Street Square, E.C., June 27, 1895.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress was made with Private Bills last week:—

Bill presented and read the first time: Liverpool Electric Supply (Transfer) Bill.

Bills read a second time and committed: Brighouse Corporation Bill; Local Government Provisional Order (Gas) Bill.

Bills reported, with amendments: Brighouse Corporation Bill; Cranbrook District Water Bill; Local Government Provisional Order (Gas) Bill.

Bills read the third time and passed: Brighouse Corporation Bill; Gas Orders Confirmation Bill; Gas and Water Orders Confirmation Bill.

HOUSE OF COMMONS.

The following progress was made with Private Bills last week:—

Bills read the first time: Barnsley Corporation Water Bill; Gas Orders Confirmation Bill; Gas and Water Orders Confirmation Bill; Rotherham Corporation Bill.

HOUSE OF LORDS COMMITTEE.

(*Before the Earl of* JERSEY, *Chairman; Earl* GREY, *the Earl of* DARTMOUTH, *Lord* CALTHORPE, *and Lord* CRAWSHAW.)

DEWSBURY AND HECKMONDWIKE WATER BILL.

This Bill, which, among other things, is to empower the Dewsbury and Heckmondwike Water Board to construct additional works, and to authorize the Heckmondwike District Council to sell their share in the undertaking to the Dewsbury Corporation, and to provide, in the event of such sale, for the dissolution of the Board, came before the above Committee on the 18th ult.

Mr. PEMBER, Q.C., Mr. BALFOUR BROWNE, Q.C., and Mr. FREEMAN appeared for the promoters. The following were the petitioners against the Bill, who were represented by the Counsel named: The Sheffield Corporation, by Mr. LITTLER, Q.C., Mr. CRIPPS, Q.C., Mr. PAGE, Q.C., and Mr. GERALD FITZGERALD; the Rotherham Corporation, by Mr. BIDDER, Q.C., and Mr. BAGGALLAY; the Doncaster Corporation, by Mr. WORSLEY TAYLOR, Q.C., and Mr. RAM; the Soothill Urban District Council, by Mr. J. D. FITZGERALD; the Duke of Norfolk, by Mr. ERSKINE POLLOCK, Q.C.; Messrs. S. Fox and Co., by Mr. WORSLEY TAYLOR, Q.C., and Mr. READER HARRIS, Q.C.; the steam-users of the Don, by Mr. CRIPPS, Q.C., and Mr. J. D. FITZGERALD. Petitions against the Bill had been presented by the West Riding Council and Rivers Board. The objections of these bodies were, however, almost identical with those to the Barnsley water scheme, to which reference was made in the JOURNAL for June 4 (p. 1201); and having regard to the decision in that case, they reserved their opposition. The three Corporations above named were prepared to contend that all the water the Joint Board required, if they really needed any, could be obtained by constructing a reservoir at the head of the River Holme.

Mr. PEMBER, in opening the case, said the question the Committee had to decide was nearly similar to that which had been decided in the Barnsley inquiry. The existing reservoirs of the Board were known as the Dunford Bridge, Windleton, Snailsdon, Harden, Upper Windleton, Lower Windleton, Whitley, and Dewsbury Gate. The proposed new reservoir was to be in the watershed of the Little Don, and was to be called the Little Don reservoir. All the reservoirs on the Don were completed, with the exception of the Snailsdon and Harden, both of which were in progress, and would be finished by September next year. When these were ready, the total supply of the Board would be 3,440,000 gallons of water a day. The promoters proposed to take 2700 acres, and impound the water from this area for the purposes of the additional supply, out of a total of 11,500 acres. The total capacity of the proposed reservoir would be 330,000,000 gallons; and they had arranged with the millowners to give a supply of 1,500,000 gallons a day as compensation water. Like Barnsley, the promoters had a good many outside districts depending upon them for water. The existing works were owned by the Dewsbury Corporation and the Heckmondwike District Council, in the proportion of three-fourths by Dewsbury and one-fourth by Heckmondwike. Besides Dewsbury and Heckmondwike, the promoters were under a 20 years' agreement, of which 12 years had still to run, to supply Ossett. There was also a 15 years' agreement with Soothill, of which 11 years had to run. Flockton had a 30 years' agreement, of which 20 years were unexpired. The total population of the district was 68,500; and the consumption of water in 1894 was 2,177,000 gallons, or thereabouts—an average of 30 or 31 gallons per head per diem. In Dewsbury, the consumption amounted to 40 gallons per head daily; the reason being that the trades

of the town were such as required a great quantity of fresh water—as much as 14 gallons per head per day being consumed for trade purposes alone. Dewsbury was also peculiarly situated topographically. It was a difficult town to drain; and a large body of water was required for flushing purposes. Besides, it was a water-closet town in the fullest sense of the term. With regard to its present needs, in 1887 the town was in great straits for water. To increase the supply, it was necessary to pump from a disused coal pit, and to purchase the water from the millowners and from neighbouring authorities. In 1893, the Corporation had again to purchase water. After such experiences, he ventured to assert that Dewsbury was only acting wisely and prudently in coming to Parliament with a scheme for an additional supply. The Corporation calculated that, in a very short time—three to five years hence—they would be absolutely at the end of their present resources. This meant that Dewsbury would be in serious straits for water at the end of (say) seven years from now. Their present surplus was some 430,000 gallons a day; and this would only last about three or four years. The principal opponents of the Bill were the Corporations of Sheffield, Rotherham, and Doncaster; the millowners and steam-users on the River Don; Messrs. Fox; and the Duke of Norfolk. The promoters proposed to meet the larger oppositions thus: To the Sheffield, Rotherham, and Doncaster Corporations, they would say: "This small slice of watershed does not really concern you." Sheffield, Rotherham, and Doncaster had large unused resources. The small watersheds in the Bill were at a great distance from them; and geographically they lay close to the authorized Dewsbury works. Parliament had already allowed Dewsbury to go into the watershed of the Don; and they now only proposed to take away water from a tributary of the river. They said, as Barnsley had said, that the proper and statesmanlike course was for the little towns to take the waters from the little watersheds close at hand, and leave the large towns, who could better afford it, to go a long distance for their additional water supply.

Mr. *E. Mawdsley*, the Town Clerk of Dewsbury, and Clerk to the Dewsbury and Heckmondwike Water Board, was examined by Mr. FREEMAN in support of the statements made by Mr. Pember. He said that from June to October, 1887, their supply was greatly restricted; and they had to pay £2700 for additional water. In 1893, they did not purchase so much; but still they had to buy of the millowners.

In cross-examination by Mr. LITTLER, on behalf of the Sheffield Corporation, witness said the agreements alluded to for supplying the outside districts were all comparatively recent ones—the earliest being in 1883. The water undertaking was not carried on at a profit. The Heckmondwike District Council had been opposing the Bill; but an agreement between the two authorities had been arrived at.

Questioned by Mr. CRIPPS, on behalf of the steam-users on the Don, witness stated that Dewsbury felt bound to supply the outside districts, even if they bought water for them. They spent £2700 on the purchase of water in 1893; having bought 12 million gallons in that year. They sold 220 million gallons to the outside districts, and to Barnsley 46 million gallons, or some 26 millions above their normal supply. They gave 4½d. per 1000 gallons for the water they bought, and sold it to Barnsley at 7½d. per 1000 gallons; but this fact did not lessen their need for water in the future.

Cross-examined by Mr. READER HARRIS for Messrs. S. Fox and Co., witness said he was aware of the great value of their works, and knew they were dependent for their prosperity upon their water supply. He presumed they had an adequate supply at present. He was aware that the Little Don was the only available source upon which Messrs. Fox could depend. The promoters had not approached Messrs. Fox, as they had done in the case of the other millowners. He did not think the promoters were acting arbitrarily in taking the proposed water to supply outlying districts at the cost of Messrs. Fox's works. As a matter of fact, he did not think Messrs. Fox would be sufferers by the scheme at all, owing to the amount of compensation water to be sent down. The scheme was simply an extension of one which Parliament had already sanctioned for the supply of the outlying districts. He was prepared, on behalf of the promoters, to say that, if Messrs. Fox now approached them, they would be prepared to make reasonable terms with them, as they had done with the other millowners.

Mr. *M. Oldroyd*, M.P. for Dewsbury, and holding public and business positions in the borough, in answer to Mr. FREEMAN, said the water of the Don was eminently adapted for the purposes of dyeing. The water of the Calder was largely used for dyeing and scouring; but it was utterly unfit for the more delicate treatment of fabrics. The trade of the district had become one that required a constant and ample supply of fresh water if it was to maintain its prosperity.

On the following day, further evidence was given on behalf of the promoters. In the course thereof, it was stated that, owing to want of water, work was being sent out of the district. The Borough Surveyor of Dewsbury (Mr. H. Marks), who is the Engineer to the Joint Board, informed the Committee that water was supplied to various districts by meter; and he admitted that this was done at a loss. Nevertheless, they contracted in 1887 to supply Ossett at 6d. per 1000 gallons; the water having been previously supplied by Batley at 6½d. He acknowledged that, if the outside supply were cut off, there would be plenty of water for Dewsbury. Mr. Marks's evidence was confirmed by Mr. G. H. Hill, M.Inst.C.E., who stated that the great fault of public bodies was to put off their water schemes too long. It was, he said, the height of folly to delay the carrying out of new water-works. At the close of this evidence, the Committee adjourned.

On the resumption of the proceedings the next day, further evidence was given in support of the promoters' case. Mr. Paterson, who said he was well acquainted with the districts now being supplied by the Joint Board, assured the Committee that it was impossible for Wakefield to supply them when their contracts with Dewsbury expired, as Wakefield had quite enough responsibility on its shoulders at the present time. With regard to Bradford, the Corporation had no statutory power, nor had they the capacity, to supply, even if they desired to do so. But, at any rate, they would have to take their pipes through Dewsbury to do it. Asked if it was a proper thing for an authority to sell water to outside districts at a loss, witness thought it was, under certain circumstances. A millowner on the Calder testified to the great irregularities in the supply of water for the mills on the river, and said it was essential for their prosperity that the quantity should be increased. The Parliamentary Agent of the promoters (Mr. Pritchard) explained certain financial features of the Bill; and the promoters' case closed. The Chairman then expressed a wish to confer with the members of the Committee before hearing the petitioners against the Bill. The room was accordingly cleared. On the parties being re-admitted, the Chairman said the Committee would not call upon the opponents of the new works proposed in the Bill to proceed with their opposition, as they were not prepared to pass that portion of the Bill. He explained that this did not refer to the No. 9 works. Mr. Freeman (for the promoters) remarked that this left those works, and the borrowing powers of £40,000 for completing the authorized works. By No. 9 works it was proposed to reconstruct a portion of the old works. The proposals for borrowing powers and the clauses of the Bill were then finally adjusted; and the Bill was ordered to be reported.

HOUSE OF COMMONS COMMITTEE ON LONDON WATER BILLS.

(*Before the Right Hon.* D. PLUNKET, *Chairman; Sir* J. KITSON, *Sir* H. STAFFORD NORTHCOTE, *Mr.* BALDWIN, *Mr.* BURNIE, *Mr.* MUNTZ, *Mr.* P. STANHOPE, *Mr.* AINSWORTH, *and Mr.* BRIGGS PRIESTLEY.)

Seventeenth Day—Friday, June 21.

Mr. *James Bigwood*, M.P. for the Brentford Division of Middlesex, was examined by Lord ROBERT CECIL in support of the case of the Middlesex County Council, of which he is an Alderman and Chairman of the Parliamentary Committee. He stated that the Council in their opposition represented not only themselves, but the other local authorities in the county. The Water Companies having a right of supply in the county were the New River, the East London, the Grand Junction, and the West Middlesex. Other Companies had power to supply parts of Middlesex; but their power was not exercised to any extent. He maintained that Middlesex had a primary claim upon the water found within the county, and complained that as the river supplies became less in quantity, in seasons of drought, the Companies pumped more from the chalk, which lowered the Middlesex wells. The New River Company had wells at Highfield, Campsbourne, and Betstile, within the County of Middlesex. Middlesex wanted to stand entirely aside from the general question of the London Water Supply; and that was the position which they had taken up from the beginning. It was inexpedient that London should acquire the powers of any of the Companies in Middlesex, as the interests of the two counties would be antagonistic; and he feared that the transfer of the undertakings to the London County Council would lead to an increase of the rates. He looked upon the whole question as being a very huge piece of business, about which it was very doubtful indeed to prophesy that it would be a financial success; and in the event of its not being so, the rates must increase. If they went to distant sources of supply, they might throw an unfair proportion of the expenditure upon Middlesex, by means of a differential rate. Middlesex had enough water for its own purposes, and more to spare; and he was afraid that London might make a greater demand on the spare water, in which case Middlesex would have to pay for its property twice over. He did not see that any benefit would arise to Middlesex from the transfer.

The CHAIRMAN: Are the inhabitants, so far as you know, at present tolerably well satisfied as to the quality of the water?

Witness thought they were. At present, of course, the Water Companies were not in popular esteem, in consequence of the late frost; but probably the public had not thought that in the event of meeting such a disaster as that in future, a good deal of money would have to be laid out in the lowering of the mains, and in the junction of these mains (which were the parts most likely to be frozen in the first instance) with the private consumers' taps. With this exception, Middlesex was satisfied with its supply; for the water was excellent in quality and abundant in quantity.

In cross-examination by Mr. WORSLEY TAYLOR, witness stated that he thought the water supply to London inadequate; and he would be willing to assist in the solution of the difficulty, so long as they did not interfere with Middlesex.

The CHAIRMAN said that some of the representatives of other outside authorities seemed to think that, if there were to be a purchase, they would like to purchase the water themselves, use what they wanted, and give the surplus to London.

Witness said he would have no objection to that course. Certain schemes had been foreshadowed—such, for example, as the transfer to Middlesex of the Grand Junction, the West Middlesex, and certain portions of the New River Company's works.

Mr. *Thomas Fenwick*, M.Inst.C.E., said that he had been largely engaged in all questions affecting the supply of water to various towns, in the construction of water-works, and the selection of drainage grounds for reservoirs for the last thirty years. The Grand Junction Company's works—except certain mains and pipes, and the high-level pumping-station at Campden Hill—were all within the jurisdiction of the Middlesex County Council. The pumping-engines at Hampton and Kew had an aggregate of 3514-horse power, drawing a supply of nearly 19 million gallons a day from the Thames and gravel beds. They had 245 miles of mains, supplying a population of about 136,500 outside the Metropolitan area; and 190 miles of mains within the County of London, supplying a population of 249,000. A 30-inch and a 12-inch pipe were in the Bath main-road, and a 30-inch and a 24-inch main in the Uxbridge main-road, which conveyed the water from the outside district into Hammersmith and Kensington. The West Middlesex Company derived all their supply from Hampton, where they had engines of 560-horse power. They pumped 19 million gallons of water a day through Hampton, Teddington, and Twickenham (by two 36-inch mains), into their reservoirs at Barnes. There it was filtered, and thence conveyed to the engine-wells at Hammersmith, from which it was pumped by engines of 1605-horse power into the district of supply. They had 127 miles of mains, supplying a population of about 95,000 outside the Metropolitan area; and 340 miles of mains within the County of London, supplying a population of about 486,000. The Middlesex County Council were, therefore, very much interested in the

control of these works; and he thought it would be unfair to allow the London County Council to have sole control of them. If the London Council were the controlling authority, they would be empowered to sink wells, and abstract from the county of Middlesex water which should be preserved for the material increase of population which there would be in the outer districts. If there were a deficiency in supply, or a drought, it would be possible for the London Council to favour the population inside London; or if they abandoned the Thames as a source of supply, either wholly or in part, they then could enforce upon Middlesex a partnership in the contemplated scheme. Such a scheme might be proper and advantageous for London; but Middlesex did not need it. It would be an easy matter to let the whole of the supply now brought in from the Thames by the West Middlesex Company be sent into the county of London, to be consumed there; and the Grand Junction Company, by withdrawing their supply from inner London altogether, could keep it for the supply of Middlesex. That would leave them free from intervention or interference from the London County Council, and would not saddle them with the burden of a great commercial undertaking. He cited a number of towns in which the charge for the outside districts was greater than within the borough.

In cross-examination by Mr. Balfour Browne, witness said that he thought the system of charging a higher price outside was quite fair, as they were not responsible for any loss on the water undertaking; and it was a principle authorized by Parliament.

Mr. *W. G. Austin*, Deputy Clerk of the Peace for Middlesex, gave evidence as to the difficulties in the way of the Middlesex County Council promoting Bills in Parliament, as illustrated by the Bill which they proposed to introduce in relation to the River Brent in 1893, the expenses for which the Local Government Board refused to sanction. That proposal was to deal with the question of pollution, and had no reference to the water supply.

Mr. *G. E. Eachus*, M.Inst.C.E., gave evidence as to the sources supplying the north-east corner of Middlesex. He said that, if the four wells belonging to the New River Company there were left under the control of Middlesex, they would properly supply that portion of the county with water. They would suffer very much if this supply were placed under the domination of the London County Council. He was proposing to quote some figures as to the cost, when—

Mr. Balfour Browne objected to going into the question of the cost of buying up these works, as they were only dealing at present with the Lambeth and Southwark and Vauxhall Bills.

Lord Robert Cecil urged that it was a pertinent matter on the preamble.

The Chairman said witness might go into it in a general way.

Witness said that what he wanted to show was that the water undertakings were much more profitable within the area of London than outside; and consequently if the London County Council bought up the Water Companies, and then sold back the portion in their district, they would practically have to "pay through the nose" for the portion left to them, because it would be the most unprofitable part of the undertaking. Assuming that the purchase-money of the New River Company was £9,000,000, and they required in the Middlesex district approximately one-sixth of the supply of the New River Company, if they had to pay one-sixth of the £9,000,000, it would be £1,500,000, which would be roughly equal to two years' full rateable value of the outside districts supplied; and without adding any expense for bringing water from Wales, or even the ordinary annual expenses, it would load that portion of Middlesex with at least a 2s. rate. At present they did not have to pay half that; and it struck him that Parliament took into account that the outer districts gave the water, and that the inner districts of London would help to pay and ease the burden to the outer districts in return for their giving the necessary water.

Mr. *Edwin J. Lovegrove*, engineer, spoke as to the capability of the Campsbourne well of the New River Company to supply the Hornsey district; and he objected to it being handed over to the London County Council.

Mr. *D. J. Ebbitts*, the Engineer and Surveyor to the Acton District Council, stated that Acton, on account of the large number of laundries, required more than the 35 gallons per head which (under clause 24 of the Bill) was to be allotted to the local authorities outside.

Mr. Worsley Taylor said that was a matter which could be dealt with in the clauses of the other Bills.

This concluded the evidence for the Middlesex County Council.

Sir *John Evans* was then examined by Lord Robert Cecil on behalf of the Hertfordshire County Council. He objected to London having any authority in Hertfordshire. There was no doubt that already the water supply of Hertfordshire was very seriously depleted by the demands of the two London Companies which drew a large portion of their water from the county. If the supply of the Companies was transferred to the London County Council, he feared that they would extend their demands upon the Hertfordshire water. They would have great difficulty in contending with so powerful a body as the London Council; and it would be far more difficult to deal with them than with the Companies. He was not altogether in agreement with the report of the Royal Commission. He had already pointed out in *The Times* that, whereas they proposed to draw only a limited quantity of water from the Thames, they stated that there was power along the valley of the Lea to extend the supply of water from that district by about 22½ million gallons a day by means of wells; and that in other ways 40 million gallons might be drawn from the River Lea and its valley, either by means of the river or by wells. In September, 1894, his prophecies were fulfilled, because the East London Company notified to their consumers that their supplies would be cut off during the night, so that they might economize their water to the extent of ten million gallons a day. Practically therefore the amount given by Nature was 10 million gallons a day less than that on which the Company had been formerly relying, and was certainly 50 million gallons a day less than the Water Commission said might be safely drawn from the valley.

The Chairman said he did not quite follow the object of this evidence, because these considerations would be delegated to the Arbitrator.

Witness explained that, as the London County Council were so strongly against drawing water from the river, he feared that they would take advantage of their position as the Water Authority along the Lea Valley to extend the wells; and that pumping from wells would affect more materially their springs and wells in Hertfordshire than drawing from the river would do. The Company were merely entitled to withdraw the excess of water that was flowing to waste; and, under the new conditions, in all probability, the actual sources of water would be intercepted.

Lord Robert Cecil further explained that, there being no legal rights of property in underground water, the New River Company's pumping was already drying them up to a certain extent; and they feared that the London County Council, with their hostility to the river water, would naturally pump more and more from the chalk, and completely dry them up.

Witness was proceeding to give further evidence in support of his view as opposed to the Royal Commission, when

Mr. Bidder objected.

The Chairman asked that only general evidence should be given, as the Committee did not wish to make themselves a tribunal to review the findings of the Royal Commission.

Witness proceeded to point out that, in consequence of the pumping, certain water-cress beds had dried up; and he mentioned that at Rickmansworth a private individual had bought about a quarter of an acre of land just above the junction of two streams, in which he had fixed a pumping-station, and advertised the water for sale.

Mr. *John Hopkinson*, F.G.S., F.R.M.S., was called to give evidence as to the rainfall in Hertfordshire, and as to the action of the East London Water Company in September, 1894, in consequence of the diminution of the water of the Lea, when

Mr. Bidder again objected that they could not go into any question between Hertfordshire and the East London Company.

Lord Robert Cecil urged that it was relevant, as the diminution must have been due to a depletion of the chalk water, because the rainfall was normal. If they could show that depletion was already going on, and that they had already suffered, then they made out a strong case that they should not be put into a worse position.

The Chairman said that, as far as that went, it was relevant; but they must not get into some side controversy with the Company.

Mr. Bidder pointed out that Lord Robert Cecil, in this evidence, was going to make an allegation against one of the Companies with regard to the supply of water, and the reasons for it; and to draw deductions as to the effect of their pumping. It was quite obvious—whether he was right or wrong—that the Companies had their own views upon the question; and if the evidence was to be heard on one side, it would have to be heard on the other.

The Chairman said that might be; but he could not stop the evidence in general terms.

Witness then gave evidence that the rainfall from 1891 to 1894 was 12 per cent. above the average; and that, notwithstanding the excess of rainfall, there was difficulty in obtaining water from the chalk, and the streams were running dry.

Mr. Pember complained that, according to the forms of the House, he had no right to cross-examine the witness; and it was a little hard that a witness should be allowed to make an attack on one special Company on a perfectly collateral issue, and also to go behind the findings of the Royal Commission.

The Chairman put the question to Mr. Hopkinson, as to whether his evidence was consistent with the findings of the Royal Commission, and elicited the reply that it was not.

Mr. *G. B. Hudson*, M.P. for the Hitchin Division, stated that the inhabitants of the county felt very strongly on the question of the abstraction of water by the Companies who had deep wells, by which their water was taken away.

Mr. Pember said that this evidence had better be stopped upon the threshold. These questions were thoroughly discussed before the Royal Commission, who came to the conclusion that a certain amount of water could be obtained from the chalk in excess of the present quantity.

The Chairman said that Mr. Pember had said enough already to counteract whatever "poison" there was in the last answer of the witness.

Mr. Pember said that he also wanted to point out that nothing must be done or suggested with a view to altering the Bills.

Lord Robert Cecil said they did not want to alter the Bills, but to reject them; they did not think them capable of alteration.

Witness said that living on the banks of the Lea for the last thirty or forty years, he had kept a pretty close observation on the amount of water. During the last eight or twelve years, there had been great diminution; and the land and farms in the neighbourhood of streams had been greatly depreciated in value.

Mr. Worsley Taylor stated that a special meeting of the London County Council had been arranged for the following Monday, when the form of the alternative arbitration clause would be decided upon; and he promised that copies should be supplied to the opponents as early as possible.

Mr. Lewis Coward, for the Surrey County Council, said that, although that body had come to an agreement with the promoters, they were still strong opponents to the Bills, unless the agreement were scheduled to the Bills. He therefore claimed the right to put Mr. Halsey, the Chairman of the Surrey County Council, in the box, especially as the agreement had been so vehemently attacked by other opponents.

Mr. Bidder, Mr. Pember, and Lord Robert Cecil all objected, and said that, as the Surrey Council had come to an agreement, they had no further right to intervene in the proceedings.

The Chairman said he was not very familiar with the practice on this point; but he would consider it before the Committee met again, and advise himself as well as he could on the subject. If the Committee came to the conclusion that the Surrey County Council had a right to be heard, they would be glad to hear them.

The Committee then adjourned till the following Tuesday.

Eighteenth Day—Tuesday, June 25.

Mr. Balfour Browne to-day brought up the alternative clause which had been agreed upon at the special meeting of the London

County Council on the previous day. He said he did not propose to discuss it, as he understood, from the decision of the Committee, that, when clause 6 came to be considered, it would be open for Counsel representing the Water Companies to propose amendments. He would only remark that he believed the clause carried out the decision of the Committee. It read as follows:—

And whereas (failing agreement as to sale and purchase), in order to determine the fair and reasonable value of the undertaking, it is intended to provide that the Arbitrators should, in determining such value, have regard to all the circumstances of the case, and should hear and consider all matters, whether past, present, or future, laid before them by either party relating to any such circumstances, and should not be precluded by any legal objection from entertaining the same: Be it therefore enacted—There shall be paid by the Council for the transfer of the undertaking such a sum of money as the Arbitrators determine to represent the fair and reasonable value of the undertaking, together with such further sum as the Arbitrators may award to meet the cost of reinvesting such money, in the event of no arrangement being made by the Council under which such money may be reinvested without cost; and the Arbitrators, in order to ascertain such sum, shall inquire into and consider all the circumstances of the case and the contentions of the Council and the Lambeth Company respectively, and may deal with the same or any of them in such manner as they, in their absolute and unfettered discretion, think fit, on such terms and in such manner in all respects as they think fair, reasonable, and expedient, and as fully and effectually as could be done by Act of Parliament. The Arbitrators may at any stage of the proceedings under the reference to them, and shall, if so directed by the Court or a Judge, state in the form of a special case any question of law arising in the course of the reference; and any question of law so stated shall be for the determination of the Court, subject to all right of appeal as from a judgment or order of the Court.

Mr. Pember said that, though Mr. Balfour Browne treated it as a matter of clauses, he regarded it as one of preamble, because of the particular form which the preamble took when it specified that the transfer was to take place upon the terms and conditions contained in the Bill. Therefore the clause became part of the preamble; and as part of the preamble, he should claim to treat it.

Mr. Balfour Browne said he was not going to preclude Mr. Pember from dealing with it as part of the preamble; but he did not propose to discuss it then, as he had closed his case on the preamble.

The Chairman remarked that it was only necessary for him to say at present, on behalf of the Committee, that they were glad the County Council had been able to meet their request by having the clause prepared for that day's sitting. He would not at present express any opinion as to whether it did or did not carry out the decision of the Committee, as he had not had an opportunity of considering it. But with regard to the question of preamble, Counsel would remember that the Committee reserved their decision as to whether or not they would, in any shape or form, postpone the preamble, with the view to having the matter of clause 6 discussed; and when the case for the petitioners for the Bill was closed, they would take this into consideration. Since the last meeting of the Committee, he had had the advantage of the advice of the authorities on the question whether the County Council of Surrey had a right to be heard at this stage. He was informed that, as they had been present through all the proceedings, and had gone through the necessary forms to keep themselves before the Committee, they were entitled to be heard then on their petition. But they must confine themselves strictly to the terms and objects of the petition; and so far as they had changed their ground since, by entering into an agreement with the promoters, they could not be heard on any matters touching the agreement.

Mr. Pope suggested that, apart from the question of whether clause 6 should be discussed on the preamble or on clauses, the Committee should first of all consider whether, in truth, the new clause now brought up by the promoters did carry out, or was in harmony with, the intimation of the Committee. He said the view of his clients was that it was directly contrary to that intimation. He invited the Committee to look at the clause, to see whether it did not go behind the intimation of the Committee—and, in fact, in the teeth of it—and raise over again practically the question which the Committee had already decided.

The Chairman said he thought it better that they should conclude the matters they were discussing on the last day before they turned their attention to the clause.

Mr. Pope observed that he only intervened because he was anxious it should not be said that they allowed the Committee to slip into a course of procedure which they might have prevented if they had intervened at the time.

Mr. *Edward J. Halsey*, the Chairman of the Surrey County Council, was then called. In reply to Mr. Lewis Coward, he detailed the steps which had been taken, in conference with other local bodies in the county, on the water question. Their policy was that, while not in any way antagonistic to the idea of municipal control of the water supply for London, they would oppose to the utmost any attempt to deprive Surrey of the complete and independent control of its own water supply, by which he meant not only the means of distribution and the sale of water in bulk, but also the sources of supply.

Mr. Lewis Coward asked the witness if he considered that the agreement they had made with the London County Council carried out this policy.

Lord Robert Cecil objected that the question was not a proper one.

The Chairman overruled the objection; saying that they could not go into the agreement at all, as it was not referred to in the petition.

Witness (continuing) said the main reasons which dictated the policy of the Surrey County Council were that they would resent the authority of another Council within their county, which would result if the Bills were passed as they stood. Another reason was that they could see no justification for what might possibly, and probably would happen—viz., that the area of Surrey at present supplied by the Lambeth and Southwark and Vauxhall Companies would hereafter be drawn in to bear some of the expense of procuring a further supply for the County of London. They must have the absolute right to the water, to the pumping, to the reservoirs, and to the filter-beds.

The Chairman hoped Mr. Halsey would understand that the Committee would have been very glad to hear him, both for the personal assistance which he might have given them, and also on behalf of the Council, if it had been possible at another stage; but, owing to the course of matters, the Committee had, he said, been obliged to keep a tight rein upon all evidence.

Witness said the only thing he resented was that the agreement had been attacked by neighbouring local authorities with whom it had nothing to do; and they were obliged to sit and listen to the attacks, and to hold their tongues.

Mr. Balfour Browne said he had a right to cross-examine the witness. But Mr. Halsey was an opponent he was not afraid of; and therefore he did not propose to exercise that right.

Mr. Batten then addressed the Committee on behalf of the Waltham Holy Cross Urban District Council in opposition to the Bill. He asked the Committee to give an intimation to the promoters that the urban authorities round London, who represented the districts in which the population was growing, and which would be the London of the future, should have not only the bare pipes and mains, but also their own sources of supply. Waltham was a perfectly self-contained district, and quite capable of supplying its own inhabitants with abundant water of the purest character, obtained from its own district. The clauses of the Bill which provided for the giving back of water to the urban districts by the London County Council were perfectly illusory.

Dr. *J. D. Priest*, the Medical Officer of Health for Waltham, and Mr. *W. Beck*, the Chairman of the District Council, gave evidence in support of these views.

Mr. Morton, on behalf of the Corporation of West Ham, said they did not desire, if it were possible to avoid it, to oppose the principles of the measure so far as they related to the claim of the London County Council to be the Water Authority for the County of London; but they had a strong objection to the Council being the Water Authority for West Ham. Negotiations had been going on between the promoters and the West Ham Corporation which had not arrived at a precise or definite result; and, under these circumstances, he was anxious not then to go into the case for West Ham, as it might have the effect of preventing these negotiations coming to a satisfactory settlement. The quantity of water proposed to be supplied in bulk—viz., 35 gallons per head per day—was ridiculously inadequate for West Ham, as two factories last year took 250 million gallons; and it would be impossible, as the Bill was drawn, for the borough to exercise the compulsory powers given to it.

This having concluded the case for the outside authorities,

The Chairman asked Mr. Pope whether he wished the Committee at this stage to express an opinion upon the new clause of the Council before the case for the Companies commenced.

Mr. Pope said it was not upon the merits of the clause, but upon the fact, which might be more or less a demerit, that it did not carry out the intimations of the Committee.

Mr. Bidder proceeded to refer to previous discussions in the Committee, to show that the clause was not in harmony with the previous decision of the Committee, when

The Chairman (interposing) said it was rather a matter between the promoters of the Bill and the Committee.

The room was then cleared, and the Committee consulted in private. On the re-admission of the parties,

The Chairman said: The Committee have given to the clause which has been submitted to them such consideration as was possible in the short time it has been before them. Of course, it must be understood, in the first place, that any adoption of this clause which we may now signify is subject, as we said originally, to the decision we may arrive at after we have heard Counsel for the opponents of the Bill with reference to it. But on the question which we have been asked to answer—viz., as to whether this clause, as submitted to us by Mr. Balfour Browne just now, does give effect to the decision which we arrived at—speaking generally, and subject to further consideration, and also to one or two points to which I wish to call attention, we do not see anything at present in the clause, as submitted to us, which is inconsistent with the decision already arrived at as to clause 6. But I should like again to emphasize what I have said, that we, of course, have only been able to give it hasty and cursory consideration; and there may lurk in certain of the words some meaning which we do not at present see. I should also like at once to call attention to one or two points. First, it will be remembered that we were very emphatic in saying that we wished the Arbitrator to have it in his discretion to accept all the evidence, if any, and to give such effect, if any, to the considerations submitted to him as he in his discretion should deem right. At the present moment, we are inclined to think that it will be necessary to put some words into the clause, when we deal with it as a clause, and when we come to the clauses, which will make it amply clear that it is to be for the Arbitrator to decide, when any matter is submitted for his consideration, how far he will go into evidence, and whether he will go into evidence at all upon it. That we wish to have made quite clear. Further, we wish to guard ourselves against expressing, at the present moment, any opinion upon the words which refer to the discretion of the Arbitrator—"as fully and effectually as could be done by Act of Parliament." The Committee have not as yet had this matter discussed before them; and, of course, they are not to be taken as agreeing to those particular words until the matter has been fully discussed before them. But, speaking generally, the opponents of the Bill (subject to the observations I have made, and to any further observations which we may have to make upon it, which do not occur to us at present) must deal with it as being a clause which does substantially carry out the intention and the decision of the Committee. I say again that the opponents of the Bill are at liberty, in dealing with the clause, to advance such arguments as they may think fit against the clause generally, or any part of it, and that we will listen to such arguments with an open mind. The Committee have also come to this decision, at least: At present they see no objection to going into this matter as one of preamble; and they think, on the whole, that it would be a more convenient course than postponing the preamble, as was suggested, I believe, by Mr. Pope. Of course, it will be for Counsel to suggest, and the Committee to adopt, when we come to clauses (in case we should come to clauses), any verbal alterations which may be necessary.

Mr. Pember then addressed the Committee for the Lambeth, the

East London, the Grand Junction, and the West Middlesex Water Companies. He said that, though the eight Companies had been for a long time—sometimes thoughtlessly, and sometimes purposely—maligned, they had done their full duty to London, and had provided it with an abundant supply of excellent quality, and at a cost which compared very favourably indeed with that at which water was supplied to other great towns in the United Kingdom. It was a misfortune for the Companies that their *apologia* had never been made before Parliament, and never seemed likely to be made, for, all through the parliamentary proceedings in past years, they had been prevented from defending their position; and he wished now clearly but respectfully to protest at being compelled to resign their position as the Water Authority. But, if it were advisable for the great Metropolitan communities (which he should have been amply prepared to contest) to reverse the present system of water supply, no one could deny that it was a matter of the deepest concern that it should be equitably brought about. There was no hurry in regard to it, and no need to adopt crude, any more than unfair, methods. It was a matter of the most serious import to thousands of persons who had invested their money in the shares of the Companies. They had heard a great deal of talk about rich Companies fattening upon the consumers, and of this being a contest between the representatives of those consumers on the one hand, and a group of wealthy Companies on the other. This was only clap-trap, and clap-trap calculated to work very widespread injustice. The Companies were composed, in the main, of small and presumably poor holders, who had invested their savings at high premiums and at low rates of interest. Learned Counsel then criticized the action of the promoters in dividing the scheme into eight Bills, and proceeding with two only. He urged that they should be debarred from purchasing any one or more of the undertakings without acquiring the whole; otherwise the Council would be able to compete with the Companies left outside.

The Chairman said it might shorten matters if he were to state the decision which the Committee some time ago arrived at—viz., that they would be disposed to put such a clause in the Bill, should it be passed. Of course, he could not at present pledge himself to the particular terms of the clause.

Mr. Pember then submitted that the proposal for the transfer of the works before payment was made or the price fixed upon, was one which the Committee ought not to sanction.

The Chairman expressed the hope that the Companies and the Council might be able to agree as to the price, as it would save an enormous amount of time and money.

Mr. Pember said that perhaps he was wrong in absolutely despairing on that point; but, at the same time, he was entitled to say that the contingency of non-agreement must be provided for.

The Chairman: Oh, yes.

Mr. Pember said the proposal of the London County Council was absolutely contrary to the most elementary principles which regulated transactions between man and man.

Before Counsel had completed his address, the Committee adjourned till the following day.

Nineteenth Day—Wednesday, June 26.

Mr. Pember continued to-day his address on behalf of the Lambeth and other Companies. He stated that the proposal to acquire the undertakings before the price was fixed or paid, was unprecedented; and to say this was hardly to characterize it with proper effect. What was there to make this case differ from others of the kind, except that it was a much larger purchase in money value than most similar purchases had been? But this did not take it out of the ordinary category; it only made it a conspicuous instance of the category. Gas undertakings of great magnitude had been bought very frequently indeed, and so had important water undertakings; and both would be bought very frequently again. But, so far as he knew, no one had ever yet discovered that entry before payment, and even before the value of the property was ascertained, had ever been found necessary to avoid confusion. He asked the Committee to consider the injustice which such a provision would entail. The London County Council were to enter into possession of the water undertakings, their plant, their premises, their reservoirs, their mains. All would be theirs for months and years. Just think how they, as hostile owners, pending the arbitrations which the Companies would have no power to press on, and which were to last from six to ten years, might so manipulate the concerns as to damage them in a physical and material sense, so as to diminish the amount eventually to be paid for them. He did not wish to be supposed always to be holding up the London County Council as monsters of iniquity; but he said the Water Companies ought not to be subject to such a chance as the one proposed, and ought not to be so put into their power. Further, by clause 14 of the Lambeth Bill, from and after the date of transfer, they were to hand over to the Council "all the books, accounts, and documents of the Company relating to, and necessary for, the conduct and management of the business of the undertaking." It was just those books which ought to belong to the Company; and if any access to them was to be given, it would be given with a certain amount of jealousy and of environment such as an Arbitrator or a Court of Law might determine. This was an absolute reversal of the proper position of the two parties. Then it must be remembered that the only persons the Company could employ in the inspection of the books would be strangers; for under section 20, they were to take away all the Companies' servants. Of course, the very interests of those men would all be transferred with the transfer of the undertaking. Their sense of allegiance would be naturally towards their new masters, their permanent masters for the future—those to whom they would have to look for the chance of retaining their situations, and whom they would be bound to serve loyally, carefully, and zealously, for the purpose of retaining those situations. To offer the Company their services for the purpose of arbitration would be simply a mockery. Such a process was an illustration of the monstrousness of the clauses which necessitated it, because it was one of the many clauses of the Bill which arose solely and entirely from the determination on the part of the Council to ask for transfer before payment, or even before the ascertainment of value. The learned Counsel also criticized the clauses of the Bill which prohibited the increase of officers' salaries and the entering into contracts unless with the consent of the Council. On the latter point, he said there had not been a single contract made since 1894 with the consent of the Council. They had no more right to consent to contracts made by the Water Companies than to consent to those which he might have made with a builder to repair his own house. The West Middlesex, the East London, and the Southwark and Vauxhall Companies last year obtained parliamentary powers to raise sums of money from £300,000 to £400,000 or £500,000, for the purpose of increasing their mains, for improving their filtration, and for enlarging their storage; and peremptory clauses were put upon them to commence the works at once. These works had been begun; and very large contracts, involving hundreds of thousands of pounds, had been entered into since July, 1894, which, under the ill-considered clause in this Bill, would be absolutely annulled. It seemed to him incredible that people who had to settle not only on the basis of equity, but of common sense, should put in such a clause as that. He thought, however, that he saw the object of it. One of the charges made against the Companies was that they were deficient in filtration and storage works; and if the Council could invalidate the contracts, they might go to the Arbitrators and say that the Companies were deficient in these works, and that they had no means of improving themselves because all the contracts they had entered into since July, 1894, had come to an end. Supposing the Bills should be "hung up" for the next five or ten years, were the Companies to wait an indefinite time for the improvement of their storage and filtration, while the Council made up their minds to act, and perhaps might never make up their minds to act at all. Referring again to the arbitration clause, he asked why the shareholders in the Water Companies should be picked out to be the victims of an untried, novel procedure, the result of which no one could forecast. The ordinary form of arbitration in such cases was that of the Lands Clauses Act. He admitted that, under that form of arbitration, Arbitrators generally gave something on account of compulsory sale; but if such an enhanced sum was given, it was intended to cover delays and difficulties, and possible slight losses on reinvestment. The 10 per cent. was a creature of the imagination; for no one knew really the enhanced value which an Arbitrator had in his own mind. Of course, the enhancement of value would be a large sum on a transaction of 30 or 40 millions of money; and if it involved one big cheque being paid *en bloc* to some huge financier, something might be said against the question being taken into consideration by the Arbitrators. But in this case there would be some 14,000 or 15,000 people among whom it would have to be divided; and each of them would stand to lose something in the way of brokerage upon the reinvestment.

Sir J. Kitson asked if he understood Mr. Pember to assert that there was no custom which had established a particular percentage.

Mr. Pember replied that he did not think there was. It might be very likely that Arbitrators, by a sort of rule-of-thumb, added 10 per cent. in their own minds; but that it was an absolutely universal custom was not true. The London County Council kept harping upon the special necessity of protecting the purchaser, or, as they put it, the public of London. He granted that the public of London ought not to be robbed; neither surely should the shareholders in the various Water Companies. It was not the Companies who were the aggressors, but the London County Council. All the Companies asked was to be left alone; and therefore, if any special protection were needed, it was for the Companies and not for the London County Council. But no special protection was needed for either. There were no special features in the case; and therefore the transaction should be left to the operation of the general law. He referred to the discussions in the London County Council on the subject, and to the observation of Lord Onslow that to lose the clause, either in form or in substance, was to make London pay what it considered a "fool's price" for the undertakings. In other words, London had suggested to itself a point of value at which it would be worth while to buy the water-works; and anything beyond this they would consider a "fool's price." Therefore they must have the protection, in meal or in malt, which clause 6 would give them—that of preventing the Arbitrators from assessing against them a higher price than they were prepared to give. The learned Counsel again urged that the arbitration should be left open under the Lands Clauses Act, and that the alternative clause did not carry out the declarations of the Committee. He asked the Committee to take care lest the last performance of the London County Council should beguile them, and induce them to do, under cover of what they called "innocent words," as great an injustice as could possibly be done under any question as to compulsory purchase and sale. As the conditions of the clauses were part and parcel of the preamble, he asked the Committee to reject the Lambeth Bill as embodying a crude and an unfair scheme for carrying out what might or might not be a desirable change in the water supply of London.

Mr. Littler, for the Kent Water Company, said they were in an entirely different position from all the other London Water Companies. Everybody had admitted the admirable administration and the excellence of the supply of the Company, who had been decided against, in a matter essential and vital to their own interests, without having been fully heard. This had arisen partly from the actual condition and difficulty of the matter itself, and partly from the conduct of the public authorities. But they felt that it mattered little to them, if they were to be executed, whether they were hanged or disposed of by some other method. What they felt was that, up to the present time, since 1881, and then only partially, because there had been an agreed scheme between the Water Companies through Mr. Smith and the then Government, they had never been completely heard; and even before Sir Wm. Harcourt's Committee, the whole question was never discussed. It had been more or less necessary for Committees to follow the course which had been invariably taken, of stating that they did not propose to discuss this, that, and the other question, all of which were vital to the Company's existence. Therefore, he felt that he was, to some extent, fighting the matter with one hand tied behind his back. If the question were open from the beginning, whether or not the undertaking of the Kent Company was to be bought, and whether or not it was wise, in the interests of the population of London itself, that it should be bought, he had abundance of evidence.

But he wished respectfully to state at the outset that, whatever might be the view of any other Water Company, the Kent Company most emphatically and distinctly protested against being acquired by anybody. A more unjust, a more carelessly worded, a more improperly drawn Bill than that now before the Committee could not very well have been drawn. To present such a Bill must have been an advised piece of work for the purpose of destroying the property which it was his duty to protect. From end to end it was full of indications of this purpose, which he trusted would never be accomplished. Why were the Kent Company dragged into the matter at all? They supplied water to an enormous area outside London, and to a very small area inside. With one single exception, every Director and principal officer was either a Kentish man or man of Kent. That the Company were accidently partly within the County of London was no fault of theirs; and the proposal to acquire the undertaking was an injustice to the county for whose benefit they had spent their money. It was perfectly true that, at the present moment, it was a very profitable speculation; but it was not so at first—no water company was. They spent their money with the desire of providing a thoroughly effective and proper supply for the district in which the then and present shareholders were mainly interested. They had done their duty thoroughly; and because it so happened that Parliament had thought fit to include a portion of the district within the County of London, they were asked to take part in all these enormously expensive proceedings, and so have their property taken from them in a method which was only justified by the most eminent public interest. If the Committee were going to lay down the principle of first compelling them to part with their property, and secondly to part with it on terms which were not justified by existing law, they were laying the foundation for the deprivation of all those rights of property which, from the time of the Romans onwards, had been recognized as being the very first principles of existence of any intelligent and properly civilized state. It was, in this view, a far more serious question than the mere case of the Kent Company that was before the Committee. The Committee had said, what he had fully anticipated would be their decision sooner or later, that the matter must be dealt with as a whole. But he respectfully submitted that the Kent Company ought not to be part of the whole. Whatever they did with the other Companies, they ought to say that, as regards the Kent Company, there was no reason whatever why they should be worried, tormented, and harassed by further proceedings. If the London County Council were to purchase the works of the Metropolitan Water Companies, the Kent Company ought to be no part of the scheme. If, however, the Council hereafter wanted the 30 square miles which they had in London, then let them do as other people had done—by agreement purchase the mains and pipes if the Company chose to sell them. But there had been no case ever presented to Parliament of compelling a water company, or any other company to part with their rights while they were behaving properly. Why were the London Water Companies to be made an example of? Not because London was badly off, not because it was suffering, for it was the most healthy of all the great towns of England. There was no public necessity, but only a "fad" or a fancy. There was an idea which people were pleased to call "municipalization of water;" and he supposed gas and railways, and everything else, would follow in due course until private capitalists would have nothing to invest in. The Kent Company was one which could stand before Parliament, or anywhere else, and face comparison with any supply in England, be it municipal or by a company, whether for charges, for quality, for regularity, or for propriety of conduct. This was admitted on all sides, even by the promoters, and by the Kentish authorities. Under these circumstances, he was entitled to criticize every line of the proposals under which it was sought to buy them up—proposals which were absolutely unparalleled so far as the Kent Company were concerned. The proposal to acquire the undertaking was not in the interests of those for whose benefit it was established—the people resident in Kent—but for the purpose of securing water for London to the detriment of the Kentish people. If the promoters would consent to strike out the Kent Company, he would not have a word more to say. He submitted that the Committee should declare that there had been no reason shown for the purchase of the Kent Company's undertaking at all, and that therefore they were out of it, not only now but for all time. He hoped that one result of the present inquiry might be that they might be left to do their own beneficent work in their own way, and in their own district.

At this point of the learned Counsel's address, the Committee adjourned till the following day.

Twentieth Day—Thursday, June 27.

Mr. Littler continued to-day his address on behalf of the Kent Company. He pointed out that there was no power taken by the London County Council in the Bill to raise money for the purchase of the undertakings. He knew of no case of a Purchase Bill in which the authority seeking to purchase did not also take care to provide the necessary money to carry it out; and this provision was all the more essential after the decision of the Committee that the undertakings were to be bought as a whole. The Committee were therefore asked to sanction these two Bills for the purchase of the undertakings of the Lambeth and the Southwark and Vauxhall Companies without there being any certainty that there would be ever any authority to purchase the rest, and without the faintest notion of whether or not any purchase whatever could be carried out. They had no power to compel the Council to come before Parliament and promote a Bill for the purpose of raising the money; and if they found the arbitration was going against them, it might be that they would abandon the whole thing, on the ground that they had no money. Supposing they thought the undertakings could be bought for £15,000,000, and their value was £40,000,000 (which, unless absolute confiscation was to take place, was the least amount likely to be found by the Arbitrators), were the Committee going to allow them to spend their money and put upon the ratepayer £600,000 a year by way of sinking fund, if the ordinary term of 60 years was allowed? But by the Council's Money Bill they asked for 100 years.

Sir J. Kitson asked where the 100 years was stated.

Mr. Littler said it was in the Council's Money Bill.

Mr. Freeman denied that such a provision was in the Money Bill.

Mr. Littler quoted the clause to that effect. He objected to the transfer of the undertaking before payment; and he urged that the arbitration should be conducted under the Lands Clauses Acts, instead of any special clauses being inserted in the present Bill. He saw the same vices in the alternative clause submitted by the Council as were contained in the original clause which the Committee had rejected; and he expressed the opinion that, unless the Council had seen that the same purpose could be effected by it as by the clause they fought so hard to retain, they would never have proposed it.

The Chairman called attention to the words in the clause with reference to the sum to be awarded by the Arbitrator to meet the cost of re-investing, and said that the Committee, when they expressed general approval of the clause, had not in their minds what the particular effect of such words might be.

Mr. Pember contended that it might have the effect of excluding from the mind of the Arbitrator the possibility of his taking into account any other element beyond the cost of reinvestment. He proceeded to criticize the clause in regard to the way in which the officers and the debenture-holders of the Company were to be dealt with; and he concluded by again urging that there was no reason why the Kent Company especially should be purchased by the London County Council.

Mr. Balfour Browne, at the request of the Committee, gave the reasons for his contention that the new clause was in harmony with the decision of the Committee; stating that by it the Arbitrator would be able to arrive at the value of the undertaking, and have regard to "all the circumstances of the case" with a free hand. He intimated that any words which the Committee thought were in derogation of that view the promoters would be willing to amend.

The Committee then consulted in private. On the readmission of the parties,

The Chairman said the view they took at present of the alternative clause was that it substantially carried out the decision of the Committee, subject to a probable alteration in the preamble of it (which he understood Mr. Balfour Browne did not object to, though the Committee did not wish to bind him), and also subject to an alteration which would make it quite clear that the words "such sum as the Arbitrator may award" and the following words did not in any way fetter or reduce the power of the Arbitrator to consider fully whether he should give any and what sum, or the question of whether any "addition shall be made to the fair and reasonable value of the undertaking in respect of compulsory sale," if in his discretion he should think fit to do so. Their object was to leave the Arbitrator as perfectly unfettered as could be with regard to this question. The Committee also reserved for further consideration the final words of the paragraph—viz., "and as fully and as effectually as could be done by Act of Parliament." But in other respects they thought the clause carried out substantially the decision at which the Committee arrived some time ago. As to their further proceedings, it was clear to all that if the dissolution of Parliament was to take place within the period generally expected, it would be a mere waste of time and money to attempt to conclude the consideration of the Bill in such a way as to enable it to be taken up again in the next Parliament at the stage at which they broke off. Therefore he thought it would be hopeless to proceed further with the investigation in the present Parliament. At the same time (all things in politics being uncertain), the Committee could not exclude the possibility of some change taking place in the political situation. Therefore they would adjourn till Wednesday; and if it should then appear that there was no prospect of a prolonged session of the present Parliament, such as would enable them to get the business through, they would not attempt to do it.

Mr. Balfour Browne said it was a great pity the Committee could not hear these Bills out, as the remainder of the proceedings could not take very long. If the preamble were found to be proved, in all probability the opponents would not discuss clauses; and then the Bills could be suspended at a stage when they could be taken to the House of Lords in the following session.

The Chairman said the Committee had considered this matter, and had come to the conclusion that there was no prospect of their being able to arrive at a final decision as to the preambles of the Bills within the time which appeared to be at their disposal.

The Committee then adjourned till Wednesday (to-morrow).

Rushden and Higham Ferrers District Gas Company, Limited.—At the recent annual general meeting of this Company, the Chairman (Mr. Paul Cave) read the Directors' report, which stated that the net profit realized in the year ending March 31 last amounted to £1085; being an increase of £464 on the preceding twelve months. The sale of gas produced £4009, as compared with £3431—being an augmentation to the extent of 18 per cent.; and the receipts from residual products and the profits on gas-fittings were also higher. In pursuance of the policy indicated in last year's report, £414 of the amount available on the profit and loss account had been appropriated in reducing the cost of the two old undertakings at Rushden and Higham Ferrers respectively; and there was left a sum of £745 for dividend, which the Directors recommended the shareholders to declare at 6 per cent. on the paid-up capital. A dividend after this rate would, according to the Company's Articles of Association, entitle the shareholding consumers to a bonus of 1d. per 1000 cubic feet of gas consumed by them during the past year up to a maximum consumption of 10,000 cubic feet for each share held. Dividend and bonus together amounted to about £623; leaving £122 to be carried forward. Reference was made to the loss sustained by the Company by the death of their Manager, Mr. John Lewis, and to the appointment of Mr. J. T. Lewis, of Wellingborough, as Managing-Director of the Company, and of his brother (Mr. H. C. Lewis) as Deputy-Manager. The Directors had decided to reduce the price of gas 2d. per 1000 cubic feet as from March 31 last; and adopting this policy, they said they were persuaded that, while a reduction would be a material boon to consumers, the increasing consumption would more than compensate the Company. The report was adopted; and the dividend recommended was declared.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, June 27.

(*Before Lords Justices* LINDLEY, LOPES, *and* RIGBY.)

The Ventnor Gas and Water Company v. The Local Board of Health for the District of Ventnor.

This was an appeal from a decision of Mr. Justice Kekewich, delivered early this year, and reported in the JOURNAL for Jan. 29 (p. 225), whereby he declared that the defendants were not entitled to take water without payment, for the purpose of watering the roads, &c. from the mains of the plaintiffs, excepting from those constituting what was termed the "low-level" system.

Mr. WARMINGTON, Q.C., and Mr. HAMILTON appeared for the appellants; Mr. CRIPPS, Q.C., and Mr. BRAMWELL DAVIS, Q.C., represented the Company.

There are in Ventnor three levels of water-mains, indicated respectively by the colours red, blue, and green. The last are the highest; and they were laid entirely by the Company. The red are the lowest; and they were laid by the late Mr. Livesay under an agreement with the then Improvement Commissioners of Ventnor, and were purchased from him by the Company in or about the year 1866. The blue occupy an intermediate position in both respects. The chief contest was as to the green; the defendants contending that, under the terms of the agreement made with Mr. Livesay in 1858, they, as successors of the Improvement Commissioners, were entitled to take water free of charge from any mains of the Company, who succeeded Mr. Livesay; and further that, even if they were not right as to these pipes, they were entitled to take water from those indicated by the colour blue.

Mr. CRIPPS pointed out, on behalf of the Company, that no question had been raised before Mr. Justice Kekewich as to the mains marked blue.

There being considerable difference between the Counsel on each side as to the facts with reference to these mains,

Mr. *J. G. Livesay* was called to give additional evidence with regard to them.

The further hearing of the case was then adjourned.

Friday, June 28.

On the resumption of the proceedings,

Lord Justice LINDLEY intimated that their Lordships were of opinion that the order as made by Mr. Justice Kekewich was slightly too wide; and that, subject to anything Counsel might say, they proposed to make a declaration that the defendants were not entitled, under the agreement of 1858, to take water for any purposes from any mains of the plaintiffs laid by them under their parliamentary powers, and not under the agreement, or in substitution for mains laid by Mr. Livesay under the agreement, or with the consent of the then Improvement Commissioners. If this were accepted in principle, the better way would be for the Junior Counsel to make it plain, with reference to the map attached to the agreement, by means of letters, what portions of the mains were excepted from the declaration, as having been put down by Mr. Livesay under the agreement.

After some discussion, the order was made in this form; each of the Lords Justices giving a short judgment in which he pointed out the reasons for his decision.

Lord Justice RIGBY said the leading consideration was this: That, by the 4th section of the agreement, the Commissioners were to be entitled from time to time to place fire-plugs on any of the main pipes that Mr. A. F. Livesay had used for supplying the inhabitants of the town with water He said he did not think this could be cut down to any of the main pipes the liberty to lay which was granted by the agreement; for the 8th section clearly contemplated their extension beyond the limits of the express grant. The real question at issue was what main pipes belonged to Mr. Livesay. Anything that never belonged to him was altogether outside the agreement; but everything that did belong to him—and the dividing-line must be the time when the Act came into operation—was, in his judgment, within the express terms of the 4th clause of the agreement. The plaintiffs were entitled to the costs of the action; but, as they had put their rights rather too high, and the defendants had, to some extent, succeeded on the appeal, there would be no costs of the appeal on either side.

It was then arranged that, if the Junior Counsel could not agree on the exact limits of the blue mains from which the defendants were entitled to draw water, Lord Justice Rigby should give his assistance.

HIGH COURT OF JUSTICE IN IRELAND—CHANCERY DIVISION.

Thursday, June 20.

(*Before the* MASTER OF THE ROLLS.)

Alliance and Dublin Consumers' Gas Company v. Corporation of Dublin.

This was an action instituted by the Alliance and Dublin Consumers' Gas Company against the Corporation of Dublin, to have the award made in December, 1889, in regard to the meters attached to the public lamps, carried into execution, and specifically performed by the defendants. They also applied for a mandatory injunction to compel the defendants to remove all defective meters from the public lamps, and to provide, in lieu thereof, proper meters within the meaning of the award, for the purpose of ascertaining the consumption of gas supplied by the plaintiffs to the defendants, and for an inquiry as to the damages sustained by the Company by reason of the defendants' breaches of the award.

Mr. W. KENNY, Q.C., Mr. RONAN, Q.C., Mr. GORDON, Q.C., and Mr. A. F. BLOOD appeared for the plaintiffs; the SOLICITOR-GENERAL, Mr. O'CONNOR, Q.C., and Mr. PHILIP O'C. WHITE represented the defendants.

Mr. KENNY, in stating the case, said the action was the last incident in a course of litigation which had existed for some years between the Gas Company and the Corporation with reference to the public lighting of the city. He wished he could express with confidence that the present was the last of a long series of actions; but, having regard to the difference and the correspondence which had taken place, he could scarcely venture to do that. Legal proceedings had been taken from time to time for the purpose of recovering from the Corporation the amount of the monthly account for the consumption of gas in the public lamps of the city. There had likewise been several arbitrations. He thought he might venture to say that in all cases the Company had been uniformly successful. The Company were incorporated in 1866; and, by the Act passed in that year, they were empowered to contract with public authorities for the supply of gas for public purposes. Down to 1890, the Company remained the owners of the public lamps and lamp-posts in the city; and they supplied the meters to the lamps—the average being one to every ten lamps. Prior to 1889, various disputes arose between the Company and the Corporation as to the public lighting of the city; and, in order to settle the differences, they were referred eventually to Mr. A. G. Vernon Harcourt and Mr. H. E. Jones. The Arbitrators decided that the Company should sell the plant to the Corporation at a certain price, and that in future the Corporation should supply the meters for the purpose of measuring the gas. The price of the plant was subsequently fixed by arbitration at £14,341. It then became the duty of the defendants to provide and fix the new meters; and accordingly the plaintiffs wrote to them on Jan. 17, 1891, requiring them to provide the new meters. On Dec. 7, 1891, a reply was received, stating that they had given orders for ten new meters, and that they would be fixed to the lamps in a reasonable time. But, notwithstanding, the Corporation, up to July, 1891, had only provided and fixed six new meters. In that month more were put in. But the plaintiffs complained about them; pointing out that they were so defective in their construction, and of such insufficient capacity, that they ceased from time to time to register the quantity of gas furnished to them, to the great loss of the Company. In consequence of these complaints, the Corporation had to remove several of the lamps. From September, 1892, up to the present time, the Corporation had persisted in fixing meters of the same type as those which were removed as being defective, with the result that the Company were losing heavily. They had endeavoured to induce the Corporation to agree with them as to the appointment of an Arbitrator to decide the question whether the meters provided by the Corporation were proper meters within the meaning of the award. No settlement, either as to the question to be submitted to arbitration or the person to be the Arbitrator, had been arrived at; and after a considerable amount of correspondence, the Board of Trade refused to appoint anyone, as the parties could not agree to the reference. The Corporation had now fixed 188 new meters; and, by careful examination and taking readings of the quantity of gas consumed at different times, the Company were convinced that all of them were of defective construction and insufficient capacity, and that many of them from time to time passed gas without registering it, and were in other respects improper. The Corporation, in their defence, said that the award in question provided that the Company should make arrangements for a proper testing-place for the gas; and that they had failed to do so. The Corporation also denied that they were guilty of any delay in providing the new meters according to the award. The Corporation immediately took over the lamps, and put themselves in communication with the makers, and asked them to send in a tender for 200 meters—being about the number required. Their tender was accepted by the Corporation; but it was considered advisable that, before getting a consignment of the entire number, a few samples should first be tried in actual working. These were accordingly sent to the Corporation, who had them fixed to the lamp-posts. The Company objected to them as not being proper meters within the meaning of the award. This led to correspondence between the Corporation and the Company, and interviews between their respective representatives; and it was not until Oct. 6, 1891, that the Company, as the Corporation alleged, withdrew their objections. This they did by a deputation, who met the Gas Committee of the Corporation; and, after discussion and explanation, expressed themselves satisfied with the meters as supplied. The Company did not at the interview agree to the meters. The Corporation further said that the changes necessary took some time; and they averred that the alterations were effected within a reasonable period, and that the meters were of a proper character. Some of them, they said, had to be removed; but it was solely for repairs consequent on injuries caused by want of care and by ill-usage during the operations of watering and testing. Some few of the meters, they admitted, might have failed to register correctly; but this must, they said, necessarily occur from time to time in any large meter system. The Corporation added that they were willing to submit to arbitration the matters in controversy between themselves and the Company; but the Corporation considered that the question proposed to be submitted was only part of the controversy which had been, and was still, taking place with reference to the consumption of gas. The Company, they said, had not complied with the arrangements made as to the gas-testing station and the apparatus in it. The Corporation complained that the Company had refused, and continued to refuse, access to a material and necessary part of the testing-place; that the supply of gas to the station was not adequate; that the testing-station was not properly heated and ventilated; and that the Company used an old pattern of photometer of an unreliable and condemned type, useless for the proper testing of the illuminating power of gas.

The MASTER of the ROLLS remarked that he did not think this had anything to do with the present case.

Mr KENNY, continuing, said the Corporation averred that no proper arbitration could be held with reference to the gas-testing station. They likewise averred that they had complied with the award, which required that the meters should be the manufacture of one of two firms, and that they were proper meters within the meaning of the

award. They further said that the action had been caused solely by the refusal of the Company to include a material and necessary part of the dispute; and that the action should be dismissed with costs. Counsel proceeded to deal at length with the facts of the case, and read the correspondence between the Corporation and the meter-makers, and between the Corporation and the Company. He stated that they would produce as witnesses Mr. Cotton, the Company's Secretary and Manager, Mr. William Sugg, of London, and Mr. Frank Wright, a gentleman who was named in the award as one of the firms to supply the meters, and who would confirm Mr. Sugg's evidence. They would also examine Mr. Livingstone, a gas expert, and the Surveyor to the Vestry of St. George's, Hanover Square, and another expert. In conclusion, he asked his Lordship to grant the injunction.

Friday, June 21.

To-day, evidence was given on behalf of the Company.

Mr. *W. F. Cotton*, J. P., detailed the negotiations that proceeded between the Corporation and the Company in the matter of the constant complaints made by the latter as to the defective meters supplied. He objected that the meters were wanting in capacity, and did not properly register the gas that passed through them. He believed that 90 per cent. of the meters, if now examined, would be found to be out of order.

Mr. *M. Doolin*, the Company's Lighting Inspector, testified to the accuracy of the returns made by him as to the condition of the meters.

Mr. *J. Cotton*, the Assistant Secretary of the Company, proved the accuracy of a return prepared by him, giving the results of the examination of the new meters since they were introduced by the Corporation, from the official returns and from correspondence which had passed between them and the manufacturers. From this return, he estimated that 159 out of the 203 meters supplied were defective.

Mr. *G. Livingstone* stated that he was present on the previous Wednesday at an examination of ten of the meters in different streets in the city; and it was found that nine of them were defective. He considered the meters entirely unsuited for the average meter system.

Mr. *W. Sugg* considered that meters of the size and capacity of those in Dublin were utterly useless for the purposes of the average meter system.

Additional evidence for the plaintiffs was given on the following day, and their case then closed; the further proceedings being adjourned.

MARLBOROUGH STREET POLICE COURT—Friday, June 28.

(*Before Mr.* J. L. HANNAY.)

The Gaslight and Coke Company v. Dowling.—Unlawfully Laying a Gas-Pipe and Removing a Meter.

Two summonses which had been issued against Mr. J. L. Dowling, of 24, Tottenham Court Road, at the instance of The Gaslight and Coke Company, were heard to-day. In one, the defendant was charged with having, on or before April 24 last, laid, or caused to be laid, a pipe communicating with a pipe belonging to the Company, without their consent, and contrary to the Gas-Works Clauses Act, 1847; and in the other case, he was charged with having removed a meter by which the Company's gas was registered, without giving them notice, contrary to the provisions of their Private Act of 1868, section 64. The summonses were taken together.

Mr. W. O. HODGES (instructed by Messrs. Bedford, Monier-Williams, and Robinson, of 6 and 7, Great Tower Street, E.C.) appeared for the plaintiffs; defendant conducted his own case.

Mr. HODGES, having explained the nature of the two summonses as stated above, said there was no charge of fraud against the plaintiff. Quoting the sections of the Acts governing the summonses, Counsel pointed out that a portion of section 18 of the Gas-Works Clauses Act, 1847, ran as follows: "Every person who shall lay, or cause to be laid, any pipe to communicate with any pipe belonging to the undertakers, without their consent, ... shall forfeit to the undertakers the sum of £5 for every such offence," &c. The case under this section was this: Mr. Dowling entered into a contract with the Company for a supply of gas; and the meter, in the first place, was put in the basement inside his house. On March 26 last, when the register of the meter was taken, the meter was in its original position; but, on April 24, one of the inspectors called to again take the index of the meter, and found it had been moved from the basement to the area outside, and that the Company's pipe from the main which ran to the inlet of the meter had been cut off, and a fresh one connected with the meter in the area. Then, in the second case, section 64 of the Company's Act of 1868 provided that, before any person connected or disconnected a meter by which the Company's gas was registered, should give not less than twenty-four hours' notice, in writing, to the Company; and any person failing to do this, was liable to a penalty not exceeding £5. Counsel proceeded to call his Worship's attention to a case which was decided on the first question in the Queen's Bench Division in 1885, to show that it was not necessary to prove fraud, though in part of the section the word "fraudulently" is used. It was sufficient to show that a pipe had been connected with the Company's pipe. The Court, in giving judgment, said: "Although there had been no waste or misuse of gas, or any fraud or injury, the appellants were liable as they had connected without the Company's consent." Therefore it would be sufficient for him to show that a connection had been made in this case without the consent of the Company; and that in the second case the meter had been moved.

Mr. *Vincent*, one of the Company's employees, gave evidence to the effect that, when he called at Mr. Dowling's in March, the meter was in the basement; but on April 24, it had been moved into the area. When the meter was in the basement there was only a short length of inlet-pipe; but after it had been shifted to the area, there was about 8 feet of inlet-pipe.

Witness was cross-examined by defendant to show that the area was covered in, and communicated with the basement.

Mr. *Gitson*, one of the Company's Inspectors, stated that, in consequence of a report by the last witness, he visited the defendant's premises, and saw the meter in the new position, which was exterior to the house wall. The defendant had given no notice to the Company with reference to the fresh connection. On April 26, he drew defendant's attention to the serious liberty his gas-fitter had taken in disconnecting the Company's service-pipe, and re-fixing the meter. He requested that the work should be altered, and asked who had executed it. He could not get any information from the defendant, or replies to the letters which he had written on the subject.

In cross-examination, witness said he was not aware that, on the 3rd of May, a letter was written to the Company by defendant, complaining of an escape of gas, and that a man was sent to look after the matter.

Defendant said a great deal turned upon this point. There was no doubt there was an escape of gas; and they could not ascertain where it was. A gas-fitter was sent for; and he said the meter was in a dangerous condition and should be moved. In the letter he (defendant) had received from the Company's inspector, the liability was fixed on the gas-fitter.

Mr. HANNAY: But you know you are the master.

Defendant (proceeding) said that, the escape continuing, on May 2 he wrote to the Gas Company; and on May 3, they sent a young man to look at the meter. He told him (defendant) that the meter was a very old one; and he would take the index and have the meter tested. In consequence of this escape, his account was 100 per cent. in excess of the usual amount. When the Company's man examined the meter, he said it leaked.

Mr. *Gitson* stated that the meter was only fixed in 1888; and there was no leakage from it until after it had been moved.

Defendant: The date on the meter is 1875.

Mr. HANNAY said there was no doubt there had been an infraction of the law in both cases; and each party appeared to have assumed rather a haughty manner. He should impose a penalty of £3 in each case, and on one summons he would allow £2 2s. costs, which would make in all, with the summonses, £8 6s.

Question as to the Payment of Water-Rates.

In the Lord Mayor's Court last Tuesday, an action brought by the East London Water Company against Mr. J. Childs, of Cleve House, Boleyn Road, Stoke Newington, to recover £32 4s. 2d., water-rates due from him for certain houses and stables in Pelham Street, was heard by the Recorder (Sir C. Hall, Q.C.). The only defence raised on the pleadings was that the Court had no jurisdiction; and Mr. Ruegg, the Counsel for the defendant, argued that, inasmuch as there was no contract that the rates should be paid in the City, the plaintiffs were bound to sue in the County Court of the district in which the houses were situate, and where the rates were payable. Mr. Lewis Glyn, who appeared with Mr. George Kebbell for the Company, argued that water companies were not bound to collect their rates, which were payable at the office, wherever it might be. He quoted the decision of Mr. Justice Charles in the case of *The Northern Stone Company v. Gibney* in support of this contention; and, proceeding, he said that if a consumer omitted to fulfil his obligations, the cause of action arose in the district in which the creditor's—in this instance the Water Company's—office was situate. In the present case, the Company's office was in the City, and therefore part of the cause of action arose within the City; and this gave the Court jurisdiction in cases under £50. The Recorder held that the defendant was bound to pay the rates at the Company's office; and said the fact of his not having done so, gave the Court jurisdiction. He therefore decided for the plaintiffs for the amount claimed.

Reduction of the Central Middlesex Water Company's Capital.

In the Chancery Division of the High Court of Justice last Saturday, a petition asking the Court to confirm resolutions which had been duly passed for reducing the capital of the Central Middlesex Water Company, Limited, came before Mr. Justice Stirling. Mr. Ingle Joyce said the Company was incorporated with a nominal capital of £32,000, divided into 3200 shares of £10 each. Only 1500 shares were issued; and these had been fully paid up. Not long ago, there was a legal transfer of part of the undertaking to the Colne Valley Water Company, in respect of which £10,250 was paid to the Central Middlesex Company. The capital being in excess of their requirements, it was proposed to distribute the sum of £7500 by paying back £5 per share on the 1500 shares. Resolutions authorizing the reduction had been duly passed. His Lordship sanctioned the reduction, and dispensed with the further use of the words "and reduced" after one week.

The Automatic Coal-Gas Retort Company, Limited, v. The Newcastle-under-Lyme Corporation.—We understand that this action, to which reference was made in the JOURNAL on April 9 last (p. 764), has been settled by the defendants withdrawing their opposition to the Company's patent rights, and paying the royalty in full.

The Public Lighting of the City of London.—At the meeting of the Commissioners of Sewers of the City of London last Tuesday, the Streets Committee presented a report relative to lighting, by means of electricity, the smaller streets in the City. They submitted a report from the electrical inspector thereupon, and recommended that the experiments therein suggested be made, the City of London Electric Lighting Company charging only the actual cost to them of the work, estimated at about £386. The Court approved of this suggestion, and instructed the Committee to carry it into execution. A letter was read from the Incandescent Gas-Light Company, offering to supply their lights, which, they stated, were being employed for similar purposes in Berlin, Paris, and other Continental cities, and had proved highly successful. Their system, compared with electric lighting, was, they added, about one-eighth of the cost. It was resolved to refer the application to the Streets Committee for consideration and report.

MISCELLANEOUS NEWS.

THE EXAMINATIONS IN GAS MANUFACTURE.

The Pass List.

The following are the names of the successful candidates in the last examinations in "Gas Manufacture" by the City and Guilds of London Institute:—

HONOURS GRADE.

First Class.—Cornish, J. H.; Lewis, G. P.; Milbourne, R. J.

Second Class.—Adderley, A. F.; Cuthbert, A. G.; Dickinson, E. G.; Dunn, M.; Guiver, J. N.; Hislop, L.; Kros, G.; Pettigrew, W. E.; Pye, J. H.; Richmond, C.; Riley, H. E.; Saville, A. E.; Shadbolt, F.; Strivens, C. J.; Watkins, J. T.; Weippert, E. D.; Wilde, W.; Wilson, A.; Winter, F. J.

ORDINARY GRADE.

First Class.—Barnett, W. A.; Brooks, A. E.; Golding, H. A.; Hallaway, J. P.; Mott, W. J.; Nield, W.; Tagg, S.; Tarratt, F. P.; Tiffen, J.; Tully, T. S.; Wicks, G.; Wise, F.

Second Class.—Archer, W. H.; Askew, S. G.; Bingley, J., Booth, R.; Brown, W. E.; Buckley, A. E.; Butterworth, J. T.; Copeman, E. J.; Glenny, G. W.; Jackson, T. J.; Jennings, G. L.; Mansfield, E. A.; M'Combie, H. J.; Marston, A.; Mitchell, H. V.; Napier, J. W.; Ovens, W. D.; Parsons, F.; Price, W. H.; Ralph, G.; Ross, G.; Slater, J. H.; Sutcliffe, P. S.; Sykes, F. C.; Thompson, A. M.; Wildman, J. R.

We learn from the Superintendent of Technological Examinations (Sir Philip Magnus) that the prizes have not yet been awarded.

The Question Papers.

The following were the questions put to the candidates by the Examiner (Mr. Alfred Colson, M.Inst.C.E.):—

ORDINARY GRADE.

1. Describe the process of carbonization, and give a sketch and description of a through clay retort. 2. What process immediately follows carbonization? How is it effected, and with what results? 3. What is the usual treatment of coal gas for the removal of ammonia? 4. Enumerate the chief impurities contained in crude gas, and state how their presence may be detected. 5. Describe a method of freeing gas from sulphuretted hydrogen. 6. What is the use of the exhauster? 7. How is the illuminating power of gas ascertained? 8. Of what service is the inferential jet photometer? 9. How would you test spent oxide for sulphur? 10. For what purposes are the station meter and governor employed in gas-works; and how is the latter regulated?

HONOURS GRADE.

1. Describe the principles of the chief methods of heating gas-retorts 2. Give an outline sketch (elevation) and description of a setting of eight retorts, with fittings. 3. What kinds of coal are most valuable for gas-making, and why? 4. Give a sketch (plan, elevation, and section) and description of a purifier fitted with three tiers of sieves. 5. In what way would you estimate the quantity of ammonia, sulphuretted hydrogen, and carbonic acid in coal gas? 6. Give a description, with outline sketch, of an untrussed two-lift gasholder and puddle tank, and explain the difference between the latter and a rendered tank. 7. Describe a process for manufacturing sulphate of ammonia from ammoniacal liquor, pointing out what precautions should be taken in order to prevent nuisance. 8. Describe some system of stoking machinery, and state what advantages it may have over hand labour. 9. Describe some method of enriching gas other than by means of cannel. 10. What is the difference between a flat-flame burner and an Argand? In what respects do these differ from an incandescent burner; and what advantages may be claimed for each?

LANCASTER CORPORATION GAS SUPPLY.

Reduction in Price—The Quality of the Gas.

At the Monthly Meeting of the Lancaster Town Council last Wednesday, the Gas Committee submitted a resolution recommending a reduction in the price of gas to consumers within the borough (other than to consumers having prepayment meters) to 2s. 6d. per 1000 cubic feet, subject to a discount of 10 per cent. upon payment within one month from delivery of the account, and also to 2s. 6d. for gas supplied for public lighting within the borough, subject to a discount of 20 per cent. upon payment of the account within one month of delivery. The minutes contained an extract from a report made by the Manager (Mr. C. Armitage) in 1893 with reference to the quality of the gas, and complaints as to the blackening of ceilings.

Mr. N. W. HELME, said he had pleasure in moving the confirmation of the minutes of the Gas Committee, especially as, after most careful consideration with the Manager, as to the position of the undertaking, and a comparison of the profits of last year with the estimate for the ensuing year, the Committee were able to recommend that which was half promised when the price of gas was advanced owing to the increased price of coal—viz., that they should, as soon as possible, reduce the price. They now recommended that the price should be reduced 3d. per 1000 cubic feet within the borough; and they proposed to give a further reduction to the Lighting Committee for the purpose of developing the lighting of the town. It would be within the recollection of the Council that the opinion was some time ago expressed that the Committee should address themselves to the production of a better quality of gas which would not blacken consumers' ceilings so much as that which had been supplied. In the minutes was an extract from the report presented by the Manager in 1893, with reference to the quality of the gas, and to that report he especially directed attention, because in view of these facts he wished to point out that the increased use of cannel would not give freedom from blackened ceilings. In largely increasing the amount of cannel used in gas manufacture, they would without doubt improve the illuminating power of the gas they supplied; but it would not have the other effect. It would cost about £1200 a year for extra cannel to increase the illuminating power; and in facing this question of the provision of an additional £1200 a year out of revenue for the purpose of giving a brighter light, the Committee felt the public would prefer to have gas of the quality at present supplied, if at the same time they could have a reduction of 3d. per 1000 feet. The gas at present sent out compared favourably in regard to illuminating power with that of seventeen other provincial towns from which returns had been obtained. There was only one place in the country where better gas was supplied, and that was Liverpool. At Lancaster they used 31·82 per cent. of cannel; and the average at the other places was only 14 per cent. In regard to the illuminating power, they stood at Lancaster at between 19 and 20 candles; while 17·45 candles was the average of the other towns he had taken. The question might be asked whether it was desirable, in the interests of the department, that the reduction in price should be made. Last year they had a net balance to credit of £4550 on the basis of a charge of 2s. 9d. per 1000 cubic feet. This year they required £1100 extra to be put aside for the new sinking fund; which would allow them to provide, during the next 44 years (that being the equated period decided upon) the sum necessary to cancel the increased charge upon the undertaking, owing to the financial operations in getting rid of the irredeemable debt and converting it into a redeemable one. If the Council sanctioned this reduction, it would cost £1855. They would have to make full provision for the legitimate maintenance of the works and mains; and they had taken out the average cost in that matter. Since 1880, the average cost of maintenance had been £888. But last year they spent £922; and in addition, for maintenance of mains, £347 was expended, whereas the average amount for the latter since 1880 was £230. Therefore on both those heads they had put aside last year £200 more than the average of previous years. Then last year they paid out of revenue £697 for the laying of new mains—a charge that might strictly have been put to capital account. If the Corporation would put aside such a sum as would fairly allow of the fabric of the gas undertaking being maintained up to the standard required, in view of further possibilities in the shape of extensions, he thought they would be justified in making the reduction, having regard to the desirability of giving the public gas at the lowest possible cost, consistent with the financial obligations of the Corporation. At any rate, the figures he had quoted should leave them £1000 a year which could be devoted to the relief of the rates, and a further balance, which the Committee would strive to increase, of £500, which the Council could deal with as they thought fit. If they desired to hand over £1000 to the relief of the rates, he thought there would be another £500 by which, if they were desirous of doing so, the work of the sinking fund could be accelerated, so as to pay off the capital liabilities in a shorter period than 44 years.

Mr. BOWNESS seconded the motion.

Alderman GILCHRIST said he was disposed to allow the reduction of the price on the distinct undertaking that, if the Gas Committee failed to convey to the borough fund the sum of £1500, after paying all costs of maintenance and liabilities, the price must at once be raised again to 2s. 9d. It was a question for the Council to consider whether they would endeavour to accelerate the reduction of the debt, or they would undertake the grave responsibility of repaying it upon the scale propounded. This was the first time the Gas Department had yielded such a net profit to be disposed of in the way contemplated. During the last fifteen years, the profits had amounted to £29,000; and the Corporation had never derived anything from them except a sum of £636 and another of £500. They were now entering upon a calculation which had never been verified in the past; and this was a venturesome thing to do. They had increased the debt of the undertaking by the addition of something like £30,000; and it seemed to him that the wisest course for them to pursue would be to endeavour to break the back of that debt, and get it under £100,000. He had been pleased, and he thought the Council had reason to be gratified, with the activity displayed recently in trying, if possible, to put the undertaking on a better footing than it had been for years past; but he thought this reduction might have been with safety deferred until they saw the product of next year or the year after.

Mr. HELME said the policy had been carried out for several years of assigning the profits to what had practically amounted to a development of the capital value of the undertaking. They had paid for £23,000 of capital expenditure out of revenue during the time the concern had been in the hands of the Corporation. Originally the old Gas Company spent £37,000 on capital account; the Corporation had since expended £26,473—making a total of £63,473. The Company received a premium of £50,000 for the sale of the undertaking; and the Corporation had had to pay £22,743 for the conversion of the irredeemable stock and mortgages, so that they had a gross liability of £136,216. On the other hand, they had £23,000 of increased value on the undertaking, paid out of profits; and the result was that the works and plant were in first-class order, and capable of producing and distributing 150 million cubic feet of gas per annum.

The minutes having been agreed to,

Mr. HELME announced that the reduction would take effect at the end of next quarter.

PLYMOUTH GAS COMPANY.

The Annual Meeting of the Plymouth and Stonehouse Gas Company was held last Thursday—Mr. G. HENDERSON, in the chair

The report for the year ended March 31 last stated that, after payment of the authorized dividend in January, there remained to the credit of the profit and loss account £23,908, from which the Directors recommended the payment of a dividend for the half year ending March 31 last of 6¾ per cent. on the ordinary stock, 9s. 6d per share on the additional shares, and 9s. 3d per share on the new shares, free of income-tax. This would absorb £6331, and leave £17,577 to be

carried to the credit of the next account. The Directors reported that the Bill promoted by them in the last session of Parliament for enlarging the powers of the Company received the Royal Assent on Aug. 25, and that the £50,000 of 3 per cent. debenture stock authorized by the shareholders in February last had been subscribed. In order to meet the increasing demand for gas throughout the district, it was, the Directors said, necessary to erect an additional gasholder, and they had accordingly entered into a contract for one capable of holding 2 million cubic feet, which would be available for the coming winter. The balance-sheet showed that the total amount of the stock and share capital authorized was £235,000; and of debenture stock, £70,000. The stock and share capital paid up was £125,000; the premiums received amounted to £30,000; and the debenture stock, to £50,000—a total of £205,000. The expenditure on capital account to March 31, 1894, was £144,786. Since that date, the additional expenditure had been £42,423, of which £42,013 was on account of new buildings and manufacturing and storage works, £207 on new mains and services, and £203 on meters. The balance on capital account was thus £17,709. From the revenue account, it appeared that the receipts were: From the sale of gas, £60,001 (of which £54,844 was from private consumers, and £5157 for public lighting); from meter-rents, £3478; residuals, £21,698; transfer fees, £9; interest, £249—total, £85,436. The total expenditure was: Manufacture, £59,823 (including coal, £43,204); purifying materials, &c., £1642; salaries, £1165; wages, £9938; repairs and renewals of works of plant, £3863; distribution, £3945; publ c lamps, lighting and repairs, £1112; rents, rates, and taxes, £1984; management, £3192; law and parliamentary charges, £1791; other small items, £563—total, £72,412, and leaving a balance of £13,024 to carry to profit and loss account. The coal account showed that 68,000 tons of coal and 1510 tons of cannel were carbonized during the year. The production of coke was calculated at 44,973 tons, of which 11,715 tons were estimated to have been used on the works. The sales of residuals were: Coke, 32,258 tons; breeze, 2173 tons; tar, 692,870 gallons; and sulphate, 541 tons.

The Chairman, in moving the adoption of the report and balance-sheet, congratulated the shareholders on the continued increase in the consumption of gas. During the past year, the quantity registered was, he said, 666 million feet—an increase on the previous year of 38 million feet. As the shareholders knew, difficulties had been experienced in starting the new retort-house. Most of the men in the employ of the Company were Union men; and they did not take kindly to the introduction of machinery for charging and drawing the retorts—in fact, they did everything to prevent it being a success. The dampers were constantly tampered with, so that the heats might be diminished, and the Company prevented from making the usual quantity of gas per ton of coal; and, of course, that mischief must have been done by somebody who knew what he was about. On one occasion, an attempt was made to wreck one of the large gasholders; and this, if it had been successful, would have meant the loss of some thousands of pounds to the Company. An attempt was also made to interfere with one of the governors; but fortunately that mischief was discovered in time to save part of the town from sudden darkness. Referring to the subscription of £50,000 of 3 per cent. debenture stock, the Chairman said it was a proof of the confidence the public had in the security of the Company. The Directors applied for some of that stock; but, as the total applications exceeded the amount to be issued, they failed to get what they wanted. The erection of a gasholder, 120 feet high, was being carried out; and in this way the Directors were anticipating the requirements of the district. During some months last winter, they had great difficulty in meeting the increased demand for gas, in consequence of the lack of sufficient storage. This involved an additional cost to the Company. During some weeks, the increase in the demand amounted to 2,000,000 cubic feet over the corresponding periods of last year. In future, however, the Company would be able to meet any increased demands. Adverting to the balance-sheet, the Chairman said the income from the sale of gas had amounted to £60,001, showing an increase of £3335 over last year's receipts. There had also been a slight increase in the meter-rental. The residual products compared very favourably with previous years—£21,698 having been received, as against £20,831 in 1893-4. The interest was slightly less than last year, on account of the Company's inability to secure the usual discount off the coal contracts. The total receipts had been £85,436, against £81,642—an increase of £3794. With reference to the debit items, coal had cost more; the increase being £3514. Salaries of officers and labourers had only been £9983, against £10,625—a decrease of £642, notwithstanding the large increase in the quantity of gas produced. This was due to the machinery introduced, which, it should be added, had not yet been fully utilized. There had been an increase in rates and taxes. As to the future, it was hoped that, during the coming year, better terms would be secured for the supply of coal; and if only a difference of 6d. a ton was obtained, it would mean £1500 or £1600 to the benefit of the Company. The new retorts and gasholder would also effect considerable savings, and would fully justify the expenditure.

The resolution was carried.

The retiring Directors and Auditors having been elected, thanks were accorded to the Directors and officials for their services.

ELECTRIC LIGHTING NOTES.

Financial difficulties are again troubling the St. Pancras Vestry. The Electric Light Department require another £75,000, in order to settle bills due on account of the construction of the King's Road central station and dust destructor. A few weeks since, a Special Committee was appointed to consider and report upon the question of issuing 3 per cent. bonds, guaranteed by the rates, for all future loans. The report was adverse to the proposal; and Dr. Bell, the Chairman of the Finance Committee, last Wednesday moved that the money be borrowed from the London County Council in the usual way, as the cost of negotiating the public issue would be too large. He said Counsel had advised: (1) That the Vestry would not be able to issue bonds at a discount; (2) that there was no hope of their price being advanced; and (3) that the amount required was too small. The last reason will afford food for reflection for the St. Pancras ratepayers. Mr. Barnes dissented. Why, he asked, should not all the debts of the Vestry be paid off by means of the proposed bonds? They would be as safe to the investor as Consols or the Bank of England. He moved, as an amendment, that the question be deferred, and the probable cost of negotiating such a public loan as suggested be presented at the next meeting of the Vestry. In spite of Dr. Bell's protest that the money was required immediately, the amendment was carried. The appointment of a Chief Electrical Engineer was next proceeded with. Out of 56 applications, three candidates had been selected—Mr. Sydney W. Baynes, Mr. Henry R. J. Burstall, and Mr. B. Deakin. Mr. Sweet, the Chairman of the Electric Lighting Committee, announced that at their meeting the first-named gentleman obtained 17 votes, and the other two 13 each. Mr. Doll asked why their present Engineer was not among the selected three candidates. As it was, he would have to teach the new man his duties. No answer was vouchsafed to this question. Mr. Dixon asked whether Mr. Sweet had been in communication with Mr. Baynes prior to the advertisement being issued. Mr. Sweet was understood to say that he certainly had been introduced to him. The questions submitted to the candidates had not been suggested by one of themselves. The candidates then attended the Vestry, and questions were put to them by the members. Several of them were, however, ruled out of order, including one by Mr. Dixon as to who introduced Mr. Baynes to Mr. Sweet. Mr. Baynes, who is now with the Corporation of Bradford, was ultimately appointed, at a salary of £600 a year.

In view of the near approach of the completion of their works for the supply of electricity, a little handbook has been issued by the Walsall Corporation, giving a description of the system, and the uses to which electricity may be applied. The high-tension continuous current system, with transformers, has been adopted. The station is situated on the site of the old gas-works in Wolverhampton Street. Three large Parker dynamos, coupled direct to Chandler engines, supply a continuous high-tension current at 2000 volts, which is carried to three sub-stations in the town, where it is transformed down to 105 volts. Two sets of batteries at one of the sub-stations will furnish current during the hours when the load is light. The cost of supply will be 6d. per Board of Trade unit, which, it is stated, will work out, under ordinary domestic conditions, to half as much again as gas at 2s. 6d. per 1000 cubic feet, when giving an equivalent amount of light.

A large extension of the electricity distribution system is about to be undertaken at Portsmouth; and the present installation of 100 arc lamps in the streets is to be increased by 250 lamps. This is an easy way of improving the finances of the department; and possibly the ratepayers, who will have to bear the additional burden, may have something to say on the matter when they learn the extra cost in comparison with the existing system of gas lighting.

The orders which the Electric Lighting Committee of the Halifax Corporation have in hand for current have compelled them to contract for a 300-unit dynamo, to be coupled direct to a 600-horse power vertical engine. The new plant will more than double the present motive power—500 horse.

The York City Council last Tuesday considered a report of the Electric Lighting Committee, recommending the acceptance of the tender of the Electric Construction Company, of Wolverhampton, to supply the necessary plant and fittings for an installation for the sum of £10,865, and an application to the Local Government Board for sanction to borrow £15,000 for the purpose. The scheme proposed is known as the Oxford system. There were three other tenders, as follows: Siemens Bros. and Co., £10,345; Brush Electrical Engineering Company, £8360; Messrs. C. A. Parsons and Co., £10,266. It was resolved to refer the matter back to the Committee, with instructions to ascertain from the four Companies on what terms they will supply the city with electricity, and work the plant for a number of years.

An appeal to the Assessment Committee as to the rating of the electric lighting works at Bristol revealed some interesting figures. The assessment returned stood at £3000 gross, and £1850 rateable value. The Committee were asked by the Corporation representative (Mr. Wise) to reduce the estimate to £1745 gross and £1428 net. The account on which his figures were based showed that the number of private lamps fixed on Dec. 31 was 15,000; and an increase of about 2300 was estimated for the present year. The average revenue per lamp was 6s. 11½d., which would yield £6062. Deducting discounts, the net revenue of the private lamps would be £5880. The quantity of electricity supplied to the street lamps (90) came to 150,417 units, which equalled, at 6d. per unit, £3760; and the discount left the net revenue from the street lamps at £3008, and the gross from all sources at £8888. The cost of production totalled to £5808; and subtracting this from the gross gave £3008 as the net income. The tenants' share of revenue and landlords' deductions, further reduced the total to £2061, from which had to come rates and taxes at 6s. 8d. in the pound, amounting to £516, which brought down the net annual value of the whole undertaking to £1545. Inasmuch as the works were situated in two poor-law unions, with a gross of £676 outside this authority, Mr. Wise asked the Committee to reduce the assessment to £1428. Inquiries had been made in various quarters to ascertain the amount at which electric light stations were assessed; and in no case except Manchester did it approach to anything like the sum which was put down on the Bristol undertaking. In Manchester, where the works were assessed at £2500, there was a supply of 439,000 units, as against 293,000 units in Bristol. The entire cost, including meters, was £82,000; and at present the undertaking was not paying. For the year 1894, the rate-in-aid was £7000, which included the public lamps, from which no revenue was derived. The Committee, after hearing the other side, concluded to leave the parties to arrange the gross value, and to fix the rateable value at £1500.

New Reservoirs for Leeds.—The Leeds Corporation Water Committee have resolved to recommend the Council to purchase between 9 and 10 acres of land, which has been offered to them by Lord Cowper's agent for £3600, and which is required for one of two new service reservoirs it is proposed to construct.

THE LONDON COUNTY COUNCIL AND THE WATER COMPANIES.

The New Arbitration Clause.

A Special Meeting of the London County Council was held on Monday last week—Mr. ARNOLD in the chair—for the purpose of considering the report of the Parliamentary Committee with reference to the new arbitration clause proposed to be inserted in the Water Transfer Bills, to carry out the views expressed by the Hybrid Committee of the House of Commons to whom two of those Bills have been referred. An abstract of the report and the text of the clause were given in the JOURNAL last week (p. 1388); and they came before the Council accompanied by a recommendation that the draft clause be tendered to the Committee in substitution for the provisions relating to the terms of transfer which stand in the Bills.

Mr. T. M'KINNON WOOD, the Chairman of the Parliamentary Committee, in moving the reception of the report, said he did so with an unusually grave sense of responsibility. This proposal for the purchase of the water undertakings was opposed by some members of the Council in the interest, as they alleged, of the ratepayers. These gentlemen seemed to regard the ratepayer as a being possessed of a pocket, but having no interest beyond it. He himself preferred to regard him as an ordinary human being, with many other interests not less vital. His anxiety was that the ratepayer should pay no more for the undertakings than they were justly worth, all things considered; while at the same time he did not desire that he should pay less. As to the clause now before the Council, the objections to it came from those very people who had all along opposed the transfer. They did not like the clause before; and now that it was altered, they, in effect, said it must be dropped because the conditions to which they formerly objected were now removed. There were two courses before the Council—either to proceed with the Water Bills or drop them—and he held that counsels of delay only came from those who wished to have the whole matter shelved.

Mr. C. A. WHITMORE, M.P., moved the following amendment: "That, as the conditions under which the purchase of the Water Companies would be carried out under the proposed new clause are essentially different from those which have been sanctioned by the Council in clause 6 of the Lambeth Water (Transfer) Bill, the Finance Committee be directed to report upon the probable financial effect upon the rates of London of a purchase of the Companies under these altered conditions; and that the Water Transfer Bills be not further proceeded with until this report has been presented to the Council." He said it was perfectly true that he was opposed to the policy of purchasing the water undertakings; but he ventured to urge the wisdom of the amendment upon those who were in favour of the purchase, and who yet wished to exercise reasonable precaution in the conduct of the transaction. He contended that the past policy of the predominant majority on the Council had been opposed to the idea of the compulsory purchase of the water undertakings; and he quoted extracts from previous reports bearing out this view. The only way in which he could account for the change of opinion was that they had persuaded themselves that they could invent a scheme of arbitration whereby they could buy the water undertakings at a much less sum than that which had been anticipated. This was to be done by making the arbitration not an unlimited and unrestricted or fair one. His amendment asserted that there had been a change in the arbitration clause. The clause, as now proposed, he believed to be a fair one, and one which they all ought to be willing to support; but it was vain to suppose that the alteration which had been made was not an essential alteration. By this clause, the Arbitrator would be able to pronounce upon the matter according to his unfettered discretion; and, he contended, they ought to have some sort of information from the financial authorities of the Council as to what would be the results of this transaction. It must not be understood that the Moderates were not as ready to have a good and pure water supply as the Progressives; and they hoped, with the change in the Government and the assistance of a practical Parliament, to be able to obtain all that was necessary in the control of the Water Companies, in the interests of London, without the purchase of their undertakings.

Sir GODFREY LUSHINGTON seconded the amendment, and asserted that it was impossible to frame a clause which should give effect to the ruling of the Chairman of the Hybrid Committee and at the same time carry out the wishes of the Council.

Mr. C. HARRISON argued that the clause now proposed effectively carried out the whole of the provisions that were in the Bill as originally submitted, and that it would be impossible, in any arbitration conducted under this clause, for the Arbitrators not to have regard to all considerations which the Council might submit. Further than this, it gave him jurisdiction as to matters which he would otherwise have no power to consider; and, lastly, having that jurisdiction, he was in a position to deal with those matters as fully and effectively as could be done by Act of Parliament.

Mr. R. M. BEACHCROFT said there were three points with which the Council had to deal—first, whether the clause carried out the intention of the Committee of the House of Commons; secondly, whether it was or was not a serious departure from the original clause (in other words, whether it did or did not mean the sacrifice of a vital paragraph); and, thirdly, if that should be the case, whether it was not the duty of the Council to withdraw the Bills. Either the clause was or it was not a serious departure from the original one. If it was, then Mr. Whitmore's amendment ought to be carried; if it was not, then it was clause 6 in another form. He did not wish to use hard words; but he considered that the clause was framed in such a way as to mislead the Council as to its real meaning.

The DEPUTY-CHAIRMAN (Mr. W. H. Dickinson) contended that the amendment only took rank with the other amendments moved on previous occasions, which had for their object the postponement of the purchase. The object of the supporters of the Bills was to buy the undertakings at a fair price; but it should be a price fair to the purchasers as well as to the sellers. He repudiated the remark of Mr. Beachcroft, that the clause was framed with a view to misleading the members of the Council.

Sir JOHN LUBBOCK said he had not opposed the Bills in the interests of the Water Companies, but because he believed they would add some 4d. in the pound to the rates. He had been asked: Why should the Council not manage the water supply of London as well as the Town Councils of Manchester or Birmingham, Leeds or Newcastle? In the first place, because the problem was more complicated; and, in the second place, because the London County Council was much less numerous in proportion to their duties. If their numbers were in the same proportion to the population as those of the County Councils of the other great cities, they would have nearly 1000 members on the London Council; and then they would have time to undertake these extra duties. Hitherto the Progressive party had objected to improvements which were not in their judgment absolutely necessary, because they considered the cost would fall on the present ratepayers, and the landlords would gain the advantage. But here was a gigantic purchase, to which the same argument applied; and yet they were keen to undertake the responsibility. It was sometimes said that, by bringing the water supply under one control, a saving might be effected. But the Bills would have no such result. They would place the control of the water in the hands of local authorities; and, in the place of the eight Water Companies, they would have some twenty authorities. He submitted that, as the Companies were already paying their maximum dividends in most cases, and very near it in the others, with one single exception, it followed that all the Council could buy was the chance of a loss. In fact, they could not be any better off by purchase; and they ran a great risk. Therefore he was for control, and not for purchase. Surely one function of the Finance Committee was to supervise the finances; and it was most unwise and unbusinesslike to engage in this enormous purchase without any report from the Finance Committee as to its probable effect. He supported the amendment, because he was satisfied that the policy adopted by the Parliamentary Committee, by a small majority only, would land them in loss, and still further augment the ever-increasing rates of the Metropolis.

Mr. J. STUART, M.P., contended that all the circumstances of the cost were before him. If they paid £30,000,000 for the water undertakings, this meant £900,000 a year for 100 years. The income of the Companies at the present time was £1,150,000. Therefore it was perfectly possible for other figures to be worked out in a similar way. As to the Council being inadequate to overtake the work they had to do, he reminded the members that the work done by the Councils in provincial towns included that done by the Vestries and District Boards in London; and in the Metropolis there were upwards of 4000 persons engaged in it. He advocated the adoption of the clause as being within the four walls of what had been decided by the Committee of the House of Commons.

Dr. LONGSTAFF complained of the absence of information as to the probable cost of the scheme.

Mr. B. L. COHEN, M.P., declared himself in favour of the transfer of the water undertakings, if it could be equitably done; but he was opposed to the measure now before the Council, because he did not know what cost to the ratepayers would be involved.

Mr. M'KINNON WOOD having briefly replied,

The Council divided, with the following result: For the amendment, 52; against, 63—majority against, 11. On a further division, the recommendation of the Committee was approved by 64 votes to 36.

The Council then adjourned.

BELFAST CITY AND DISTRICT WATER BOARD.

The New Mourne Works.

On the invitation of the Chairman of the Belfast Water Board (Mr. R. J. M'Connell), a party of above 100 gentlemen visited, yesterday week, the Mourne district, from whence the new supply of water is to be obtained for the city and district. In connection with this visit, some information concerning the scheme has been published. The catchment area from which the first instalment of the water will be collected is upwards of 9000 acres in extent; but this can be greatly added to in the future. It has an elevation varying from 450 feet to nearly 2800 feet above sea-level; and the character of the catchment area is of the very finest description for a domestic water supply, consisting of high and precipitous mountain slopes, largely composed of fine granite and boulders on the surface. It is also free from cultivation and pollution of any kind, is uninhabited, and lies in close proximity to the sea. The Commissioners will purchase the whole of the lands within this catchment area, in order to preserve its present character, and prevent possibility of pollution in future. The water is collected at present by the Kilkeel and Annalong Rivers, which fall into the sea between Kilkeel and the favourite summer resort, Newcastle. The Kilkeel River will be intercepted in what is known as the "Silent Valley," by means of a large storage reservoir, having an earthen embankment some 520 yards in length across the valley, and will be upwards of 90 feet high over the present river bed. The top water area will be nearly 250 acres; and the total capacity will be 2850 million gallons. The total supply available from the whole of the Mourne district will be, when fully developed, about 30 million gallons per day. The reservoir will be formed in the usual way by an earthen embankment, with a puddle trench and a wall of the same material in the centre for its entire length. It will be faced with a thick lining of granite rubble on the water slope, and will have the necessary storm channels, weirs, water-tower, and outlet works. The supply will be drawn from the reservoir for use in Belfast through a number of large geared valves at different levels on the outlet stand-pipe, which will allow the water to pass in large or small quantities through the main outlet tunnel into the main gravitating conduit, which will be formed of concrete, having a maximum carrying capacity of 30 million gallons per day; the size being 5 ft. 6 in. by 5 ft. 6 in., with a regular fall of 18 inches per mile. The main conduit will be continued in "cut-and-cover work" along the mountain slopes to near Newcastle, where it will be carried through the slopes of Slieves Donard and St. Thomas

Mountains in a tunnel some 2¼ miles in length, which will be principally in the solid granite and silurian rocks. It will have a regular fall of 12 inches per mile, and a maximum capacity of 30 million gallons per day. Some parts of the tunnel will be at a depth of upwards of 600 feet below the surface of the ground, and can only be worked from either end and two centre shafts. The service reservoir will be made large enough to meet the demands of the city, having a storage capacity of about 80 million gallons, or eight days' supply. The service reservoir will be constructed at an elevation of 350 feet above sea-level, and will ensure a high-pressure supply to the most elevated districts within the Commissioners' area. The Commissioners have decided not to bring in the full supply available from the Mourne district at present, but will limit the first section to what will meet the increasing demands of the city for a number of years to come. The borrowing powers under the Act authorizing the works is, in round figures, £800,000.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Glasgow Corporation Gas Department have closed a year of great success. There was an output of gas of over 4000 million cubic feet—an increase over the preceding year of 260 million feet, or more than 7 per cent. This is the greatest quantity of gas the Corporation have produced in any one year. It is doubtless due chiefly to the extreme cold of last winter, which led to a very large consumption of gas for heating purposes. In that view, there is to be seen the advantage of the Corporation policy of producing a gas which they can sell at a moderate price, the success of which is being vindicated year by year. Other corporations—all the large gas-works in Scotland are now in the hands of corporations—may be expected to take note of what has been done in Glasgow, and in time to go and do likewise. Besides gas for heating, there must have also been a greatly increased consumption for lighting. It is announced that there was a very considerable portion of the increase in the central area of the city, where electric light is supplied. This points to the view that the one light leads to the other being in greater demand; and gives another proof that gas and electricity are not so much rivals as partners. There has been an increase in the demand for electricity, but not nearly in the same proportion as for gas, which thus more than holds its ground.

The Corporation have confidence in the gas undertaking; for whereas a year ago it was reported that they had carbonized 468,000 tons of coal, they have just completed contracts for the current year for 500,000 tons. Last year they did not contract for the whole twelve months. By this time of the year, the strike of the miners had begun to disturb the market; and the Gas Committee, correctly estimating what the outcome of the struggle would be, only contracted for a few months' supply, and twice afterwards during the year they were in the market. This year there is, at present, perfect tranquillity in the coal trade; and the Committee have therefore felt themselves in a position to secure a whole year's supply. In doing this, they have been able to get their supplies, taken all over, at a reduction of about 6d. per ton upon last year's rates. As compared with the prices paid two years ago, there is an advance of from 3d. to 6d. per ton for splint; and cannel is about the same as then. The price agreed upon for splint is from 6s. 2d. to 6s. 6d. per ton; offers at 6s. 8d. having been declined. Second-class cannel has been secured at from 10s. to 11s. per ton; and third-class, at from 8s. 8d. to 9s. There would seem to be some reason to expect a rise in the price of coal during the year. Of course, that is almost self-evident, prices being abnormally low; but it also has force given to it by the fact that the Corporation have thought fit to contract for the whole year, as well as by the circumstance that one former large contractor this year declined to offer at the prices going.

The Edinburgh and Leith Gas Commissioners, at their monthly meeting on Monday, resolved to purchase the undertaking of the Corstorphine Gas Company, at the price of £1850. Bailie Kinloch Anderson said that the Company valued their undertaking at £2310; but they knocked off £460. The Commissioners would not manufacture gas in Corstorphine, because they had no statutory powers to do so; and they would require to lay a 6-inch main from the end of their own mains to join the 4-inch main of the Corstorphine Company. This would cost a considerable sum; and they calculated that the interest on the purchase-money and on this outlay would be £61 10s. At present, the price of gas in Corstorphine was 5s. 10d. per 1000 cubic feet. They proposed to reduce it to 4s.; and they expected a revenue of £400 a year. The only condition in the agreement was that the Company should obtain the consent of residents in the neighbourhood to the use by the Commissioners of one of the gasholders of the Company. The acquisition of the undertaking by the Commission would be a great benefit to the residents in Corstorphine, because they would get Edinburgh gas at 1s. 10d. per 1000 cubic feet less, and the present charge of 2s. 6d. a year for meters would be abolished.

Bailie Kinloch Anderson explained the accounts of the Commission for the past year, which were given in last week's JOURNAL; dwelling particularly on the improvement there had been in the gas-stove account. Regarding the matter of the chimney at the Edinburgh works, the Clerk read a petition which had been presented to the Dean of Guild Court by the Procurator Fiscal, requesting the Commissioners to attend the Court on Thursday; and asking the Court to interdict the Commissioners from proceeding with the erection of a chimney at the Edinburgh Gas-Works without a warrant, to order them to take a temporary chimney which they have already erected, and to find them liable in a penalty not exceeding £25. It was explained, in answers which are to be submitted to the Court, that the Commissioners acted in the interests of public safety in what they did. Bailie Anderson said they could do nothing in the way of examining the large chimney until they got a temporary one erected, and every hour was precious; but the action of the Dean of Guild Court would entail several weeks' delay. Two members of the Commission—the Clerk, and Mr. Mitchell, the Engineer—were appointed to attend the Court, and defend the action of the Commissioners.

In the Second Division of the Court of Session on Thursday, their Lordships gave judgment in the action by the Magistrates of Glasgow against Messrs. Ireland and Son, coal importers, of Dundee, in which £240 3s. 5d. was sued for as the price of a cargo of coke. At the request of the defenders, the pursuers sent a box of coke to a firm in Hamburg; and afterwards the order was given to ship 900 tons of coke at Grangemouth for the Hamburg purchaser. The coke was rejected at Hamburg as not conforming to sample. Lord Kyllachy decided that the sample box never having entered into the contract, the sale was not by sample; and he gave decree for the amount sued for. Their Lordships of the Second Division have reversed that finding. Lord Trayner, who gave the opinion of their Lordships of the Second Division, said that the order for 900 tons was given as the result of the sample which was sent. He was of opinion, therefore, that the sale was by sample; and he was of opinion that the pursuers understood it to be so, because their position throughout was that the cargo did conform to sample—a position they did not need to maintain if the contract was what they contended it was. The defenders never saw the sample, and were not intended to see it; they could not therefore have compared the cargo with a sample they had never seen. It was at the port of destination only that it could be ascertained whether the cargo did or did not conform to sample. The case was continued, on account of litigation in the German Courts between Messrs. Ireland and Son and their Hamburg purchaser.

The Dunfermline Gaslight Company are to be congratulated on the success which has attended the removal of their gas-works to a new site; everything has been found to work with the greatest satisfaction. The output of gas rose from 59,634,000 to 62,429,000 cubic feet; and as the unaccounted-for gas was reduced from 17·52 to 11·18 per cent., there was 6,000,000 cubic feet more gas sold during the year. There has been improvement in everything. The greater quantity of gas was produced from 124 tons of coal less; the yield of gas having been 580 cubic feet per ton more. The revenue from gas increased from £8604 to £9710; from tar and liquor, from £651 to £947; and from coke, from £480 to £510. The yield of tar and liquor rose from 55·26 to 67·16 gallons per ton of coal carbonized. The gross profit was £3829, as compared with £3414 in the preceding year. The shareholders met on Wednesday, and adopted the report of the Directors, which recommended the payment of the customary dividend of 6 per cent. It was reported to the meeting that the Company's Manager (Mr. Hubert Pooley) was selected, in April last, to appear before the Wallasey District Urban Council, in connection with the appointment of Engineer and Manager for their gas and water undertakings; but the Directors of the Dunfermline Company, in order to retain his services, at once offered Mr. Pooley the equivalent salary to what would be paid at Wallasey, at the same time minuting their appreciation of his management. Mr. Pooley accepted the terms, and entered into a yearly engagement. The Directors did well to be generous towards Mr. Pooley, who has, ever since his arrival in Dunfermline, been engaged upon the transfer of the works, and in addition has been able to produce such good results. The Company is excellently financed, as well as managed, as is shown by the state of the capital account, and by the fact that, after the heavy outlays they have had during the past two years, they are able to place £900 to a reserve fund.

Mr. Storey, who took the leading part in the gas transfer at Falkirk, has intimated his resignation of his seat in the Falkirk Town Council, and, necessarily, upon the Gas Commission. The principal reason he gives is the state of his health. He is anxious to have rest after the worries of the past two years; but he adds that "in the public interest, also, it is perhaps as well that one who, in the discharge of his duty, incurred so much opposition, and perhaps ill-will, should now step aside, so that personal feelings may the more readily subside, and all may unite in working the gas business in the interests of the community." I fear the latter may be really the chief reason; for there is a disposition to lay the blame upon Mr. Storey of some of the disappointing features of the gas transfer. That is not as it should be, because, although Mr. Storey initiated the various steps which were taken, the whole Council must bear the responsibility of adopting them. It is almost a pity that the Gas Commission should be deprived of the services of the one who has bestowed most attention to the subject, almost as soon as they had started on their career. But everyone will echo Mr. Storey's wish that personal feelings may subside; for, where personal feelings rule, there can be no good management of a gas undertaking.

The Cambuslang Gas Company—thanks to the energy of the Manager, Mr. J. Donaldson—have just closed the best year they have ever had, and that, too, notwithstanding large losses in consequence of the miners' strike of last year. The Directors have strengthened the reserve and depreciation funds, and have given Mr. Donaldson an increase to his salary—the third within five years. They have also reduced the price of gas from 3s. 11½d. to 3s. 6½d. per 1000 feet; that used for cooking and heating remaining at 2s. 11d. The reduction in price is equal to 3 per cent. on the capital. Though situated in a mining district, the Company are fortunate in the matter of thefr unaccounted-for gas, which only amounts to 7·27 per cent.

Dundee Corporation Gas Stock has changed hands of late at the rate of £350 per £10 annuity, *ex* the half-year's interest, which is an advance upon previous business of £15.

A meeting of the Arbroath Gas Corporation was held last night, to consider the subject of working up the residual products within the gas-works. The Special Sub-Committee in charge of the subject—who, it will be remembered, recently visited Inverness to see the chemical plant in use at the gas-works there—gave in their report. It was to the effect that they found the plant being worked efficiently in very small space; and as regarded complaints of nuisance by adjoining residents, it was found that there was more smell from the changing of the purifiers than was given off by the chemical plant. They stated that spent liquor was run into the town's drains, which discharge into the River Ness; and there never had been any complaint either of polluting the water or destroying fish. The Sub-Committee recommended the Corporation to erect plant. They estimated that £400 would be ample to meet the cost; and taking the average prices they have received for residuals during the past three years, they calculated that the clear profit on the working would be £863 per annum, which would be £213 more than the average price they

have received from contractors. On the prices obtained during the year just closed, the clear profit would be £968, which would be £320 more than was received from the contractor. The Corporation unanimously approved of the report and recommendations; and the Works Committee were directed to carry the resolution into effect.

The Jedburgh Gas Company have paid a dividend at the rate of 6¼ per cent., and have reduced the price of gas by 5d. per 1000 cubic feet. Last year they also reduced the price by 5d.; and the Chairman, at the meeting on Wednesday, said that, notwithstanding the reduction, there had been a net profit of £324.

The revenue for the past year of the Greenock Water Trust amounted to £20,594; and the expenditure, to £20,572, of which £11,992 was for interest, and £325 was extraordinary expenditure. There was a surplus of £21. The Trust have taken advantage of their statutory power to postpone the operation of the sinking fund from 25 to 60 years. The advantage of this was seen in the fact that last year they were able to reduce the water-rate by 3d. per pound. Of the revenue, there was an increase of £400 upon the sum derived from millowners, which shows an improving trade in the town. Had the sugar works been in full working order, there would have been other £1500 of revenue.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 29.

Sulphate of Ammonia.—The market has been quiet; and the value at the close is £9 15s. f.o.b. at the ports. The quantity offered by makers has been rather larger; but actual requirements are small, and that probably accounts in the main for the decline in value. Dealers continue to offer ahead at a premium of 5s. to 7s. 6d. per ton, according to position.

Nitrate of Soda is unchanged; spot value being from 8s. 3d. to 8s. 4½d. per cwt.

LONDON, *June* 29.

Tar Products.—A more hopeful feeling has sprung up in regard to carbolic and cresylic acids, although business has been done at 1s. 4d. for 60's, and 1s. for refined cresol. These are exceptionally low prices; and it is felt that bottom has been touched in them. There is still a good inquiry for pitch; but fuel makers declare they are unable to pay the prices asked by dealers. The actual value of pitch largely depends upon the port of shipment; and, where high prices have been mentioned as having been obtained, it has been due to exceptionally low freights and other facilities. Very little has been done in anthracene; but it is firm at Committee rates, although some small outside lots have changed hands at less prices. A little more is being done in oils, but at most wretched prices. Transactions during the week have been marked at the following prices: Tar, 17s. to 21s. Pitch, 35s. to 37s. 6d. Benzols, 90's, 1s.; 50's, 11½d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent. naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d.; salts, 18s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 4½d. Anthracene, nominal, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia continues weak. Buyers hold off for still lower prices. Stocks are comparatively low; and there is no reason why sulphate should be sold under £10, especially having regard to its nitrogen value relative to nitrate of soda. Prices realized during the week, at all ports, have ranged between £9 15s. and £9 17s. 6d., less 3½ per cent., according to port of shipment. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Business throughout the coal trade of this district continues to drag on in a very slow fashion, as regards all descriptions of round coal, either for house-fire or iron-making, steam, and general manufacturing purposes; with three days per week still about the full average that the pits are working. So far as list rates are concerned, these remain nominally without any material alteration; but in the open market, there are plenty of sellers at very low figures, where clearances can be effected of surplus supplies—a good deal of coal being held under load, both in this and other surrounding colliery districts. In gas coal, the position remains very much as reported recently; and where contracts have been settled, they are practically upon the basis of prices that have previously been given. At the pit mouth, best Wigan Arley coals, although quoted at 10s. 6d., are only realizing this figure on occasional very small sales; 10s. per ton representing more nearly about the average selling price. Seconds Arley and Pemberton four-feet average about 8s. 6d. per ton; and common round coals, from 6s. for steam and forge qualities, to 7s. for house-fire descriptions. For gas coals, the average contract prices range from about 6s. 6d. per ton for good Wigan four-feet, to 7s. for partially-screened Arley mine coal. For shipment, excessively low prices have been quoted where sales of any weight can be made for prompt delivery; and 5s. 6d. per ton at the pit is a very common price. Delivered at the ports on the Mersey, there are sellers at about 7s. 3d. and 7s. 6d. per ton; while 7s. 9d. represents about the full average figure. Engine fuel moves off rapidly, owing to the present very restricted production of slack; but it can be scarcely reported as more than firm at recent quoted rates, any appreciable advance being very difficult to obtain.

Northern Coal Trade.—There has been a rather better demand for steam coals in the last few days; and with a production that has been diminished by the local race holidays, the market has been slightly quickened, though the range of prices is very little altered. The demand for household coal is naturally at about its lowest point; so that the collieries producing this class of coals are working very short time, and the same remark applies to other kinds of coal that have more especially a winter trade. Best Northumbrian steam coals may be quoted at about 8s. 9d. per ton f.o.b.; second kinds, at 8s. to 8s. 6d.; and steam smalls, at 3s. 3d. to 3s. 6d. The demand is slightly enlarged for the latter class. In gas coals, the demand is a little fuller, and must now be increased weekly, though it will be a month or two before it reaches its normal extent. Generally, the prices quoted range from 6s. to 7s. per ton f.o.b.; but contracts are taken at about the lowest of these prices, at about which figure some large dealings have taken place for delivery over the next twelve months. In the manufacturing coal trade, the demand has been locally quieter; but there has been a better export, especially of smithy coals. In the coke trade, the demand is a little larger, both for export and for use in the north-western furnaces; and the prices are fully maintained at 13s. to 14s. per ton f.o.b. Gas coke is only in limited production just now; and hence the stocks are small. Prices are unaltered. It is not expected that the decision of the Northumbrian miners to terminate the Conciliation Board at the end of the year, will lead to any labour difficulty. The Durham miners retain their Board.

Scotch Coal Trade.—There is no further fall in prices for coal in Scotland; and although there is great dulness, there is a belief arising that the lowest ebb has been passed, and that both demand and prices will now begin to improve. There are already indications that contracts which were lost last year on account of the strike, are again returning to Scotland. Meantime, a fair business is being done for home consumption; and iron and other trades are doing a large and profitable business. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. (full); splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 144,993 tons—a decrease of 31,212 tons upon the previous week, and of 8329 tons upon the corresponding period of last year. For the year to date, the total shipments have been 3,120,558 tons—a decrease, as compared with the corresponding period of last year, of 394,487 tons.

The Brighouse Gas and Water Works.—At the meeting of the Brighouse Town Council last Wednesday, Alderman Sugden, the Chairman of the Gas Committee, presented the accounts of the department for the past year, showing a profit of £700. The gas-works, he stated, had been valued at £80,000, all of which had come out of the profits; the works really not having cost the ratepayers a penny. Alderman Stocks presented the annual statement as to the water-works, showing a loss of £300 for the year.

Maryport District Council Gas Supply.—The Maryport District Council having applied to the Local Government Board for sanction to borrow £1100 for gas purposes, Mr. Langton Coke, M.Inst.C.E., held an inquiry into the matter last Wednesday. The money, it appears, is required for extending the mains, and erecting lamps for lighting Ellenborough and Netherton, the cost of which is estimated by the Gas Manager (Mr. Morris) at the amount asked for. The extension now proposed to be carried out is part of the work contemplated when the Provisional Order of 1886 was obtained, giving the then Trustees powers to borrow £10,000 from time to time, subject to the approval of the Local Government Board.

The Oil-Gas Experiments in Bradford.—At a meeting of the Gas and Electricity Committee of the Bradford Town Council last Wednesday, it was stated that an endeavour had been made to get a further supply of oil for the oil-gas experiments at the Thornton Road gas-works, in order that Mr. Lewis T. Wright might make a trial of the process. The firm, however, who alone supply the oil, stated that they were unable to furnish a further quantity to the Corporation at the present time. In the discussion which followed, it was pointed out that the Corporation would be placed in a difficulty if the supply failed when the system had been adopted. As the Committee have still about 2½ tons of oil in stock, it was decided to communicate with Mr. Wright and Dr. Dvorkovitz, with the object of ascertaining whether this quantity is sufficient to allow the experiments to proceed.

The Glasgow Gas Commissioners' Contracts.—The Glasgow Corporation Gas Trust's Sub-Committee on Contracts have bought their supply of white Irish limestone for the next twelve months at 6s. and 6s. 10d. per ton. It is expected that something like 30,000 tons will be required. The suppliers' quarries are at Glenarm, on the Antrim coast, and their own steamers bring the limestone to the Clyde, where it is put on railway waggons to be conveyed direct into the various gas-works belonging to the Corporation. The same Sub-Committee have accepted an offer from Messrs. C. and W. Walker, to supply and erect a couple of their patent purifiers at the Dalmarnock Gas-Works. The Barrowfield Iron-Works Company, Limited, of Glasgow, have contracted with the Gas Commissioners to supply and erect four coke-riddling machines at the Dawsholm Gas-Works; and an offer has been accepted from the Airdrie Iron Company for the supply and erection of two large coke-hoppers at the same works.

East Surrey Water Company.—In the JOURNAL for the 18th ult., we briefly noticed the report of the Directors of this Company for the year ending March 25 last, which was presented at the meeting of shareholders on the previous Saturday. In moving its adoption, Sir F. Bramwell, F.R.S., called attention to the fact that, though the receipts appeared to be only £470 more than last year, as a matter of fact those from regular customers were £700 in excess. The previous year was, he said, one of abnormal drought; and there was in consequence a large sale of water for building and other purposes, which, to a certain extent, must be regarded as a kind of casual income. During the past year there had been less expenditure of this kind, which reduced the real increase of £700 from regular customers to the £470 appearing in the accounts. The policy of the Company during the eighteen years he had been associated with it was, first of all, to do their duty to the district by supplying, day and night, water which he believed to be of the first quality in the kingdom. This year the Company had obtained, for the first time, a dividend of 5 per cent. upon the ordinary shares; and there was every reason to believe it would be maintained. In conclusion, he referred with regret to the resignation as Chairman and Director of Mr. Easton, who had served the Company so ably and so long; and he cordially welcomed their new colleague, Sir Myles Fenton, who had accepted the vacant directorship, and also the post of Deputy-Chairman of the Company. The dividend recommended was declared. Votes of thanks having been accorded to the Chairman and Directors, Sir F. Bramwell, in responding, bore testimony to the valuable counsel and ready co-operation of his colleagues on the Board, and to the indefatigable exertions of the esteemed Manager and Secretary (Mr. J. R. Downes).

The Working of the Cleckheaton Gas Department.—The annual report of the Gas Department of the Cleckheaton District Council shows the gross profits on the year's operations to have been £3611, as compared with £2760 in the previous year. The capital employed is £38,410, which is equal to 11s. 3·93d. per 1000 cubic feet accounted for. The price of gas to consumers was 3s. per 1000 cubic feet, less 10 per cent. discount.

Increased Storage at the Willenhall Gas-Works.—A new tank and 100 feet telescopic gasholder are in course of construction for the Willenhall Gas Company, in accordance with the plans and specifications of Mr. W. North, of Stourbridge. Mr. T. Vale, of Stourport, is the Contractor for the tank; and Mr. Jesse Tildesley, of Willenhall, for the holder. The work is being carried out under the superintendence of Mr. J. C. Belton, the Company's General Manager.

Exhibitions of Gas Appliances.—A seven days' exhibition was concluded at Bolton last Friday. The appliances on view were principally the manufactures of Messrs. C. Wilson and Sons and Messrs. G. Bray and Co., of Leeds. At intervals during the exhibition, Miss Holroyd delivered some practical lectures on high-class, invalid, and every-day cookery. Gas and local trades exhibitions, prompted by Messrs. Richmond and Co., Limited, have just closed at Manchester, Edinburgh, Carmarthen, and Pontypridd; and in each case they have been marked with distinct success. At Manchester, there was a fine display of incandescent lights, sewing machines were driven by the "Stockport" gas-engine, and there were exhibits by various other firms in the gas industry. The exhibition was opened by Mr. C. Nickson, the Superintendent of the Corporation Gas Department; and lectures were delivered by Mrs. Brightwell. At Edinburgh, the lectures were by Miss S. L. Richmond, who was introduced to the audience by Bailie Kinloch Anderson, J.P. At Carmarthen the lectures by Miss Wilkinson were well attended, and she was presented with a purse of money by the audience. At Manchester, Edinburgh, and Pontypridd, the exhibitions had a fortnight's run; and a humourous lantern lecture, entitled "Gas *v.* Coal," was given at each place by Mr. E. W. T. Richmond. Messrs. Parkinson and Co. held a successful exhibition last week in the Victoria Rooms, Oswestry. Miss E. Sanderson gave practical demonstrations on cookery twice daily. Messrs. Fletcher, Russell, and Co., Limited, held an exhibition of their gas stoves and heaters in the Town Hall, Castle-Douglas, last week, at which Mrs. H. M. Young was the lecturer.

Tipton Gas Supply.—At the last meeting of the Tipton Urban District Council, the annual accounts of the Gas Department were presented. They showed that the gross profit was £4513; and the net profit, after payment of the principal and interest on loans, £3 15s. 6d. This sum, added to the balance of accumulated profits brought forward (£638 2s. 3d.), made a total of £641 17s. 9d., of which £100 had been employed for the installation of regenerative furnaces, and £167 for a bridge; leaving £374 17s. 9d. In a note at the end of the accounts, it is explained that, in compliance with the provisions of the Local Government Act of 1894, they are made up to the 31st instead of the 25th of March. The expenditure for this additional week was about £300; and, but for the alteration of date, the profits would have been increased by this amount. The gross profit represents a dividend at the rate of 6·1 per cent. upon the amount of capital employed. The statements relating to the working, which is under the supervision of Mr. Vincent Hughes, show that 8157 tons of coal and cannel were carbonized in the period covered by the accounts, as compared with 8432 tons in the preceding year; the quantity of gas made being 86,220,000 cubic feet, as against 90,422,000 cubic feet. The gas sold and used on the works amounted to 77,706,987 cubic feet, and the leakage, &c., to 8,402,416 cubic feet, or 9·75 per cent.; while for the year 1893-4, the figures were 81,786,332 cubic feet and 8,768,917 cubic feet, or 9·68 per cent. It is explained, however, that the quantity of gas sent out during the extra week was upwards of 1½ million cubic feet, which is included in the gas not accounted for. Mr. Hughes points out that this ought to be deducted; and then the proportion of leakage, &c., would be reduced to 8 per cent. With regard to residuals, the make of coke and breeze is estimated at 4978 tons; of tar, 110,652 gallons; of ammoniacal liquor, 242,461 gallons of 10-oz. strength. The accounts were approved.

Cooking by Gas at Truro.—The Truro Gas Company have lately been having an exhibition of Messrs. J. Wright and Co.'s gas cooking-stoves; and, in conjunction therewith, Mrs. Thwaites gave an excellent series of lectures on cookery. This lady, in addition, prepared a gas-cooked dinner, which was served in the Public Rooms, and partaken of by the Mayor (Mr. Silvanus Trevail) and a party of gentlemen, including representatives of the Gas Company and Mr. S. J. Ingram, the Manager. After dinner, the Mayor proposed "Success to the Truro Gas Company;" remarking that the fact that so honourable and esteemed a citizen as their venerable friend Mr. Robert Tweedy was Chairman of the Company, entitled it to the highest respect. As to the use of gas for cooking, he believed the convenience of it at the Atlantic Hotel had been such that they would not do without gas-stoves under any consideration. Mr. Heard acknowledged the toast. He said it was the Company's endeavour to extend the usefulness of gas, more particularly for cooking; and he believed it would be much more generally used for this purpose in the future. Mr. J. James also responded, stating that the Company were desirous to give the community full value for the money they laid out. Their new Manager had, he said, given the greatest satisfaction; and the citizens generally would appreciate his services, if the future was to be at all representative of what he had done during the short time he had been with the Company. He was one who would hold up his hand for progress at any time. Mr. Ingram expressed his pleasure at witnessing the cordial relations existing between the Corporation and the Company. He said he thought they would find cooking by gas very economical, if properly managed; and the domestic who was not economical with a gas-stove, would be no more economical in the use of coal. He could assure the consumers, though they often looked with suspicion upon any recommendation from the manager of a gas-works, it was the Company's desire to treat their customers with the greatest possible consideration. Votes of thanks were accorded to Mrs. Thwaites and to Messrs. Wright and Co., and acknowledged by Mr. Pitts.

Messrs. Fletcher, Russell, and Co., Limited, finding the building reconstructed specially for them a few years ago at No. 115, Cheapside, much too small for the adequate display of a complete series of the Company's appliances, have taken larger premises at No. 134, Queen Victoria Street, which are expected to be ready for occupation next month.

The Sheffield Gas Company's Coal Contracts.—The Sheffield Gas Company, who require from 160,000 to 170,000 tons of coal, have just completed their contracts with local collieries. We learn that a good deal of satisfaction is expressed at the way in which Sir F. T. Mappin, Bart., M.P., the Chairman of the Company, and Mr. Hanbury Thomas, the General Manager, have conducted the business. They did not attempt to take advantage of the weakness of the market to cut down prices, but had the tenders delivered, and dealt with them in a very reasonable and satisfactory manner. As a general rule, the gas coal contracts which have been placed in the Yorkshire district were concluded at prices ranging from 3d. to 6d. per ton less than before.

Sales of Shares, &c.—Yesterday week, Messrs. Cox and Son sold at Torquay 300 £10 shares in the *Torquay Gas Company*, at prices ranging from £16 to £16 9s. The average price was £16 5s.; and the total realized was £4875 15s. A small number of £10 shares in the *Portsmouth Water Company* were sold locally a few days since at £28 15s. each. Messrs. William Bush and Son sold, last Tuesday, at Sheffield, six *Sheffield Corporation Water Annuities* of £5 each for £149 each. Seven annuities on the gradual scale at present at £2 15s. each, were sold for £112 10s., and one annuity on the graduated scale of £3 8s. 9d. was sold for 112½ per cent. Messrs. W. G. Stansfield and Co. disposed of some small amounts of gas stock at Bradford last Thursday, at the following figures: £20 of consolidated and £20 of original stock of the *South Shields Gas Company* for £75 each lot; and in the *North Bierley Gas Company* £30 of original stock for £61, £13 of new 7 per cent. stock for £17 10s., and £14 of new 7 per cent. stock (£2 16s. paid) for £5 2s. 6d., and £107 of capital stock for £212, and £25 of new stock for £36 10s. At Scarborough, last Wednesday, Messrs. W. T. Hart and Son sold £72 of 5 per cent. preference stock of the *Scarborough Gas Company* at £137 per cent.; and £105 of 7½ per cent. new consolidated stock at £175 per cent. These prices are the highest on record.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 28.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22 - 23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15—16	..	4 13 1
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
200,000	5	10 May	6½	Bombay, Limited	5	6¾—7¼	..	4 9 8
40,000	5	,,	6½	Do. New	4	5—5½	+½	4 14 7
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	250—255	+3	4 10 2
180,000	,,	,,	8½	Do. New	100	200—205	+3	4 2 11
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220—225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	122—125	..	4 0 0
320,000	20	28 Mar.	11½	British	20	52½—53½	..	4 4 1
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¼—7¾	..	5 3 2
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100—103	..	5 16 7
150,000	20	28 Feb.	8½	Cagliari, Limited	20	26½—27½	..	6 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Oil Stock	100	290—295	..	4 11 6
165,000	,,	,,	10½	Do. New do.	100	217 -222	..	4 14 7
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	137—142	..	3 3 4
800,000	Stck.	12 June	13	Continental Union, Limited.	100	255—260	+5	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	.	4 16 2
535,000	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	100	122—127	..	4 2 8
486,090	10	31 Jan.	11	European, Limited	10	24½—25½	..	4 6 3
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	285—290	+10	4 2 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c.Pf.	100	277—282	..	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	188—193	..	3 12 6
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	128—131	..	3 1 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	187—190	..	3 3 2
3,800,000	Stck.	10 May	12	Imperial Continental	100	247—252	..	4 15 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5½—6½	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	114—116	+1	4 6 2
541,920	20	12 June	5	Monte Video, Limited	20	15½—16½	..	5 1 2
150,000	5	24 May	8	Oriental, Limited	5	7—7½	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾—5¼	..	5 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	3 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	8½—9½	..	7 7 4
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	297—302	..	5 19 6
290,000	,,	,,	13	Do. C do.	100	307—312	..	4 3 4
775,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	168—17[illegible]	..	2 17 10
60,000	Stck.	23 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	285-290	+2½	3 9 0
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	235—240	+5½	3 6 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	150-155	+1½	2 18 0
700,000	50	26 June	7	Grand Junction	50	113-117	+3½	2 19 10
708,000	Stck.	14 Feb.	12	Kent	100	307-312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	250-260*	[illegible]	2 17 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	205-210*	+6	4 11 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	14[illegible]-14[illegible]	..	2 13 11
500,000	100	14 Feb.	12½	New River, New Shares	100	[illegible]—[illegible]	+10	3 7 0
1,000,000	Stck	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	142-14[illegible]		2 15 7
902,500	Stck	12 June	4	S'thwk & Vxhall, 10 p.c. max	100	[illegible]—10[illegible]	.	2 9 1
126,500	10	,,	4	Do. D 7½ p.c. do.	100	[illegible]5-1[illegible]	..	2 17 2
1,155,066	Stck.	12 June	10	West Middlesex	100	285-290*	+5	3 9 0

*Ex div.

The Profits of the Stoke-on-Trent Town Council.—The Executive Gas Committee of the Stoke-on-Trent Corporation have agreed to make a remittance of £2000 to the Town Council on account of the current year's profits.

The Suggested Reduction of the Illuminating Power of Gas at Liverpool.—Last Wednesday, a conference between the Lighting Committee of the Liverpool City Council and Mr. Edward Lawrence, Mr. H. B. Gilmour, and other representatives of the Gas Company, took place at the Town Hall, to consider the proposal to lower the illuminating power of the gas, and thus ensure greater cheapness to the consumers. To carry these suggestions into practical effect, an application to Parliament on the part of the Gas Company would be necessary; and the parties to last Wednesday's conference discussed the question whether such a measure would be desirable. The deliberations lasted nearly an hour; but it is stated that no definite decision was arrived at.

Explosion of a Gas-Engine at Ipswich.—Last Wednesday, a startling explosion took place in Salthouse Street, Ipswich, on the premises of Mr. C. E. Thurman, which have recently been fitted up as a flour-mill. Mr. Thurman, assisted by four men, was starting a new gas-engine of 14-horse power, when suddenly the condenser exploded with a loud report, blowing away the brick and iron work surrounding it, and doing other damage. Happily, not one of the men near the engine was injured, though the force of the explosion smashed the windows and blew off a portion of the roof of the building. It is supposed that some foul air in the condenser which burst was the cause of the explosion, and with the exception of a few pipes and rods twisted, no material damage was done.

Selby Gas Supply.—The report of the Manager of the Selby Gas Department (Mr. M. Dunn) for the month ending the 25th ult., shows an increase to the extent of 37·75 per cent. in the production, and of 34·33 per cent. in the consumption of gas, as compared with the corresponding period of 1894. The price has been reduced from 3s. 3d. to 3s. per 1000 cubic feet to ordinary consumers; and those using prepayment meters now receive 25 instead of 20 cubic feet of gas for 1d. A fresh district of supply has been added; and the mains to connect it with the present area are being laid. The necessary additions and alterations to the plant to meet the extra demand for gas are also being proceeded with. It is gratifying to learn that Mr. Dunn is able to dispense with Sunday labour in his works during the summer months.

Water Supply for Yorkshire Villages.—The Malton Rural District Council had before them last Saturday week the question of the water supply to a number of villages in their district—including Slingsby, Brawby, and Butterwick—which is being pressed on their attention by the Local Government Board. A report was read by Mr. Richardson, engineer, in which he suggested a joint scheme for supplying several villages. A Committee is considering the matter.

Seville Water-Works Company, Limited.—The annual meeting of this Company was held last Thursday, at the London Offices, No. 86, Cannon Street. The report and accounts for the year ending March 31 last showed that the income was £29,432; and on taking into account the credit on exchange, it was £30,148. After deducting working expenses, the cost of laying on services, and debenture interest, the net profit was £11,808, as compared with £9323 in the previous year. Adding the unappropriated profit at March 31, 1894—£1118—and charging the contribution to the sinking fund of £610, the interim dividend, and placing £2000 to the reserve fund, made the amount standing to the credit of profit and loss account £6249. The Directors recommended that a dividend at the rate of 4 per cent. per annum, free of income-tax, be paid for the past half year, which would absorb £5422, and leave £827 to be carried forward. The Directors announced the death of their colleague Mr. Edward Horner, and the appointment of Mr. Easton Devonshire to fill the vacancy. The Chairman (Mr. David Evans), in moving the adoption of the accounts and the declaration of the dividend, mentioned that exchange had improved since the last meeting; but it was a little higher now than it was on March 31 last. The tendency again appeared to be to go down; and therefore, he hoped, they would have a lower average rate of exchange for this year's remittances than last. The Directors had had formal application from Messrs. Easton, Anderson, and Goolden (who had become a limited Company) to be released of their liability to complete the contract, as the limited Company were disinclined to be subject to an indefinite liability. They claimed either to complete their contract, or to be relieved of their liability to complete it. The Company's arrangements with the Municipality did not admit of immediate completion; and the opinion of their legal advisers was that this was a matter for compromise. Mr. W. Blaber seconded the motion; and after a short discussion, in which Count Torri Diaz and Mr. E. A. Hankey took part, the motion was carried. The retiring Directors (Messrs. Evans and Blaber) and Auditors were re-elected.

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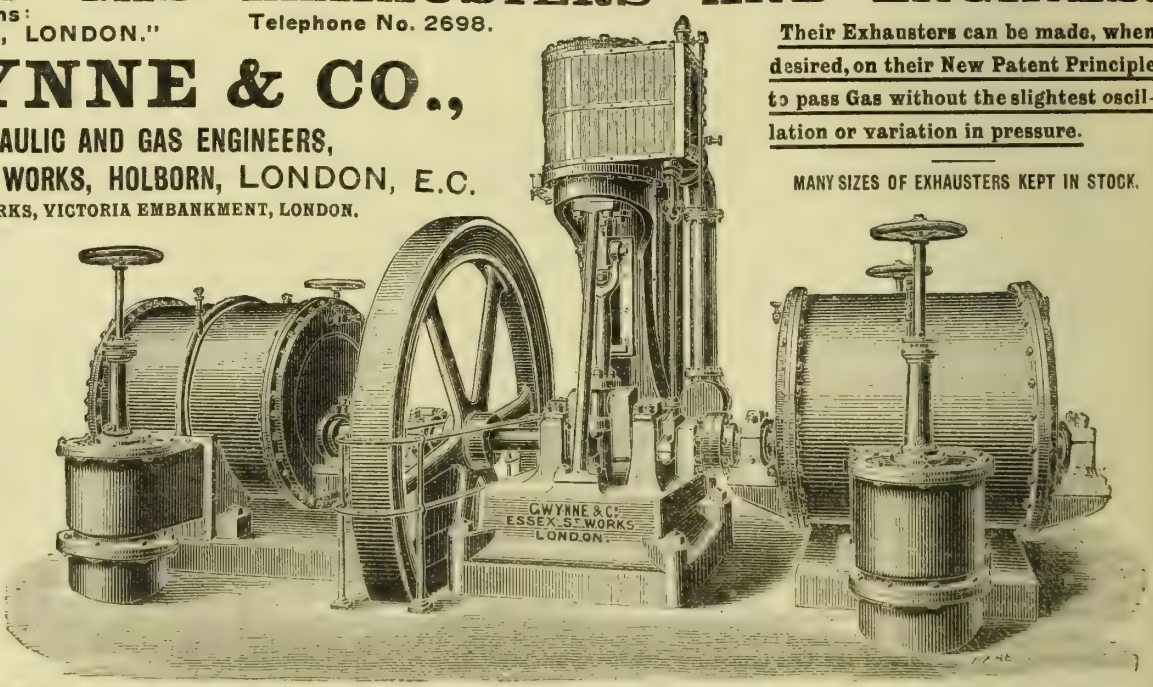

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EDITORIAL NOTES.

The Report of the Committee on Weights and Measures.

A HIGHLY interesting report from the Select Committee on Weights and Measures, with a summary of the proceedings of the Committee, has just appeared as a parliamentary paper. The Committee were appointed in February last "to inquire whether any and what changes in the "present system of weights and measures should be "adopted," and numbered in all seventeen members—Sir Henry Roscoe being Chairman. They now state that they have considered the matters referred to them, and have agreed upon a unanimous report which strongly favours the legalization and adoption of the metrical system of weights and measures by England. In the course of their inquiry, the Committee took evidence from witnesses representing many different interests, and also received from numerous corporations, school boards, and other public bodies, resolutions without exception in favour of the adoption of the metrical system. Almost all the witnesses expressed a strong opinion as to the complicated and unsatisfactory condition of our present weights and measures. The evidence goes to show that not only is our foreign trade, in every branch, seriously handicapped, but that the home trade would be benefited if more simple and uniform standards of weights and measures than those now existing were adopted. Strong evidence was brought forward as to serious loss of time incurred by English school children in having to learn the complicated system of tables of existing weights and measures, and the urgent need of the adoption of a simpler system. Moreover, it was proved to the satisfaction of the Committee that a compulsory change from an old and complicated system to the metrical had taken place in many European countries without serious opposition or inconvenience, and that the change was appreciated. Consequently, the Committee recommend that the metrical system of weights and measures be at once legalized for all purposes; that after a lapse of two years the system shall be rendered compulsory; and that it be "taught in "all public elementary schools as a necessary and integral "part of arithmetic, and that decimals be introduced at "an earlier period of the school *curriculum* than is the case "at present." Thus is the principle in arithmetic of Dr. Colenso—terror of many schoolboys who are now greybeards—justified by the wisdom of Parliament. It must be remarked, however, in justice to the Colenso-hating schoolboy of the fifties and sixties, that decimal arithmetic is not always the same as a decimal system of weights, measures, and currency.

When we receive the printed evidence, we shall be in a better position to criticize the findings of the Committee. Meanwhile, it may be admitted that public feeling has been gradually coming round to the view so unequivocally expressed by the Committee. The totally different subject of the currency apart, there can be no question about the complication and confusion that characterize our British "Table Books"—so oft bedewed by the tears of the wretched schoolboy, whose sluggish reason cannot help him to understand either the nomenclature or the subdivisions of our standard system of weights and measures. When he becomes a man of science, the schoolboy makes a way for himself out of these troubles by artfully "bye-"passing" the illogical intermediate weights and measures, or, as a chemist, he boldly thinks and talks in the metrical system—no man forbidding him. Thus busy people have a way of passing mentally from yards to miles, from pounds avoirdupois to tons; or they take a weight or a measure as a point of departure, and express all its fractions as decimals. Yet it is no easy task to teach children to use and reckon by decimals, when the ordinary transactions of life are not carried on by the same system of weights, measures, or coinage. The British coinage must, of course, remain unchanged. Would that sovereigns in private ownership would exhibit the same steadfastness! But, *pace* the Committee, our old-fashioned weights and measures had better go. People will soon get used to asking for half a kilo. of tea. The late Professor Rankine's typical workman declared his resolve to "eat by the pound, and drink by the quart, "and work by his two-foot rule." But the spirit of the time is too strong for the Professor's successors; and there is no valid reason why England should cherish an

antiquated system of weights and measures unintelligible to the rest of the civilized world, and anything but convenient to those who use it.

Gas engineers, at least, will not object, on principle, to deal in cubic metres of gas in place of thousands of cubic feet, though, in sooth, the new unit will be somewhat small and difficult of adjustment to the coinage. There will be no possibility of marking such gradations of price as a penny per 1000 cubic feet up or down in even fractional currency; for a farthing per cubic metre is very nearly equivalent to 7d. per 1000 cubic feet. For the moment, we do not exactly see how this difficulty is to be overcome. In one respect, however, gas engineers will look favourably upon the metrical system. It is their only hope of deliverance from the absurd way in which the degree of purity of coal gas is expressed. It has often been complained that the system of stating sulphur impurities in grains per 100 cubic feet was ingeniously devised to place in juxtaposition a high numerical expression for the impurity and a low one for the gas, so as to convey to ignorant persons an altogether erroneous idea of the relative proportions of the two quantities. When the metrical system is legalized, this little imposition will be quietly consigned to the limbo of things missed, but not wanted. We shall no longer hear of grains of sulphur and cubic feet of gas, but of percentages of impurity to commodity, which will put a very different aspect upon the question of purification. It will be an interesting exercise for the Gas Referees to translate their requirements into metrical terminology. No help in this connection can be derived from French practice, for the French users of the metrical system do not test coal gas for sulphur or ammonia. They are content with the test for sulphuretted hydrogen; and if the acetate of lead paper does not blacken in a quarter of an hour, or the time allotted for the photometrical observation of the same gas, they are perfectly satisfied with the gas.

Mr. M'Crae on Labour in Gas-Works.

The influence of the Journal teaching was apparent in several of the papers read at the recent Gas Institute meeting; a good example being the paper by Mr. John M'Crae, of Dundee, upon "The Management of, and "Remuneration to, Gas Workers," and the spirited discussion which followed the reading of it by the author, who, by the way, proved himself a smart debater in dealing, in his reply, with his critics and commentators. There is nothing novel in the paper, which was mainly intended to show how very comfortably Mr. M'Crae's men work at Dundee. But the fact of such a paper being included in The Gas Institute transactions, and eliciting so long a debate, is proof that there is general interest among gas managers in those Labour questions to which it has been our policy to devote much space and particular attention. Mr. M'Crae is an eight-hour man; the three-shift system having been in vogue in Dundee, as he told his audience, for the past twenty-four years. He employed some rather strong language in advocacy of this system, and in condemnation of the alternative two-shift division of the gas-workers' day. We do not regard the difference as a matter about which to throw stones. Where men are required to work the twelve-hour shift, turn and turn about, year in and year out, with no relief whatever from Sunday labour, no days off, and no holiday, we have no hesitation in characterizing the condition of their toil as simply organized cruelty, and a shame to their managers and employers. It is only too true that this was the condition generally prevalent in gas-works, especially of sizes from small to medium, a quarter of a century ago. It still exists in some backward works, under the thoughtless, or perhaps mercenary, sanction of managers, directors, and corporation committeemen who have been too long familiar with the arrangement to see anything wrong in it, especially as stokers who have grown up under it are usually contented with their lot. Talk about the exhausting nature of stokers' work and their slavery to long hours is not impressive to managers who, though perhaps not getting the utmost out of their men, probably know of the same gangs working on for many years without wearing out more than ordinary day labourers. With shovel work in country retort-houses, men have been known to keep going for forty years and more before passing into a hale old age with a pension. But this is not the point. The things to be regarded are the indubitable facts that what served well enough as a condition of labour for the last generation will not answer to-day; and that what does best in one locality and set of circumstances is not necessarily best for all. In one district, the men available for retort-stoking work may be of a fairly high class, who appreciate refinements in their surroundings and the rule of kindness and consideration in their treatment. Elsewhere they may be the dregs of a particularly rough population, whom no gas manager would have dealings with on any terms, if he could help himself. The gas manager does not make his men what they are, but must take what he can get. It is all very well to preach the saving virtue of gentleness; but the truth is not yet out of the old proverb which tells us that it is impossible to "make a silk purse out of a sow's ear." Mr. Alderman Miles and Mr. Hutchinson have both had recent experiences of the point of this saying.

While the respective virtues of the eight-hour and twelve-hour shifts were dealt with in Edinburgh in a somewhat cursory fashion by Mr. M'Crae and others, nobody really went into the heart of the matter on that occasion. When this is done, the actual amount of work accomplished by the men under each system, as measured by the weight of coal carbonized per man, must not be overlooked. The eight-hour man is required to do more while he is at it, in every three-shift works that we know of, than does the two-shift man. The former has to work harder in every hour of his shift than the latter. Nor, for all Mr. M'Crae's warm asseveration, is it true that a twelve-hour shift in the retort-house means twelve hours of work in the same sense as the navvy, the bricklayer's labourer, or the harvester knows the term. While, therefore, any of these descriptions of labourers are required, as a natural thing, to work nine, ten, or more hours a day, it cannot be reasonable to stigmatize the twelve-hour shift as "wrong." Nothing good was ever effected yet by using ethical considerations out of their proper connection. With regard to the remarkable speech made by Mr. William Carr upon the inhumanity of those engineers who favour labour-saving machinery for gas making, it is sufficient to say that what he appeared to uphold as the duty of gas managers in this respect is tantamount to the negation of all mechanical progress. If he is to be esteemed a benefactor of mankind who makes two blades of grass grow where only one grew before, he is not less so who delivers mankind from toil that can be as well, or even better, done by mechanism. Mr. Carr was, however, sufficiently answered by Mr. Denny Lane and by Mr. Stelfox. It is difficult at this time of day to take seriously such observation as those made by Mr. Carr.

More Trouble for Salford.

The Corporation of Salford have had a disagreeable experience in connection with their Provisional Order for increased capital powers for gas purposes. They desired to raise £85,000 in addition to their existing borrowing powers; and they endeavoured to obtain statutory authority for this apparently innocent and routine proceeding by the usually convenient way of a Provisional Order. The result, however, has illustrated once more the deceptive nature of the system followed, which is only cheap and expeditious when the powers asked for are not seriously objected to. In this case, the Bill to confirm the Order was strongly opposed by the Swinton and Pendlebury District Council, with the remarkable result that the Committee imposed such terms upon the Corporation as to cause them to withdraw the Order. And, more wonderful still, the Committee gave it as their unanimous opinion that the Swinton and Pendlebury authority should have their costs as against the Corporation. We believe the latter decision to be without precedent. Upon the face of the record, it looks as if Salford had been hardly done by; but the "true inwardness" of the matter does not appear on the surface. The trouble goes back as far as 1891, when certain outlying districts supplied with gas by Salford including Swinton and Pendlebury, successfully combined to put an end to the systematic and excessive "milking" to which they were subjected by means of differential prices, the benefit of which went wholly to the supplying authority. Swinton and Pendlebury, with Eccles, were to have had their own gas-works as a prize of victory; but before a Bill could be promoted to carry into effect the opinion of the 1891 Committee, Eccles withdrew from the combination—being content with the reduction of the differential rate to 2d. per 1000 cubic feet, and not fancying a gas-works in the district. Swinton was ready

to go on; but was in turn successfully opposed by Salford. Since 1892, however, the financial affairs of the borough have been moving, as everybody knows, along a very questionable road. A large sum of money has been lost sight of, somehow; and, as the natural consequence, the Gas Committee have paid over tremendous subsidies to help to straighten out the Corporation accounts. This course of robbing Peter the gas consumer to pay Paul the ratepayer, might, Swinton thought, be very good fun for Salford; but there was no sound reason why Swinton should suffer for the sins of Salford, especially after obtaining a decree *nisi* for the dissolution of the union of the two districts. Consequently, when Salford applied for another £85,000, Swinton seized the opportunity for telling Parliament all about its municipal misdeeds.

Mr. Balfour Browne did all in his power for the promoters of the Order; but the best plea he could raise on their behalf was that, after all, Swinton only paid 2s. 6d. for the gas that is sold in Salford for 2s. 4d.—which price, he contended, was a very low one indeed. Swinton was but an insignificant customer of Salford—only taking about one-sixth of the total output of gas; and why should there be all this grumbling over so trifling a matter? Well, he had his say, and marshalled his witnesses. But, without calling upon those for the other side, the Committee found that the Salford Gas Committee were treating Swinton unfairly. It was not a question of whether such gas as Salford sent to Swinton was low priced or not, but of what it cost to produce, and the amount of profit realized by Salford. It was found that Salford was making about 13 per cent. profit on the corrected gas capital, and paying several separate and distinct kinds of subsidies out of the revenues of the gas undertaking. The Committee thought that Swinton had a right to protection from this policy; but when this opinion was declared, the promoters withdrew their Order rather than accept the protective clauses to which Swinton was held to be entitled. Then the Committee made that memorable pronouncement with respect to the Swinton costs already mentioned, and included in their report to the House. It was considered, in effect, that a big municipality should not be encouraged in persistent attempts to ride roughshod over a little neighbour, or to wear down righteous opposition by repeated applications to Parliament which no small district could afford to as repeatedly oppose.

For more reasons than one, this parliamentary victory of Swinton over Salford is worthy of being signalized as one of the leading events of the year in gas politics. It effectually exposes the weakness, and insufficiency to bear the stress of parliamentary opposition, of the cardinal principle by which British municipalities owning gas-works are in the habit of fixing the price of gas—the idea that, when the municipality, with one eye upon the price of gas and the other upon the needs of the municipal treasury, resolve that the gas is "cheap," or "cheap "enough," nobody else has a right to say another word on the subject. It is the excuse of "cheap enough," in regard to municipal gas, that enables corporations to plunder the gas consumer with all the pretence of doing him a service. "In the time of the old company," the argument runs, "you were paying 4s. 6d. per 1000 cubic feet "for gas; now you get it for half-a-crown. Buy freely of "us, therefore, and be grateful." No mention is made of the cost at which the gas could be sold if it were not for that terrible hole in the municipal treasury which the gas consumer must stop, since there is nobody else to do it. This Swinton opposition to Salford has at least exhibited, in all its futility, the only plausible excuse for municipal oppression of the gas consumer. There is plenty of scope for further use of the argument by which Mr. Bidder discomfited Mr. Balfour Browne on Friday.

The Meeting of the Societe Technique.

The French gas managers had a very successful meeting in Paris during the week following the meeting of The Gas Institute, under the presidency of M. de Lachomette. The attendance was large; and the quality of the papers was exceptionally high. The President devoted a large portion of his address to the consideration of the changes that take place in gas coal after its extraction from the mine and before its carbonization; and much that he had to say upon this important subject was highly instructive and suggestive. The various devices that have been introduced in France as in other countries, during the last year or two, with the object of popularizing the use of gas, were also discussed by the President in a statesmanlike spirit. Some communications were made to the meeting upon the handling of coal by machinery, and one paper described what appears to be a re-invention in a French form of West's hand-power stoking machine. M. Godinet presented a long memoir upon the subject of condensation; giving a description of the system adopted at the Vichy Gas-Works. Incandescent gas lighting, calcium carbide, water gas, the sale of coke, the manufacture of ferrocyanide of potassium, automatic prepayment meters and gratuitous fittings, and the comparison of electrical with gas cooking, were among the numerous subjects brought before the meeting. M. Denayrouze was present, and exhibited his improved incandescent gas-burner, for which he put forward the claim that with an almost infinitely small supply of electricity and a large quantity of gas, very much more was done than either agency could accomplish by itself. It is satisfactory to learn, from the proceedings at the meeting, that the automatic prepayment meter seems to have "caught on" in France as completely as it has done in England. M. Melon has had gratifying success at Lille with this means of popularizing gas, which is just the thing wanted for a working-class community. He has doubled the number of consumers in two years, although gas is twice as dear as it would be in an English manufacturing town of the same size. Even so, it is able to compete with petroleum when the consumer is not asked to pay anything for fittings. It appears that French Gas Companies, as a rule, are open to put up fittings and send a prepayment meter to any householder who asks for them. The French gas managers are to be congratulated on their enterprising spirit, which has vastly widened the horizon of the native gas industry.

WATER AND SANITARY AFFAIRS.

The Hybrid Committee of the House of Commons, appointed to consider the London Water Bills, met on Wednesday, as previously arranged, and forthwith declared its own dissolution, in view of the similar event which awaited Parliament, and which was consummated yesterday. The eight Transfer Bills of the County Council are now either dead or in a state of suspended animation. Palpably, the revival of these Bills in the form in which they originally appeared is impossible. But the recent inquiry is destined to have an effect in the future, as something which yet lives. The policy of the County Council on the water question has been practically rejected; and our contention on Tuesday last that the Water Companies, despite the enormous expense thrown upon them, are really gainers by the result of the recent inquiry, is supported by the Money Article in *The Times* on Thursday, which said: "The labours of the Committee, and of others engaged in "the inquiry, have not, however, been thrown away." For it is now rendered clear, we are told, that if ever there is a transfer of the London water undertakings, the shareholders may expect "no less satisfactory consideration than has been "bestowed hitherto upon all other owners of valuable pro-"perty subjected to compulsory purchase." Such was our own interpretation of the remarks made by Mr. Plunket, accompanied by the decisions of the Committee on several points. That anything else should ever have been anticipated, indicates the unreasoning violence of the prejudice which had been raised against the Metropolitan Water Companies by the County Council, aided by a considerable portion of the public Press. It was deemed by the latter a popular line to attack the Water Companies; but it has at length been seen that the blow aimed at them must necessarily strike deeper and farther, involving many other interests than the one immediately assailed. As a sequel to the recent contest, we have declared that the water question no longer stands where it did. Of this we are the more assured by the circumstance that the minutes of evidence taken before Mr. Plunket's Committee are ordered to be printed. They will thus become a record for the guidance of the parties conducting future inquiries, and will serve as a starting-point in any investigations yet to be entered upon as to the water supply of the Metropolis.

We may also observe, as calling for some remark despite its formal character, that among the printed votes and proceedings of Parliament on Friday there is a report from Mr. Plunket on behalf of the Hybrid Committee, stating that, in the case of the Lambeth Water (Transfer)

Bill, the further consideration of the measure had been arrested by the approach of the dissolution of Parliament. In reference to the Southwark and Vauxhall Water (Transfer) Bill, and the Bills brought in by the Lambeth and Chelsea Companies, the Committee were, for the like reason, of opinion that the consideration of the said Bills "should not be entered upon" during the present session. The Committee thus appear as having done nothing beyond giving a partial consideration to the Bill for the acquisition of the Lambeth undertaking. But the truth is that the Committee have threshed out a large portion of the general question relative to the management of the Metropolitan Water Supply. As for the six Transfer Bills not named in the Committee's report, they dropped far in arrear, and were put down for a second reading on the 29th inst. The Transfer (Money) Bill was 66th on the orders of the day for Friday last. The mere arrest of the legislation projected by the County Council relative to the water supply would be of less significance, were it not that conclusions have been reached which practically involve a decision on the merits of the measures which have thus fallen through, or are at least held in abeyance.

The Transfer Bills are virtually a wreck, and will require considerable patching up if ever they are to float again. The arbitration scheme, by which the property of the Water Companies was to be depreciated to the verge of nothingness, is demolished. Compensation is to be allowed for compulsory sale. All the Companies are to be bought at one time; and they are not to be divided into sections for destruction. Transfer before purchase has not been approved. Such is the situation in which the Hybrid Committee have left the famous "acquisition" project. The decisions and opinions of the Committee may not have the force of law; but they command respect, and Parliament will not ignore them. The recommendations made some years ago by Sir Matthew White Ridley's Committee, and the conclusions arrived at by the Royal Commission under Lord Balfour of Burleigh, were recognized by the Hybrid Committee; and a like recognition will be given to the views expressed by the latter. The County Council must now trim their sails for a new tack. The Transfer Bills must be remodelled, in order to have any chance in the Parliament of 1896. As for bringing in a scheme to give London a supply from a remote watershed, such a project would have no prospect of acceptance with the Legislature, unless accompanied by a just arrangement with the Water Companies. But in whatever shape the Metropolitan Water Question comes before the new Parliament, it is important that one omission in respect to the recent inquiry should be rectified. The County Council cling to the notion that the Select Committee recognized them as the "one authority" that was to fulfil the condition laid down by Sir Matthew White Ridley's Committee, by possessing the entire water supply of the Metropolis. The Hybrid Committee refused to be pledged to that view while the inquiry was proceeding; but Mr. Plunket signified that they were excluded from considering any "alternative plan" by the circumstance that none of the petitions proposed any—the opposition simply confining itself to an objection to the County Council. This negative position was unfortunate; and it should be amended in the future. The consideration, however, is one which affects the public more than it concerns the Companies. The latter have no desire to be bought up by anybody, whether Council, or Trust, or Board. But the *animus* of the Council has been such that the Companies may desire to have business transactions with anybody rather than with them.

The Parliamentary Committee of the County Council, in a report which will be presented to-day, state that they have instructed their Agent to take steps, under the Orders which have been made for the suspension of Private Bills, to suspend all the Transfer Bills "until next session." Concerning the London Water-Works (Money) Bill, the Committee say: "This Bill will, of course, drop in conse-"quence of the dissolution." With regard to this attempt to renew the existence of the Transfer Bills, it would appear that, as these measures are opposed, the utmost the Council can hope for is to get them taken up next year from the position at which they have now arrived. But there is an apprehension that the proceedings before the Hybrid Committee will have to be gone over again. The Bills of the Chelsea and Lambeth Companies are also suspended by notice.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SECOND ANNUAL GENERAL MEETING,

HELD AT THE

QUEEN STREET HALL, EDINBURGH, June 11, 12, & 13, 1895.

Robert Mitchell, Esq., President.

PAPERS AND DISCUSSIONS.

THE MANAGEMENT OF, AND REMUNERATION TO, GAS WORKERS.

By John M'Crae, of Dundee.

It is with considerable diffidence that I appear before you to-day, and for this reason: Your Institute has ever been so practical in its dealings with the profession, and the response to appeals for papers has been so unanimous, that it seems the very essence of difficulty to fix upon a subject that has not already been thoroughly dealt with. This, then, was the writer's difficulty—fearing I would be unable to add anything of importance to the literature of the gas profession. However, the kindness, and the repeated kindness, of your President and your Secretary (a form of kindness for which, I believe, presidents and secretaries are conspicuous) in begging and re-begging papers prevailed; and I appear to-day with a short paper, the title of which is not in any way inviting. If it falls short of your expectations, I hope you will extend to the writer your kindest forbearance. One thing I am sure you will not grudge me—that is, showing the desire at least of contributing, even in a small degree, to the usefulness of the excellent Institute under whose auspices we are met.

It must be within your knowledge that for several years relations between employers and employed have not been at all satisfactory. Disputes, difficulties, and disturbances have taken place, which in my opinion—especially in regard to gas-works—might have been averted by a conciliatory spirit all round. Gas-works occupy a somewhat isolated position. As a rule, only one works (or, at least, works under one authority) exists in any town or city; and therefore there is no opposition or competition—nor, indeed, can be—and the engineer should be master in every sense of the term. If this idea is correct, then there devolves upon the engineer a responsibility which is by no means light; and if the management is carefully and thoughtfully carried out, then, and in that case, we do not require any assistance or interference from any outside institution whatever.

In the first place, I think it will be admitted that a certain class of gas-workers have very hard and exhausting labour to perform—I refer specially to our gas stokers; and if we are agreed in regard to this matter, it is quite clear that we should so adjust their hours of labour, as to make the strain on their systems as light as possible, consistent with good work, faithful service, and satisfactory returns. The hours of a gas stoker should in my opinion be eight per day; and allow me to quote the experience we have had in Dundee, which I will do as briefly as possible. What I am about to speak of, refers almost entirely to the Dundee Gas-Works.

It is now 24 years since we introduced the eight-hour system, prior to which the men and their mode of working were in a strange state indeed. Twelve hours' work in any retort-house must be a trying and a tiring task; but I am met at once by the statement of a gas engineer of large experience, to the effect that the stoker does not work the whole of his shift, he may be only employed for a portion of the time. This may be perfectly true; for no flesh and blood could possibly charge and empty retorts hour after hour. But is it not a fact that, even if our stokers are not doing constantly such work as I describe, their surroundings are of the most objectionable nature—heat, dust, smoke, and many other contributaries to anything but a comfortable occupation?

When the hours of labour were twelve per day, what was the state of matters? Leaving their work at the end of the day, the men were thoroughly exhausted, or as we

would say in commonplace language, "pumped out." No wonder, then, that they should fly to stimulants of a temporary and unsatisfactory nature; and one could see that their life to them was no enjoyment. The men were worthy men; and I am quite glad to have an opportunity publicly of speaking to their conduct and character. But supposing you think of the change of shift. A man comes to his work at 6 p.m., and he is confined, or partially so, in the retort-house till 12 o'clock noon of the following day. Can anyone listening to me consider, in all fairness, that this is proper treatment of the working men who were so employed?

Now, gentlemen, do not think that I appear before you as a Labour candidate; but allow me to point out that I consider kindness and consideration extended to your workers, is a certain mark or indication of shrewdness, and for this reason: As I have already shown, the twelve-hour shift was wrong; and what has taken place since the introduction of the eight-hour shift is sufficient warranty for what I am about to say. This change in the hours of labour has wrought what I might describe as a miraculous revolution in the conduct of our workers in the retort-houses. The men are practically as fresh at the end of their eight hours as they were at the beginning; and after having their bath, they go home like sensible men, able to take an intelligent part in their family circle. In speaking of this, I do not know whether the erection of bathrooms in gas-works is universal; but I would strongly recommend it, and from what I have stated you will not be surprised at my suggestion.

The next point to which I would make reference is the cost of the alteration in the hours of labour; and this must be an important factor in our calculations. When our men were working on the twelve-hour system, their rate of pay was 4d. per hour; and one could scarcely expect them to accept two-thirds of their former income. This would be unreasonable. We, therefore, arranged with the men that, when the eight-hour shift commenced, their rate of pay should be 5½d. per hour, which meant 3s. 8d. per day, as against their previous 4s. per day. So that the men suffered somewhat; and so did we. Owing to the increase of wages all over the country since the period I refer to, this 5½d. has gradually crept up to 7d. per hour, at which rate it now stands. This certainly means an increase in the cost of management of our works; but I am quite certain that the great majority of gas consumers in our country would not grudge an extra penny or two per 1000 cubic feet of the gas they consumed, when they knew that, but for this penny or two, the men employed in producing the article which adds so much to the comfort and brilliance of their homes, would be subjected to unnecessary exposure and hardship. Speaking in the abstract, the eight-hour day has been a great improvement; and none feel the improvement more, or to a greater extent, than the men themselves. Surely it is more pleasant for ourselves, as gas engineers, to see good results obtained at the least expenditure of bone and muscle of our workers.

Leaving the retort-house, careful attention should, I think, be paid to two other departments. We have spoken of the stokers as being subjected to considerable physical exertion, and to work of an exhausting nature; and there is another class of men who are not subjected to the same strain physically, but have responsibility, which upon the surface may be considered light, but which I am certain every thoughtful gas engineer of experience will consider of great importance—I refer to our valve-men and syphon-men. It may be, and no doubt is, within the recollection of you gentlemen, that on more than one occasion in the inquiry after a railway collision, very pointed and serious comments were made on the long hours of signalmen; and it was also (if I am not mistaken) clearly shown that at least one very serious railway accident resulted from the over-work and consequent exhaustion of the signalman. Well, come to the gas-works, our syphon-men, valve-men, and pump-men, are practically constantly employed. Their work is of an important nature, demanding their visits to nearly every part of our works at regular intervals; and we all know what would be the result of neglect in this department. Having a day of eight hours, and having secured men who acknowledge and can see the responsibility of their work under such an arrangement as I have indicated, we have excellent service, and not an overstrain on the men employed.

One other department to which I feel I must refer—and one I am sure you will all admit is amongst the most important in our profession—is the distribution, and the men employed thereunder. It must be agreed that the distributing department is the one furthest outside the personal control and management of the engineer; and consequently a great amount of responsibility is left in the hands of our subordinates. In the first place, I would say, offer every encouragement to the ready and speedy turning out of workmen during the night to attend to escapes of gas, or other unforeseen circumstances. It is not natural to expect a man to leave his comfortable, although probably humble, home in the middle of a winter's night to attend to any complaint of a nature such as I have indicated, without some substantial remuneration. And allow me to say here, gentlemen, that, having had experience of more than one serious explosion, and been the observer of several cases of suffocation, I feel very much the importance of the subject and the department I am dealing with; and I would strongly recommend that every encouragement should be offered to our employees in this part of our work. It has suited us well in Dundee; and so far as I can see, nothing has been left undone to place the distribution on the best possible footing.

Our arrangements are these: When a pipe-layer or his foreman is called out after working hours, whether with cause or without cause, he receives two hours' wages, and thereafter time and a half; and in cases of extremely severe weather, or on special occasions, refreshments are provided. The result is, by all these arrangements, together with other acts of carefulness, we have been able to reduce our leakage or unaccounted-for gas from 24·641 per cent. to 8·505 per cent. Before leaving this department, one suggestion I would make is to supply all policemen in the city with cards containing the names and addresses of gas officials who may be called upon, by day or night, to attend to escapes of gas. This simple arrangement we have found to work well—aided, of course, by our Chief Constable.

And now, gentlemen, before bringing my paper to a close, there is one class of workers to which I have made no reference—namely, the gas managers; and I feel to be treading on very tender ground, for this reason: I do not wish to appear as the champion of the profession to which I belong; but of one thing I am convinced, that the gas managers of this country have not been well treated. Do not mistake me when I use the words "well treated;" but town councillors, commissioners, or directors, have not the least idea of the difficulties and troubles attending the office of every gas manager. An eight-hour day with them is a thing they read about, but very rarely experience. They must be ready at all times for any emergency; and without any extra remuneration whatever. Now, I would not advocate bringing down the manager to the level of getting (say) time and a half for extra services rendered; but I think he ought to have, to start with, a living wage, or, as would be considered in his case, salary. Imagine this case, which took place quite lately: A gas manager wanted to take the control of a fairly sized gas-works. He must, in the first place, be an engineer; have a thorough knowledge of the manufacture and distribution of coal gas, according to principles embraced by all modern improvements; be quite conversant with regenerative furnaces, and the working-up of residual products; also be able to inspect meters and keep books and accounts. For all these accomplishments, he is offered the munificent salary of £150 per annum, with no emoluments of any kind. Now, a gas manager has to live, and be presentable to the public at all times; and I affirm that in very many cases in our country, it is next to an impossibility for the poor manager to keep his feet clear on the miserable salary he receives. I know of many cases of managers of moderate sized works, careful, anxious, diligent, and thoughtful men, who have large families simply battling with the elements (as it were), and struggling for a decent kind of existence.

Gentlemen, these things ought not so to be. A good paying gas concern should extend to their manager a share of their success; and in nearly every gas undertaking that is not a financial success, the blame lies somewhere else than with the manager, so that he should not be made to suffer. The great difficulty lies in the remedy; and until companies and corporations realize the importance of gas-light in their communities, so long will it be that in many cases those responsible for the due and economical

production of such light will have to go only partially rewarded for their services.

I have now briefly reviewed the departments of gas-works to which the title of this paper refers. I might have alluded to the Sunday labour question; but that has already been dealt with by a very competent gentleman. I might also have referred to the public lighting staff; but this department I thought would not present points of sufficient interest to you. But of one thing I am sure—that it is the duty of every gas engineer to frame rules for the guidance of his workmen, and the control of the work, and make certain that these rules are enforced; and the very fact that they are enforced, means that discipline governs the whole undertaking.

Discussion.

Mr. H. Tobey (Malton) said he was heartily in sympathy with Mr. M'Crae with regard to the position of workers in gas-works. They should receive every consideration; and everything possible should be done to ease the heavy labour they had to perform. If Mr. M'Crae paid his men 7d. per hour for an eight-hour day, that was 4s. 8d. a day, which was not an exorbitant rate for gas stokers. Many received a larger rate than that. It had been the general view that, where the hours of labour had been reduced, the quantity of work performed had not been lessened in proportion. In some cases, it had even been increased—notably in the case of a firm of engineers near Manchester, who reduced their hours from nine to eight, and found that the quantity of work performed in the eight hours was absolutely more than that performed in the nine. He (Mr. Tobey) apprehended that, when the alteration was made from twelve to eight hours at the Dundee Gas-Works, the number of charges was not reduced in like proportion. If a man put in thirty charges in his twelve hours, he would like to know what number of charges he made in the eight hours. He should also like to know the quantity of coal carbonized per man.

Mr. William Carr (Altrincham) was personally much obliged to Mr. M'Crae for his paper, which was, if not the first, at all events the most humane note sounded in the Institute since its commencement. It was well that gas managers should try to realize that there was another point of view besides that of the gas manager himself. One or two illustrious members of the profession—notably Mr. Livesey—had interested themselves in the condition of the people in their gas-works; but whether these efforts were likely to be successful, he (Mr. Carr) could not say. The paper entered on the threshold of the great labour question, which was exciting a great deal of interest in the country, and would excite still more in time to come; and he (Mr. Carr) desired to carry the subject a step farther. He, like Mr. M'Crae, was not a labour candidate; nor was he a socialist. He was not even a believer in "Collectivism;" but he should like to have a little more consideration on the part of gas engineers for those who had to do the hewing and carrying. At the last meeting of the Institute, Mr. Stelfox read a paper—for which he had, he thought, very properly received the first premium and the President's Medal—in which he stated that "to produce six million cubic feet of gas with a particular form of apparatus, the service of 20 to 24 men would be required. To make this quantity of coal gas the previous season, they employed 340 stokers; and he added that, in submitting these figures to an assemblage of gas managers, comment was needless." What was the inference to be drawn from that sentence? A little later on, he said that 8 active men would be able to do the same work—meaning, of course, that it was better to use 8 men than 340. That was apart from any consideration of saving or cost. The plain inference was, wherever it was possible to reduce the number of men, and throw a number of hands out of work, it was desirable to do so. Mr. Stelfox did not say so; but that was the inference he drew. Mr. William King, of Liverpool, speaking on the subject at the meeting of the Institution of Gas Engineers last May, was reported in the Journal of Gas Lighting for May 21, to have said: "Quite independently of the economical production, came the questions of finding a market for coke, and being more or less independent of cannel proprietors, and the possible solution of the labour question. For, however amicable the relations might be between employer and employed, they would all agree that, if they could use 20 instead of 200 men, it was in every respect very much better." He (Mr. Carr) should like to know what it would be in the view of the 180 men who were turned out, and who had their wives and families thrown on their hands, with no prospect of supporting them. Mr. King opened the discussion on the paper; and he was followed by many eminent gas engineers. But, so far as he had read, they all agreed—there was no one who took the slightest exception to this most inhuman expression. Mr. Livesey was not present, and was probably too busy to read the proceedings of the Institution; and, therefore, he had not since taken exception to it. The President of the Institute, in his excellent address the previous Tuesday morning, said there were some 55,000 to 60,000 men employed in this department of work. If they could by sending money over to Russian oil merchants throw out some 40,000 men, and increase the difficulties of the unemployed question, would it be desirable to do so? Was it a thing they should consider an advantage, because it would lessen their troubles? He had heard it stated that men who had brought an industry into a community, and employed a large number of men, were benefactors of the community, because they invested their capital for the benefit of the working people of the district; and yet they were told, in cold blood, that it would be better in every respect—apart from any economical considerations, and however amicable the relations between the workers and the employers might be—to do with 20 men instead of with 200. He (Mr. Carr) thought that Mr. M'Crae had done good service by setting the example of considering the other side of the question—the stokers' side—because the gas company or the corporation depended for its success on these very people whom they were going to throw out of employ. These men were gas consumers as well as stokers; and they formed a part of that vast community which gave the gas company or corporation the power to trade and make dividends. He was very glad that some expression should go forth from the Institute that this was not the opinion of the whole of the members.

Mr. Norton H. Humphrys (Salisbury) did not think that the substitution of the eight-hour for the twelve-hour system could be universally adopted. He was quite in sympathy with every word that had been said about having due regard to the working man; and he could quite understand that in a large works the eight-hour system was an excellent one, and that it might be substituted with advantage for the twelve-hour shift. But there were works of all sorts and sizes; and it should not go forth as a universal rule that the eight-hour shift was the only right mode of working. They had different classes of workmen to deal with. He had been accustomed to work the twelve-hour system; and most small gas-works in the South-west did the same. The class of men they had to deal with were extremely slow; they did not get through anything like so much work in the twelve hours as was done in large towns in eight hours. Some time ago an advertisement was inserted in his local papers, offering gas workers a large remuneration if they would stand in on a particular occasion when help was needed in London. Two or three of their men went up and tried it; but they soon had enough of it, and came back in a week or two, and went on very contentedly with the twelve-hour system. He believed in a good rate of wages; in considering the men with regard to Sunday labour and annual holidays; and in offering a remuneration somewhat above that prevailing in the district, so as to attract a superior order of men. But to introduce the eight-hour system in place of twelve hours would be simply unnecessary in many places.

Mr. Chas. A. Craven (Dewsbury) said he was in entire sympathy with the views enunciated in the paper, and could confirm by his own experience the fact that there was very considerable benefit in reducing the hours of labour from twelve to eight a day. He thought the hours ought to be lessened not only with regard to stokers, for eight hours was quite enough for any man to work under ordinary requirements and circumstances; and he was sure that the subject would have to be considered—perhaps not all at once, but by degrees. It was often said that, if better wages were given, and more time to stokers, they would employ it in an improper way. No doubt some of them did so; but he could give his testimony to the great moral and social improvement that had taken place in the stokers he had to do with. Some 20 or 30 years ago, when the children used to come and bring the day-meals for their parents, they were clad in a very inferior way from what they were at the present time. On Saturday afternoons,

he often met his men who had been stoking during the day decently clad (and sometimes smoking a cigar); and he was very pleased to see it. They should all try to improve the status of the workmen. He was very doubtful, however, whether the consumers would cheerfully pay 1d. or 2d. per 1000 cubic feet more for their gas supply in order to arrive at these results; but they would have to be conceded sooner or later.

Mr. W. Hardie (North Shields) said he had had some experience of the change from the twelve to the eight hour system; and he certainly thought that, in large works at any rate, it ought to be done, and might easily be done with a very small increase of cost. Under the eight-hour system, the men certainly did very much better work. Still there were cases in which it might be impossible with advantage either to the consumers, the company, or the men themselves, to work these short hours. In the case of very small works, where only two or three men were employed—one on the day shift, and one on the night shift—he thought it would be more advisable to have two men, one on each shift, who were paid 5s. a day, than to have three men whose wages were cut down to a low figure, and who would not do the work so well. He must make one remark with regard to what Mr. Carr had said, because it was rather a misrepresentation of their position to suggest that they were endeavouring to cut down the number of men employed in their works. The tendency of late years, ever since the introduction of machinery, was to cut down the number of men in all manufactures; and he (Mr. Hardie) thought that it was a very just and laudable endeavour. If the number of men was reduced, the cost of production was reduced; and that was the chief object to be kept in view, provided they did not introduce what was called "sweating." He thought retort stokers who were paid about 5s. 6d. a day, with many privileges (as they were in large works), such as time-and-a-half for extra work, and two days for Sundays, and holidays in the summer, were well off; and if the number of men were reduced from 200 to 20, and still paid a reasonable living wage, they as managers were perfectly justified in doing it. Gas engineers were not called upon to take up this subject, which was going forward irrespective of what could possibly be done by them, and try to stem the tide of workmen being thrown out of employment. If they could open up new channels and employ more men, that was all right; but to keep men employed simply for the purpose of keeping them employed, when a smaller number of men could do the work equally well, was not to be considered.

Mr. J. Stelfox (Belfast) said Mr. Carr had taken the unusual course of not only discussing one of last year's papers, but also a paper read before another Society; and as he called in question the views he (Mr. Stelfox) had expressed last year, he must ask permission to say a word or two. The actual meaning of the expression quoted from his paper was simply this: They had been accustomed to a system under which a number of men—the only men in a town available to do the particular class of work—at short notice (within 24 or 48 hours, and sometimes in 6 hours) had threatened to put a stop to the manufacture. As each of these men was doing as much work as a man could do—the work being severe while it lasted—their difficulty would have been that probably they would have had to get two or three men to do imperfectly the work that was done by any one of these skilled men; and they could not certainly, even after training, expect any man to do more. The comparison which he drew was that with carburetted water gas a man was paid, not for his bone and muscle only, but for his intelligence and attention. So that, if called upon in an emergency to do three times as much work as he was asked to do in his daily task, he could well do so. On more than one occasion, he had been called down from his house, because the men would not wait until the following morning to hear what had been done by the Gas Committee. In such cases, any manager who was practically put to the torture, because for the moment the men found themselves in a position of power, could readily appreciate the great change when he felt that half-a-dozen willing men, who had the interest of the place at heart, could save them in such an emergency. He thoroughly approved of everything in Mr. M'Crae's paper, as regarded the principle of paying men handsomely and not overworking them; but the remarks of Mr. Carr would seem to tend to this—that the engineer's duty was to see what was the greatest good to be done to the stokers, forgetting that behind the stokers there was a large community by whom they as gas managers were paid to see that the community was served. If a number of men took advantage of a momentary position of power, and chose to make unreasonable demands (and they often were unreasonable), and they, in order to save the supply to a town, were obliged unwillingly to yield to these demands, they were putting the whole community under a tax which they were not willing to bear. Everything depended upon the way in which a thing was put. He was not conscious at any time of having been a taskmaster to his men; but at the same time, he preferred not to be so thoroughly in the hands of a few men who were sometimes "put up" by outsiders to make unreasonable demands, involving a complete stoppage of light to a large community.

Mr. W. W. Hutchinson (Barnsley) said he must take exception to Mr. M'Crae's statement, where he claimed to have shown that the twelve-hour system was wrong, and that it put too much pressure on the stoker. He objected to Mr. M'Crae's conclusions, and stated that there was a popular misunderstanding that the twelve-hour shift meant twelve hours' work. This was not so; for the so-called twelve-hour shift simply meant two shifts in the 24 hours. But the men were not on the works more than 10½ hours; nor did they work more than 6½ hours in the day, either at light or heavy work. He had had the work carefully timed in the past, when it was a matter of some importance to his Company; and he found, from a careful average of old experienced stokers as well as new ones, that 4¼ or 4½ hours was the fullest extent of labour, such as the public usually understood when they talked of twelve-hour stoker work. The other two hours (making 6½ hours total work, and 4 hours absolute rest) were simply light work, that any strong lad could easily do. Even some of the stokers of the present day, if they were left free from any outside influence, would themselves object to the eight-hour shift, because it would crowd out a number of stokers simply from inability to perform the eight-hour shift in the manner required. In many cases, there was nearly as much work to do in the eight hours as in the twelve; and consequently a man not quite in his prime was turned out to a lower order of work. Though he agreed with the general tenor of Mr. M'Crae's paper, and the good intention expressed by several speakers, he thought there was a great deal of well-intentioned, but quite misplaced, sympathy; and they need not trouble at all about the matter, for the gas stoker of the present day was very well able to take care of himself. He (Mr. Hutchinson) came from a place where they paid their stokers about the highest wages in the country. He took exception also to Mr. M'Crae's statement that a spirit of conciliation would often avoid the disputes which had arisen. He knew a place where this spirit of conciliation, and good treatment, and excellent wages had been tried for 25 years; but it was not a bit of use as against other advice given to them by parties who neither found them work, paid them wages, or meted out good treatment. He approved of the spirit of conciliation, and still practised it; but he regretted it did not have the effect Mr. M'Crae put so strongly forward. With regard to gas managers, he did not want to say much; but he agreed there were many cases in which the influence of the Institute ought to be used to protect the gas manager. He had no reason to complain himself. But he did notice, with great sorrow, the ridiculously low salaries offered in advertisements for certain services; and he had heard of many cases where managers had not been properly treated by town councils and other public bodies. In such cases, he thought the influence of the Institute ought to be used in a proper and careful manner to give the members timely support.

Mr. Denny Lane (Cork) was much surprised to hear the observations made by Mr. Carr with reference to the question of employing a larger number of men instead of a smaller number. He did not think anything could be more inconsistent than his conduct, because he had ascertained by minute inspection that the garments worn by Mr. Carr were woven and spun by machinery. If, however, the wool had been hand-spun, and hand looms had been employed for these purposes, there would be a very much larger number of people employed on them than at present, Therefore, nothing could be more inconsistent than for a

gentleman who, in practice, wore clothes made by machinery to object to the introduction of machinery in gas-works. It was a great mistake, if one took the whole community together, to suppose that there would be any reduction in the amount paid in wages by the introduction of machinery. If one took Lancashire and Yorkshire before the introduction of the spinning-jenny and the power-loom, there was not one person employed in these counties in the manufacture of textile fabrics for a thousand who were employed now. If it was possible to produce any article more cheaply by machinery than by hand labour, the inevitable laws of political economy would compel the manufacturer to produce that article in the way in which it could be made most cheaply. In consequence of cheap cost and low price, the consumption would increase. Here, to a certain extent, they had protection against articles manufactured in Germany. Gas, although sometimes made portable, was not quite portable enough to be brought over from Germany; but, if they carried out the system of employing the larger number of hands instead of the smaller, the effect would be that articles manufactured abroad would be imported here, and a smaller number of men would be employed than at present. It was only right to take the whole community together—the consumers and proprietors of gas-works, as well as the people who produced the gas; and then he did not think it would be any benefit to anyone to employ 200 men instead of 20. No doubt there would be a certain amount of difficulty in the transfer of men from one industry to another; but that was inevitable to all improvements.

Dr. Stevenson Macadam (Edinburgh) said that this was a point on which a scientific expert would not be held capable of giving a practical opinion; but he hoped the meeting would acknowledge that even a scientific expert might have some common sense, or what was known in the North by the term of "gumption." It appeared to him that, under the circumstances of the different sizes of gas-works, one hard-and-fast rule could not apply. In works where a large number of retorts required to be looked after, the eight-hour system might be carried out with great efficiency and advantage; whereas in the smaller class of works twelve-hour shifts would not be too hard for the men. No doubt, this subject was one which, after the expression of opinion given by so many managers, might be fairly left for any intelligent manager to decide for himself with reference to the special circumstances of his own gas-works. There was one point in the paper which he (Dr. Macadam) was very pleased to observe—showing the care which the author (and no doubt other managers) took of their men—where Mr. M'Crae referred to the desirability of having bath-rooms for the men, which they could use before leaving the works. He had occasion lately to examine into somewhat similar works (so far as the stokers were concerned) all over the kingdom—namely, the refuse destructor works employed for the destruction of the refuse of towns; and he was glad to say that in several of these works, where they were carried out with intelligence, baths were provided. It appeared to him that the introduction of baths in gas-works, to a certain extent, where the men might clean themselves and change their clothes, was a movement in the right direction, and would enable the men to leave the works not only as sensible men, but as cleanly men.

Mr. Alderman Miles (Bolton) said he rose with some diffidence to say a word or two on this subject; but he felt bound to do so for several reasons. If members would carry their minds back to the meeting at Carlisle four years ago, Mr. Charles Nickson, of Manchester, read a paper on the relations of companies and corporations with labour. At that meeting, he (Mr. Miles) stated, along with other gentlemen, that he thought if proper conciliatory measures were meted out to the men, disputes either of one kind or another might be satisfactorily bridged over. That was his opinion at the time, because he had had considerable experience in the settlement of a dispute which had just arisen at that time. He regretted that he could not speak now in so hopeful a strain. It was said that an ounce of practice was worth a ton of theory; and, unfortunately, he had since had some experience which led him to come to a somewhat different way of thinking. At the beginning of last winter, if Mr. M'Crae had had a demand from his stokers—not through the stokers themselves, but through the wonderful Association which they now had, named the Gas-Workers' Union—that all Sunday labour should be paid for double time, he thought he would have been somewhat startled. But that was their condition at Bolton; and also a demand for 10 per cent. increase in all labourers' wages. Such a demand could not be acceded to. They had for many years made it a point of being conciliatory to all their employees. They introduced some years ago the eight-hour system, and granted 5s. a day; and he was bound to say that he thought it was the right principle, and that it had worked remarkably well. But when one boon was given and another boon was given, and one kept giving them year after year, and then just at the beginning of winter a fresh demand was made, it became almost intolerable. They could not see their way to grant what was demanded; and he feared serious trouble. It was a matter of weeks' negotiation; and many hours were spent, in conjunction with the representatives of the Association, before they could come to a conclusion. They had actually to be told at last that, if something could not be done by way of mutual concession (and it was only at the last moment that it was done), they would have to resort to stoking machinery. To this the men responded that they must take their chance if it were so. While he was willing to concede that consideration should be shown to the men to the utmost, it must be acknowledged that at times they were exceedingly difficult to deal with. A case occurred to his mind where he was sent for to the works one day by the engineer on a small matter apparently to a gas manager. They had two beds of retorts with eight mouthpieces each. One of the retorts had fallen through owing to long usage; and the men were asked to put in the quantity of coals that should have gone into that into the remaining fifteen retorts. They absolutely refused to do so; and not less than 70 or 80 of the men struck work and left the retorts—the ground of their refusal being that they could not put the extra quantity in the retorts, which was an absurd statement to make. It was pointed out to them, in unmistakable language, that the work could be done, and would have to be done; and the Conspiracy and Protection of Property Act was pointed out to them. They only then reluctantly went to their work. He merely mentioned this circumstance as one of those little matters which might come under the cognizance of a gas manager any day; and although they were very anxious to be conciliatory, yet in the future there was a great deal of trouble before them with regard to the labour question. It had been said what an excellent thing it was to provide baths for the workmen. They did so at Bolton; but they were hardly ever used. In fact, they did everything they could to make the workmen as comfortable as possible; but what the workman wanted was as small an amount of work as he could get, with as large an amount of pay. While he (Mr. Miles) was saying this, he was bound to mention that this trouble did not come from the majority of workmen themselves. It was from a few men who took on themselves the position of leaders, and who were never content unless they were making some fresh demand.

Mr. T. Duxbury (Darwen) said he well remembered the Carlisle meeting and Mr. Alderman Miles's speech, which he considered at the time to be rather truckling to the workmen. That was his opinion after the experience of a strike he had had at his own works. There seemed, however, now to be a turning round in the opposite direction of both Mr. Alderman Miles and Mr. Carr. He did not quite understand the humanitarian view which had now been adopted by Mr. Carr, seeing that it was so short a time since Mr. Carr wrote a letter from Stalybridge criticizing the Halifax gas engineer's annual report, when he said that he "was not aware that the gas-works was a charitable institution," or "that the retort-house was a convalescent home." He (Mr. Duxbury) thought that the workmen were thoroughly well able to take care of themselves; and if they were faithfully treated, without truckling to them too much, they (as gas managers) would be able to get on perfectly well with them. Mr. Mr. M'Crae referred to the gas manager's position; and smarting as he (Mr. Duxbury) was under such treatment as he presumed Mr. M'Crae was referring to, he felt very strongly on the point. He had principally to complain of one man, who had been able to do more against him than the whole twenty-three others on the council could possibly prevent. He thought members of town councils should feel that, where they found the gas manager was being persecuted at times, it was the duty of the other

members of the council to protect their servant. In his own particular case—which he only mentioned as a sample—the remaining members of the town council had not cared individually to take much action in defence of their servant, who very often was precluded from defending himself. Now, when things came to their present position, the very men they had been speaking about—the stokers and labourers—turned upon the town councillors, and told them they ought to have protected the manager. This showed, at any rate, that the workmen had some common sense, and some sense of fairness even towards their manager. If they treated the men fairly and squarely, without truckling to them, they would find them perfectly well able to reason; and no one knew better than the men themselves when they were treated fairly. With respect to the paragraph in the paper about gas managers, he hoped, if it ever fell to his lot to have an opportunity, he should certainly have something to say in defence of gas managers with respect to the personal spite or splenetic action of individual members of town councils. In his case, a man got on the town council; and there was not the slightest doubt he went for one particular purpose. Some councillors did not scruple to say that no man—the town clerk, surveyor, or anyone else—ought to have more than £2 or £3 a week; and they stuck to this principle, and worked for it. He was glad to think it was not so in a large majority of town councils. The treatment referred to in the paper, did obtain in some towns; but he (Mr. Duxbury) hoped they would be fewer in future than they had been in the past.

The President said he had abstained from taking any part in the discussions hitherto; but seeing that Mr. M'Crae had touched on the eight-hour question, he thought it right to say that it was over twenty years since the Edinburgh Gas Company first introduced the eight-hour shift. It was brought about for two reasons. First, the twelve-hour shift was thought by the Directors at that time to be long for men to be engaged in such work; and, secondly, he thought by having an eight-hour shift, and increasing the wages, they would have a better class of workers. He was glad to say that this system had been entirely successful. It was quite a treat to see the workmen and their children—especially on Sabbath afternoons—walking about the streets clad as respectably any artizans in the city; and it had been a great pleasure to him, who had been with them so long, to see them, not only so respectful to himself, but so respectably attired. With regard to conveniences for the men, they had just completed a full set of conveniences—bath-rooms, washing places, lavatories, and everything desirable, and a dining-hall which could accommodate 70 men at one time. In fact, they might almost have Sabbath afternoon service in the hall. With regard to the treatment of gas engineers by town councils and corporations, there was no doubt a great difference in different places. Some corporations were solely composed of gentlemen who spurned the idea of doing any injury to the influence of their officials. Others seemed to have no consideration for the feelings of their officials; but he hoped these were exceptional cases.

Mr. M'Crae, in reply, said he believed the discussion had been more valuable than the paper itself, especially as one speaker had criticized what another had said. Most of the gentlemen had spoken kindly with regard to the paper, for which he was obliged. Mr. Tobey referred to the amount of work performed by stokers. It must be understood that to reduce the hours of labour, and to increase work, would be no improvement to the men; and what he (Mr. M'Crae) wanted to see was an improvement. Therefore, he put it as two-thirds of the work and two-thirds of the hours. He could not say off-hand the number of tons of coal carbonized, because there were so many different systems employed in the works. Mr. Hutchinson spoke about the stokers working 10½ hours, which was called twelve hours; but he would observe in the paper that he (Mr. M'Crae) had dealt with this matter, and pointed out that, if the men were not actually filling and emptying retorts during the full twelve hours, their surroundings were very objectionable. They were not allowed to leave the place, on any consideration, except through illness—if they went out of the works, they must have a pass; and to talk about the exact number of hours the men were at hard work was all nonsense. They had to be there. Of course, he did not say they had all to be on exactly the same level; but how would Mr. Hutchinson himself like to be sitting down on a coke-heap to take his dinner, with all the heat, smoke, and dirt about. It was a good deal worse than charging a retort. It must be called a twelve-hour shift, if it was called anything at all. Now to deal with the gentlemen from the South. It must be quite refreshing to come from among those tumultuous people south of the Tweed to Scotland, the land of peace. Mr. Alderman Miles and his dirty stokers, and Mr. Duxbury and his cantankerous town councillors, he was happy to say they had no experience of in Scotland. They had baths at the Dundee Gas-Works, which were regularly used; and he did not see one stoker leave the place unless his face and clothes were clean. In fact, they enjoyed the baths very much; but, of course, they were cleanly people in Scotland. Mr. Hutchinson said his men would not vote for an eight-hour shift if it were offered them. His (Mr. M'Crae's) men would not go on a twelve-hour shift if they were asked. But this required some education; and they were certainly an educated race in Scotland. They had too a Conspiracy and Protection of Property Act in Scotland, which was posted up in the works; but he had never had to point to it. They were told by ministers, that if they wished to understand one verse of a chapter they must read the verses before. Mr. Miles had told them about his great strike at Bolton. But he should like to read the verse before that; and know if the engineer was quite in touch with all his men. Perhaps he had carried out the opinion which had been expressed more than once, that the stoker should take care of himself. Well, he was taking care of himself when he was going to strike. He said that gas managers should take care of a stoker as well as the works—to leave nothing undone for their comfort; to let the men feel that the manager was quite in touch with them himself; and that he was not only their master but their friend. He did not want to convert the works into a convalescent home; but he knew every man in his place, and every man knew him.

Alderman Miles said the engineer at Bolton was a Scotchman.

Mr. M'Crae was glad to hear it, but was sorry that he had fallen into such bad company. Mr. West referred the other day to converting labour into a pastime; and many of the members laughed, and seemed to think it was a burlesque. But he (Mr. M'Crae) thought that it was a beautiful little speech. What did it mean? It meant making the labour light. Men should be treated as men, and not as if they were machines. They were not demons, but human beings like ourselves; and they should be treated as such. They would all admit that golf was a pastime; but it was hard work all the same. So in a gas-works, as Mr. Carr said, there was a human feeling which ought to come into play in all their relations with their men; and every consideration should be shown them. But, at the same time, they should not let them off with half work. He was glad to think the subject had been pretty well threshed out; and all the matters brought forward had been so amicably discussed.

MATTERS OF INTEREST IN CONNECTION WITH THE WASHING OF CRUDE COAL GAS.

By Lewis T. Wright.

In the following paper, the author proposes to review the washing or scrubbing process employed for the abstraction of ammonia from coal gas, both from the theoretical and the practical sides; to show in what manner the operation is limited in its various stages by the properties of the ammonia compounds that are produced; to give some data that may be useful to his colleagues in controlling the efficiency of the apparatus; and to present facts hitherto unnoticed that may serve to suggest improvements in the details of the operation, and help to reduce the quantity of extraneous water employed—water that serves mainly to reduce the strength of the final product, and, by increasing its bulk, adds thereby to the cost of its transportation and conversion into sulphate of ammonia.

The author believes it would be possible, in many cases, by reducing the quantity of water introduced into the gas-purifying process, to derive considerable advantage, both from the point of view of the illuminating power of the gas and also from the unnecessary bulk of gas liquor that has thereby to be dealt with. He has carefully tested in

practice all theoretical suggestions, in order to give greater security to their application, and has endeavoured to trace in the varying circumstances of practical examples the influences of the physical and chemical properties of the ammonia compounds that occur in gas liquor.

It is well known that the quantity of nitrogen—the keystone of ammonia—occurring in coal is not large, as it is also generally known that of this small quantity but a very small percentage afterwards appears in the crude coal gas as ammonia. Caking coal generally contains about 1¾ per cent. of nitrogen—rather less than more; and those coals that contain much less than that quantity (say, from 1 to 1·4 per cent.), are generally shales or cannels.

In the author's experiences, the caking coals contain from 1·56 to 1·9 per cent. of nitrogen; and of this amount they yield from 11·59 to 15·72 per cent. as ammonia on the distillation of the coal, according to the circumstances of the case. The proportion of the nitrogen so recovered is small; and yet it is important. The cannels generally contain less nitrogen, and yield less ammonia on distillation. The same coal will not always, however, give the same amount of ammonia. The author's researches* show that the formation of this body is affected by the temperature. At very low yields of gas per ton, the amount is generally lower than at moderate yields. When the make of gas is very high, there is also a diminution in the amount of ammonia.

The following tables will give some information respecting the behaviour of coals in regard to ammonia when distilled at different temperatures. The results were obtained as in practical work, and are the results of a seven days' average.

Caking Coal.				Cannel.	
Yield of Gas per Ton.	NH_3 per Ton of Coal.	Yield of Gas per Ton.	NH_3 per Ton of Coal.	Yield of Gas per Ton.	NH_3 per Ton of Coal
Cubic Feet.	Lbs.	Cubic Feet.	Lbs.	Cubic Feet.	Lbs.
7,856	6·4	7,512	6·39	7,125	5·9
8,547	6·5	9,431	7·50	7,835	6·2
11,128	5·7	10,162	7·89	9,679	5·4
..	..	11,620	7·41	10,047	5·3

There are possibly other influences at work that affect the yield of ammonia.

In order to show the proportion of nitrogen in different samples of coal, and the yields of ammonia, the following table is given of results obtained in practical working :—

Percentage of Nitrogen.	Pounds of NH_3 per Ton.	Percentage of Nitrogen found as NH_3.
	Caking Coals.	
1·90	7·42	14·3
1·67	5·47	12·0
1·75	5·97	12·5
1·67	6·29	13·9
1·68	5·79	12·7
1·73	7·42	15·7
1·74	6·43	13·6
1·88	6·29	12·3
1·59	5·79	12·7
	Cannel Coals.	
1·28	6·1	17·6
1·46	4·8	12·1
1·37	5·2	14·0
1·28	4·9	14·2

There is a class of coal that is commonly called cannel but that is not strictly speaking a cannel coal more than in name. This coal is found in different seams and is large, hard, and bright, and has the appearance of cannel. On distillation, it intumesces and cakes. It is further characterized by containing but little ash, and is therefore free from the earthy matters that are the usual characteristics of cannel. It yields about 19-candle gas, and is probably caking coal that, being free from charcoal layers and other "partings," is harder and not so easily broken.

This so-called cannel gives :

Percentage of Nitrogen.	Pounds of NH_3 per Ton.
1·7	7·8

And, therefore, as regards ammonia, as well as regards ash, illuminating power, and coke, it behaves more as caking coal than as cannel.

In the case of coal containing 1·7 per cent. of nitrogen (an amount which may be taken as an average for caking coals), in order to give 7 lbs. of ammonia per ton of coal, it would have to yield 15 per cent. of its nitrogen in that form. But caking coal may very well yield less ammonia even when every care has been taken to avoid loss of this valuable product. It will be assumed in this paper that the yield of ammonia is 6·8 lbs. per ton of coal. This amount is equal to 1·5 per cent. of the gas by volume, or 476 grains per 100 cubic feet in the gas as it leaves the retorts and before it commences to condense.

Accompanied with this alkali, there is a large amount of acid gases—viz., carbonic and hydro-sulphuric acids. The amount of these two acids that play so important a part in the washing process, varies much indeed according to the nature of the coal. The finest Yorkshire and Newcastle coals give the least carbonic acid. The Derbyshire Silkstone and Scotch splints give notably more, and the cannels generally very large quantities of carbonic acid. Of sulphuretted hydrogen, the cannels generally give the lowest amounts.

The following table gives the amounts of these impurities in various classes of coal :—

Impurities in Condensed but Unwashed Gas.

Class of Coal.	Carbonic Acid.		Sulphuretted Hydrogen.	
	Grains per Cubic Foot.	Volume Percentage.	Grains per Cubic Foot.	Volume Percentage.
Newcastle	12	1·5	9	1·4
Yorkshire Silkstone .	12	1·5	8	1·3
Derbyshire do. .	12 to 19	1·5 to 2·3	6 to 12	1 to 2·0
Cannels	30	3·7	3 to 6	0·5 to 1·0

The quantity of both these impurities is increased when the temperature of distillation employed is increased, as will be seen in the following table :—

Yield of Gas per Ton.	Grains of CO_2 per Cubic Foot.	Grains of H_2S per Cubic Foot.
	Caking Coal.	
7,856	16·92	3·16
8,547	18·38	4·69
11,128	19·37	5·87
	Cannel Coal.	
7,853	32·60	4·80
10,047	39·27	4·97

Though the ammonia in the gas is always accompanied with more than enough acids for its saturation, yet it is not combined with these acids so long as it remains in the gaseous condition. But any water that condenses from the gas containing ammonia, or that has been otherwise in contact with such gas, and therefore also contains ammonia, will contain both carbonic and hydro-sulphuric acids, and is not a solution of free ammonia, but a solution of salts of ammonia—salts formed by the combination of this body with different proportions of the two acids in question.

As types of the class of compounds that ammonia forms under these circumstances with the two acids in question, it will suffice for the moment to consider the two carbonates—the neutral carbonate $(NH_4)_2CO_3$, in which two volumes of ammonia are found combined with one volume of carbonic acid, and the acid, or bicarbonate, in which one volume of ammonia is combined with only one volume of carbonic acid. Thus, according to the salt formed, or if both salts be formed according to the quantity of each, so will one volume of ammonia be accompanied with either half a volume or a whole volume of carbonic acid, or an amount between half a volume and one volume in the case of mixtures of the two carbonates. In the same manner, there are two similar compounds of ammonia with sulphuretted hydrogen or hydro-sulphuric acid. It will be interesting to know in what proportion the ammonia combines in practice with these two weak acids. The two acids are both called weak acids, as they are easily displaced from their combinations by stronger ones; but the sulphuretted hydrogen is by far the weaker of the two. The ammonia thus combined is technically known as "free" ammonia. This expression is quite incorrect, however convenient it may be. It, however, has become ingrafted in our technical phraseology, and serves to distinguish the ammonia that is combined with the two weak acids—carbonic and hydro-sulphuric acids—from some, and a not unimportant quantity, that is combined with stronger acids. The compounds of ammonia with carbonic and hydro-sulphuric acids are destroyed at a temperature under that of boiling water, and the ammonia that they

* See *Journal of the Society of Chemical Industry*, Vol. VII., p. 59.

contain can, in consequence, be expelled from their solutions by the simple action of boiling. But, at the same time, the liberated acid gases are also expelled; and thus if the ammonia be re-condensed in water, the carbonic and hydro-sulphuric acid also condense, just as in the original formation of the gas liquor from the gas, and the ammonia compounds are re-formed. Thus the operation of boiling does not result in the final separation of the alkali, ammonia, from its attendant acids, but only to dis-union, though owing to the somewhat greater facility with which the acid gases leave the heated solution, the proportion of acid to the ammonia can be reduced by a simple distillation and recondensation in water of the ammonia. Thus it must not be understood from the use of the term "free" ammonia that the ammonia in question is free and not combined, but only that it is united to weak acids. There is a further amount of ammonia, principally as ammonium chloride, or sal ammoniac, equal to from about one-fourth to one-fifth of the total ammonia. The chlorine that furnishes this sal ammoniac is originally contained in the coal, and in the distillation is evolved as hydrochloric acid. This body forms the "salts" that are often found mixed with tar in the hydraulic or foul mains where the temperature is high.

It will be interesting to know what volume of the acid gases in question can combine in practical conditions with ammonia. The author has investigated this subject and finds that the amount depends on the degree of concentration of the gas liquor, and the temperature at which it is formed. It will be found in practice that in gas liquor of average strength, the so-called "free" ammonia is combined in the following proportions: For every 100 volumes of ammonia there are from 60 to 70 volumes of the carbonic and hydro-sulphuric acids.

The following table will show in what manner this so-called "free" ammonia is combined:—

Strength of Liquor. Ounces Saturation.	Per 100 Volumes of Ammonia.		
	Volumes of CO_2.	Volumes of H_2S.	Volumes of $CO_2 + H_2S$.
28·0	49·0	8·0	57·0
12·0	51·5	11·3	62·8
7·5	52·4	15·3	67·7
2·7	50·0	24·0	74·0
0·2	35·0	45·0	80·0

It will be observed that the weak liquor contains decidedly more acids in proportion to the so-called "free" ammonia, than the strong liquors, but that the increase is due to the increase of the weaker acid—viz., sulphuretted hydrogen. With the ordinary strengths, there is not a notable difference in the proportion of carbonic acid, which is the impurity that is expensive to remove. It will be observed also that the amount of acids relatively to the ammonia is larger than that required by the class of compounds $(NH_4)_2CO_3$ and $(NH_4)_2S$, or those of two volumes of NH_3 to one volume of CO_2 or H_2S, but not nearly large enough for the compounds $(NH_4)HCO_3$ and $(NH_4)HS$, or those of one volume of NH_3 to one volume of CO_2 or H_2S.

The proportion of the acids varies with the temperature of the formation of the liquor. For that reason, slight differences will be found at different seasons of the year.

As regards the influence of temperature, it will be found that at a low temperature there are more acids combined with the ammonia than at a high temperature, though the difference is not very important till a temperature of about 176° Fahr. is reached. It happens, however, in gas-works that in the case of gas liquor produced, for instance, in the hydraulic main, that for every 100 volumes of the so-called free ammonia, there are only about 35 volumes of the two acids in question, of which 24 volumes will be carbonic acid and 11 volumes of sulphuretted hydrogen. Thus when such liquor is cooled and used in the scrubbers for washing the gas, the ammonia it contains is able to combine with a further 30 volumes of acid gases, of which about 20 volumes will be carbonic acid and 5 volumes will be sulphuretted hydrogen.

The composition of the liquor from the condensers having a mean temperature of condensation higher than that of the finished gas, will also exhibit the influence of high temperature in containing a low proportion of carbonic and hydro-sulphuric acids to the so-called free ammonia present. Its composition will, of course, depend upon the mean temperature at which it has been formed. This liquor, besides being able to absorb more ammonia will also be able per 100 volumes of so-called "free" ammonia originally present to add a further 10 or 15 volumes of acid gases, which will consist principally of carbonic acid. This acid, except in the case of liquors of extreme dilution, is always the predominant partner.

Since, in the final product, 100 volumes of the so-called "free" ammonia are combined with but about 65 volumes of the acids, it will be seen how, even in the case of coals yielding the lowest amount of these, the ammonia is clearly insufficient to effect the removal of more than a small part of these impurities from the gas.

Of the total volume of ammonia in the gas, which will not much exceed 1·5 per cent. in any case, one-fifth will be found in the liquor combined with the hydrochloric and other strong acids; and there will be therefore only 1·2 per cent. left for combination with the carbonic and hydro-sulphuric acids—an amount only equal to the removal of 0·6 per cent. of carbonic acid and 0·18 per cent. of sulphuretted hydrogen—quantities that appear very small in relation to the total, especially in regard to such coals as those like the Derbyshire and Scotch splint coals and cannels, giving from 1·5 to 3·7 per cent. of carbonic acid.

It is commonly stated that water at ordinary temperatures absorbs 700 times its volume of ammonia gas; but this mode of stating the case, when taken in conjunction with the operation of washing or scrubbing, is deceptive and requires qualification, as the circumstances under which water absorbs 700 times its volume of ammonia gas are not such as occur in gas manufacture.

The quantity of ammonia gas that water can absorb is dependent, among other things, on the pressure of the ammonia gas; and in order to make the common statement intelligible, it is necessary to add that water at ordinary temperatures absorbs 700 times its volume of ammonia gas when the pressure of the ammonia gas is equal to that of ordinary atmospheric pressure.

Since the quantity of ammonia in the crude gas is only 1·5 per cent. by volume, its pressure can only at the maximum be 1·5 per cent. of the total pressure of the gas, which is practically atmospheric pressure, and is therefore only equal to about 0·45 inch of mercury. The following table will show the quantity of ammonia absorbed by water at various *pressures of ammonia*, and is borrowed from Sims:—

Ammonia Absorbed by Water at Different Pressures at 68° *Fahr.*

Pressure Inches of Mercury.		Grains of Ammonia per 1 Grain of Water.
0·00	..	0·119
3·94	..	0·158
7·87	..	0·232
11·81	..	0·296
15·75	..	0·353
19·68	..	0·403
23·62	..	0·447
27·56	..	0·492
31·50	..	0·535

Not only has a solution of ammonia a tension that varies according to its strength and temperature, but the solutions of its easily dissociable compounds with carbonic and hydrosulphuric acids have in the same manner a tension of ammonia—a tension that exerts a very important influence in the operations attending the removal of ammonia from the coal gas by scrubbing or washing with gas liquor or water.

The maximum tension of ammonia gas in coal gas is only about 0·45 inch mercury; and we have consequently to deal with tensions that are too small to be shown with clearness in the above table, which is only inserted in order to show how the ordinary method of stating the case is wanting in completeness.

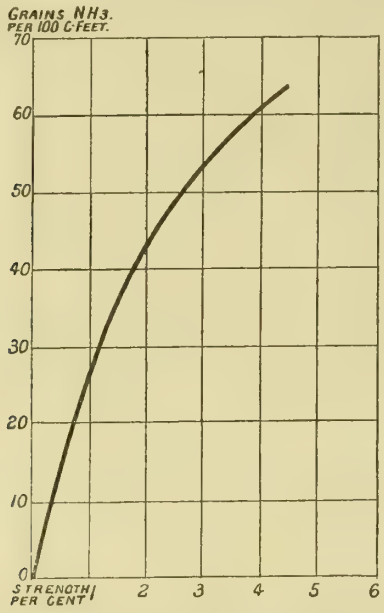
Since the ammonia tensions of gas liquor are relatively low, it is not convenient to express them in the usual way, of height of the column of mercury that balances them. It is better to state them in grains of ammonia per 100 cubic feet of coal gas.

However, since in coal gas the ammonia gas is always accompanied by an excess of acids, the liquor that condenses from the gas, or is otherwise produced, is not, as has been mentioned before, a solution of ammonia, but a solution of ammonia salts.

The major part of these ammonia salts—viz., those of ammonia with carbonic and hydro-sulphuric acids—are of an exceedingly unstable character, and in an incipient state of what is called dissociation.

The practical effect of this ready dissociability of the

ammonia compounds in question is a tendency for their solutions, such as is gas liquor, to lose the gases of which they are composed. But this loss is limited by their pressure in the atmosphere in contact with the gas liquor. Thus, just as the strength of a solution of ammonia in water is dependent upon the pressure of the ammonia gas with which it is in contact, so is the strength of the gas liquor dependent on the pressure exerted by the ammonia in the crude coal gas with which the liquor is in contact; and conversely, the pressure of the ammonia in the crude coal gas, or its proportion, is dependent on the strength of the gas liquor with which it is in intimate contact.



There is for every strength of gas liquor and for every degree of temperature (the strength in this case being on the so-called "saturation" basis) a certain pressure of ammonia that will balance its tendency to lose ammonia; and thus a gas liquor in contact with coal gas will lose ammonia (and at the same time also carbonic acid and sulphuretted hydrogen) if its quantity or pressure in the gas be less than the balancing pressure required. If, however, the pressure of ammonia in the gas be larger than that required to balance the tendency of the gas liquor to lose ammonia, then the latter will gain in strength, and abstract ammonia from the gas, until the ammonia pressure remaining balances that exerted by the liquor.

A practical example will serve to immediately illustrate this property of gas liquor. At a temperature of 60° Fahr. a gas liquor of 14 oz. strength saturation cannot reduce the ammonia in the gas it is in contact with to a lower amount than 54 grains per 100 cubic feet. (In this case it is more convenient to express the amount of ammonia on the usual basis of grains per 100 cubic feet; 54 grains is equal to nearly 0·2 per cent. by volume.)

The tension or pressure of ammonia that will balance that of any gas liquor varies with the strength of the liquor and the temperature. The tension increases with the temperature. For instance, the strength of liquor above mentioned—viz., 14 oz.—will be balanced at a temperature of 70° Fahr. by an amount of ammonia equal to about 70 grains per 100 cubic feet. Liquor of a degree of concentration so low as 1 oz. saturation exerts a degree of ammonia pressure at 60° Fahr. that is considerably over that allowed, for instance, by the London Gas Referees.

It frequently happens in practice that a portion of the scrubbing plant is used with a strength of gas liquor that at that point is not only unable to reduce the quantity of ammonia in the gas, but even serves to increase it. It must not be thought that because coal gas has been washed until it no longer has an alkaline reaction to delicate litmus paper, that the gas is thereby entirely free from ammonia. The author has found that the large proportion of acid gases present will mask the alkaline reaction of ammonia when it is present to the extent of about 2 grains per 100 cubic feet. It may be that the gas is being "scrubbed" apparently free (so far as regards the test paper) from ammonia; and this accumulates, where lime is used, as uncombined ammonia in the purifiers, and on a warm day may be given off again, thus producing a sudden rise in the ammonia impurity. It is not, as has been commonly thought, that ammonia has been synthesized in the purifiers, but that it was passing the scrubbers indistinguishable on the test-paper owing to the excess of acid gases. Theoretically, it would appear that the larger the proportion of ammonia in the gas, the easier it should be to take out a certain fraction of it. Thus, from gas containing 100 grains of ammonia per 100 cubic feet, it should be much easier to remove 10 grains than it would be to remove that amount from a gas that contained but little more than 10 grains. The chances of the water coming in contact with ammonia would be ten times as great. This is very observable in practice in the case of gas containing but very small quantities of ammonia.

This greater facility with which it is possible, in the same space and under otherwise the same circumstances, to remove ammonia of high tension, will be seen by an inspection of the table below, which is obtained from trials carried out with a mechanical washer:—

Ammonia, Grains per 100 Cub. Ft.			Cubic Feet of Gas Washed per Cubic Foot Gross Capacity of Washer per Diem.	Grains of Ammonia Removed per Cubic Foot Gross Capacity of Washer per Diem.
Inlet Gas.	Outlet Gas.	Difference Removed.		
124·0	10·0	114·0	3120	3557
136·0	7·0	129·0	1750	2257
142·0	2·3	139·7	780	1090
80·0	1·4	78·6	815	640
24·3	0·6	23·7	680	161

It will be seen that the same washing space when reducing the ammonia from 124 grains to 10 grains per 100 cubic feet could do nearly six times more work than when reducing the ammonia from 80 grains to 1·4 grains per 100 cubic feet.

The fact that the compounds of ammonia with carbonic and hydro-sulphuric acids are dissociable at ordinary temperatures, and that in consequence of this dissociability their solutions exert an appreciable ammonia tension, is, of course, the reason why it is necessary to introduce into the washing process extraneous clean water, since the natural liquor from the coal cannot remove all the ammonia from the gas, but must leave an amount equal to its ammonia tension.

A knowledge of the ammonia tensions of gas liquors of various degrees of concentration, at various temperatures, would render it possible to calculate for every case the least amount of water theoretically necessary to wash the gas clean.

To quote a case: The natural liquor from the coal is used for washing the coal gas at 60° Fahr. until its ammonia tension balances that of the gas. It is then of 14-oz. saturation strength; and the ammonia in the gas is equal to 54 grains of ammonia per 100 cubic feet. The natural liquor can now do no more work. The clean water employed to remove the remaining ammonia can be brought up to 14-oz. saturation strength, but not to any higher strength; and it is required to know what quantity of water must be employed.

Supposing that no ammonia becomes "fixed," so that all will appear in the saturation test, it will be found that the water required will be 2·54 gallons per ton of coals carbonized. Thus: The 54 grains per 100 cubic feet, if the coal is yielding 10,000 cubic feet of gas per ton carbonized, will be equal to 5400 grains of ammonia per ton; or, 0·771 lbs. 14 oz. saturation is equal to liquor containing 3·035 per cent. by weight of ammonia, supposing the liquor to have the gravity of water.

If x be the pounds of water to be employed to give the liquor of 3·035 per cent. strength, or 14 oz., we have—

$$\frac{x \times 3{\cdot}035}{100} = 0{\cdot}771\text{; or } x = 25{\cdot}4 \text{ lbs.}$$

Thus, in such a case, it should theoretically be possible to complete the washing of the gas with about 2½ gallons of clean water per ton of coals. The average quantity employed in practice is considerably more.

It is commonly stated that the strength of gas liquor in terms of degrees of Twaddel's hydrometer can be converted into ounces by multiplying by two. The author has investigated this matter, and finds that the usual factor of two applies fairly well to the finished product, and then gives ounces distillation. For natural liquors—viz., those produced directly from the coal without the addition of any clean water—the factor of two does not apply very well; being very much too low for ounces distillation. For the liquors obtained from clean water

scrubbers and washers—liquors that do not contain much so-called fixed ammonia—the factor is too low.

Class of Liquor.	Degrees Twaddel.	Strength of Gas Liquor. Ounces.		Factor. Ounces per Degree Twaddel.	
		Saturation.	Distillation.	Saturation.	Distillation.
Natural	4·00	8·72	10·20	2·18	2·54
Do.	6·16	11·09	14·96	1·80	2·43
Do. (cannel coal) . . .	3·88	6·52	8·63	1·68	2·22
Final product	6·30	10·20	12·60	1·62	2·00
Do.	6·45	10·80	13·20	1·68	2·04
Do.	5·25	8·30	10·10	1·59	1·92
From clean water scrubbers	4·80	—	8·81	—	1·83
	2·95	—	4·83	—	1·64

The term final or finished product is applied to the output from the gas-works as sent to the liquor works, containing the natural liquor from the coal and the clean water added for washing. Solutions of the commercial carbonate of 6° Twaddel, require to be multiplied by 2·15, and of 10° Twaddel by 2·13, to reduce them to "ounces"—in this case saturation or distillation indifferently. Solutions of sal ammoniac of about 6° Twaddel require a factor of 2·4 to convert degrees Twaddel into ounces distillation.

Discussion.

Mr. A. Dougall (Tunbridge Wells) said this was a most interesting paper, which gave the results of a very careful study of the washing of crude gas; but it did not show how they could profitably recover more of the nitrogen in the form of ammonia than at present. The author had advanced theories which explained scientifically the process of washing. These would amply repay careful study; and no doubt the paper would enable them to effect considerable economy in the use of lime. One point in which he (Mr. Dougall) was specially interested was the reduction of the quantity of clean water used. If they could recover the whole of the ammonia by the use of natural liquor and a few gallons of clean water, managers who sold their liquor would be under a great advantage, and many of those who were at present debarred from manufacturing sulphate of ammonia, because of the difficulty of getting rid of the spent liquor, would be able to evaporate the whole of it in the ash-pans, because there would be so very much less to dispose of.

Dr. Stevenson Macadam (Edinburgh) thought that the paper was likely to yield very good practical results. The reference made to the comparatively small proportion of ammonia extracted from coal in the process of distillation, and the large proportion left in the coke, naturally suggested the question as to whether there was any method by which a larger proportion of the ammonia could be extracted. He did not think it would be a loss, as Mr. Wright put it, that a larger proportion should be extracted; for, though it might bring down the price of sulphate of ammonia a little, that was not so much regulated by the amount produced as by the quantity of nitrate of soda that came into this country, and which, containing as it did a large proportion of nitrogen, could be used practically for manurial purposes in the place of sulphate of ammonia. It had been found—and he left it to practical men to devise means to carry it out—that if steam were introduced along with air into the coke from such works, a very much larger proportion of ammonia could be obtained. Experiments had been made in shale works, where the increase of ammonia was most marked. The passage of steam and air through the coke resulted in an increase sometimes of 100 per cent., and sometimes of 50 per cent. in the ammonia; and possibly some method of this kind could be introduced into gas-works, whereby a large increase in the ammonia could be obtained. With regard to the conditions in which ammonia might be present in the gas liquor, he quite agreed with the author of the paper that the most likely proportion of the ammonia to the carbonic acid was that of two volumes of ammonia to one of carbonic acid—that was the combination most likely to be formed. But, with respect to the sulphide combination, he should consider the proportion of one volume of ammonia to one of sulphuretted hydrogen was the most likely condition—not the proportion as indicated in the paper of two volumes of ammonia to one of sulphuretted hydrogen. It was recognized in chemical laboratories that the former combination was the most likely to be produced under the circumstances. He thoroughly agreed with the method of washing which had been suggested by Mr. Wright; and he thought the paper would be of great assistance, when put into practical shape, in rendering the gas more readily purified by means of the various liquors there—viz., gas liquor or clean water.

Professor Ivison Macadam (Edinburgh) drew attention to the large amount of nitrogen lost in the tar, as a point which required a little working up, and might fairly be considered when dealing with the yield of ammonia per ton. The amount of nitrogen found in tars—both in gas-works and paraffin-works tars—varied considerably. The compounds were mostly of an alkaloidal or a compound ammonia type. These compound ammonias, they had not yet been able to work up satisfactorily in the paraffin works. The loss of nitrogen from this source alone was considerable; and it required to be taken into account along with that found in the gas, when attempting to account for the whole of the nitrogen in coal.

Mr. C. S. Ellery (Bath) was not quite sure whether the point he was about to raise was made clear in the paper; but as one manufacturing sulphate of ammonia, the question had been running in his mind, whether by re-using the liquor, the result would not be to increase the quantity of fixed ammonia, so that the cost of treating the liquor in order to ultimately recover the ammonia would not be very much greater than at present. It seemed important to have as much ammonia in the free form as possible, consistent with proper washing. He thought it would be well if Mr. Wright would give some idea as to the washer used in the experiments he had referred to. They all knew that by different washers, and in different methods of using the same washer, the results obtained varied very much—at any rate, the sort of washer employed largely affected the question. If gas were first washed with strong liquor, as was his practice, and then passed through a washer with clean water—where they were not inconvenienced by the quantity of water used on the premises—the whole of the ammonia was removed, and they were spared the difficulty of dealing with what must be, under this treatment, a very large percentage of fixed ammonia in the liquor.

Mr. D. Irving (Bristol) said in this paper, as in all his work, the author had by practical experiment thoroughly substantiated what he brought forward; and they were much indebted to him for the data he had furnished. The method of washing as suggested was exactly that adopted at the Stapleton Road works of the Bristol Gas Company. The whole of the liquor produced from the hydraulic mains and the condensers, containing a large proportion of free ammonia, was afterwards used in the washers. The washer employed had a number of compartments, and a considerable quantity of carbonic acid and sulphuretted hydrogen was taken up in the manner suggested by Mr. Wright; and the fact that, in ordinary working, they succeeded in removing the whole of the ammonia with the addition of about 3 gallons of clean water per ton of coal, and kept the ammonia at the last scrubber outlet down to 0·3 or 0·4 grain per 100 cubic feet, showed that they approached very nearly to the theoretical work capable of being obtained from the 1½ per cent. of ammonia contained in the crude gas. It would have been interesting if Mr. Wright could have made any suggestion as to how the large proportion of 85 per cent. of nitrogen in the coal could be converted into ammonia; and he (Mr. Irving) thought they would all be willing to take their chance of disposing of it profitably on the market. He should be glad if Mr. Wright would state the method employed in testing the ammonia in crude gas. He (the speaker) had found great difficulty in getting regular results, though he had taken the greatest care; and often he had to reject results, because they were apparently so unreliable.

Mr. Wright, in reply, said that Mr. Dougall was quite correct in saying that, with attention to the principles which underlay the combinations of ammonia with carbonic acid and sulphuretted hydrogen, it would be possible, by careful study, to reduce the quantity of cold water constantly employed for washing gas. He was glad to hear of Dr. Macadam's operations, because he reminded them that it was possible by methods either known or indicated to increase the amount of ammonia which coal yielded on distillation. Whether it was profitable to adopt any of those methods, he expressed no opinion. Sir Humphry Davy once said, when the duties of men coincided with their interests, they were performed with alacrity; and he

(Mr. Wright) had no doubt that, when the interests of the gas industry coincided with the duty of converting more of the nitrogen of coal into ammonia, it would be performed with alacrity. As regarded what Dr. Macadam said about nitrogen in the tar, there was no doubt that in the tar there went away from the works a great quantity of ammonia combined with the chlorine, the hydrochloric acid, and the sal ammoniac; and in the hydraulic mains, or in the inlet of the condensers, one often came across large patches of ammonia salts which were really sal ammoniac; and this sal ammoniac went down to the tar-works very often with the tar. He met an engineer the other day who said that he meant in future to be paid for this ammonia; but whether he would succeed in getting paid for it, he (Mr. Wright) did not know. The manner in which the 1½ per cent. of nitrogen usually contained in the tar was combined, had up to the present time made it unprofitable to recover it. As regarded Mr. Ellery's question, whether the re-use of ammoniacal liquor as in the Hills and Claus washing processes would increase the fixed ammonia, he (Mr. Wright) must say it did somewhat; but not to any extent which would render these processes unprofitable if they were convenient on other grounds. Unquestionably, in the cooling and repeated re-distillation of gas liquor as employed in the Hills, Claus, and similar purification processes, there was a gradual growth of fixed ammonia in the liquor. With regard to the large proportion of nitrogen which was not recovered on distillation, some was left in the coke, and some went in the tar. He thought he might answer Mr. Irving's question with regard to the quantity of nitrogen in replying to Dr. Macadam's remarks. That gentleman told them, and he quite agreed, that one would suppose theoretically that the compound formed between the ammonia and carbonic acid would be as two volumes to one; but he also said that, as regarded the sulphur compounds, he should expect to find in both one volume of ammonia with one volume of sulphuretted hydrogen. If Dr. Macadam would look at the fifth table in the paper, he would see that, in the case of weak liquors, that tended to be the case—carbonic acid was the stronger acid of the two. But when the liquor was extremely dilute, the carbonic acid did not tend to displace the sulphuretted hydrogen to the same extent as in a stronger liquor; and, consequently, in weak liquor there was a larger quantity relatively of sulphuretted hydrogen combined with the ammonia.

Title and Index to Vol. LXV.—The title-page and index to Vol. LXV. of the JOURNAL (January to June, 1895) will be ready in a few days; and, as usual, a copy will be forwarded post free by the Publisher, on receipt of a post-card from any Subscriber.

The Examinations in Gas Manufacture.—In addition to the successful candidates at the above examinations whose names were given in the JOURNAL last week, we learn that Mr. F. West, son of Mr. John West, of Manchester, passed first class in the "Honours" grade.

The Management of the Rotherham Water-Works.—The Borough Surveyor of Rotherham (Mr. Jennings) has been appointed temporary Manager of the Water Department until the parliamentary work in which the Corporation are engaged is ended. It may be remembered that Mr. C. B. Newton formerly held the dual position of Gas and Water Engineer, and that on his removal to Carlisle, Mr. M. Murdoch was placed in charge of the gas-works—the management of the Water Department remaining open.

Death of Ex-Bailie Ure, of Glasgow.—Ex-Bailie Ure, who for a number of years had been Convener of the Gas Commissioners of the Glasgow Town Council, died last Friday afternoon. He had been in failing health for some time; and was for several weeks last autumn unable to attend to his duties. As Convener of the Gas Committee, he had the largest gas undertaking in Scotland under his supervision; and his control of it was of the most enlightened description. Since his appointment, the gas-works have been almost entirely remodelled, the largest gasholder in Scotland has been erected, and another of almost the same size is under construction.

The Metrical System for England.—A Committee of the House of Commons have lately been considering whether any changes in the present system of weights and measures should be adopted in this country; and they have agreed to a report which concludes with the following recommendations: (1) That the metrical system of weights and measures be at once legalized for all purposes; (2) that, after a lapse of two years, the metrical system be rendered compulsory by Act of Parliament; (3) that the metrical system be taught in all public elementary schools as a necessary and integral part of arithmetic, and that decimals be introduced at an earlier period of the school *curriculum* than is the case at present.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 100.)

THE general position of affairs on the Stock Exchange last week showed hardly any change whatever from that of the week preceding; and there was no perceptible increase in activity, except in the mining department, where things moved briskly. But, in spite of the prevailing quietude, nearly everything was firm, and prices for the most part improved. This was specially noticeable among the high-class investment securities, which have now reached prices hitherto undreamt of. To account for this feature, one has only to look at the enormous and increasing volume of money which does not find employment in the market, and which must go somewhere, even if Consols rise to 110. Among the high-class securities Water stocks have long ranked; and now Gas stocks are slowly, but steadily, improving their position, and leaving the 5 per cent. security mark (which used to be their station) far in the rear. During the past week, numerous and considerable advances in quotation have been effected, as will be apparent upon reference to the list on p. 100. Business, too, was much more active in response to a free demand. Gaslight issues were especially busy. The "A" opened, with a flourish, at an advanced quotation. But it never could beat the closing mark of the previous week; and, after a good run of animated dealing, it fell back to the old figures. The secured issues very naturally were in good request while money was abundant, and particularly the debenture stocks; some good rises being scored. South Metropolitans were in demand, and not even the prices wanted could frighten off buyers—the "B" changing hands on Friday at 303¾. Commercials, after being long crushed, were allowed to get up. The fact that the new stock was done on Tuesday at 220, and on Friday at 230, will illustrate how much suppressed elasticity there is in them. Scarcely anything was done in Suburbans and Provincials; but British advanced again. Continentals were firm and unchanged. Several of the remoter undertakings shared in the improvement, among which were Buenos Ayres, San Paulo, Sydney, and Melbourne. The Water Companies made further progress with their recovery; and a few quotations rose freely.

The daily operations were: The Gas Market opened strong and lively; prices being very buoyant. South Metropolitan "B" and debenture rose 3 each; Gaslight "A," 2; and Melbourne, 1. In Water, Chelsea, East London, and ditto debenture gained 2 each. Tuesday was less active; but prices still rose. Commercial debenture improved 4; British, ½; and Buenos Ayres, ¼. In Water, New River rose 5; and Chelsea, 3. The improvement proceeded gaily on Wednesday. Commercial new rose 5; ditto old, 2; and Gaslight "H," 2; but ditto "A" fell 1. Business on Thursday was active again; but changes were fewer. Gaslight 6 per cent. debenture rose 4; and San Paulo, ½. Transactions kept up well on Friday; and Commercial Gas new rose 3. In Water, East London relapsed 2. Saturday was more than usually active, and prices were good. Gaslight 4 per cent. debenture rose 1; but ditto "A" fell 1.

ELECTRIC LIGHTING MEMORANDA.

Fires at London Electric Light Stations—The Accounts of Metropolitan Electric Supply Undertakings—The Central London Railway Scheme.

As might be supposed, the frequent and disastrous fires that illuminate so luridly the career of the central station electric lighting undertakings of the Metropolis, give rise to melancholy reflections in the English electrical periodicals. The *Electrician* remarks that "the year 1895 seems destined to be written in letters of fire in the annals of electric lighting in London." Early in the year, the Kensington Court station of the Kensington and Knightsbridge Company was the scene of a serious fire; and the recent destruction of the Sardinia Street Station of the Metropolitan Company was a far graver affair. Our contemporary hopes "that these two disasters will bear fruit in more elaborate structural and mechanical precautions against fire;" but as the aspiration was accompanied by the remark that the cause of the fire remained unknown, it is open to be observed that until people know exactly where danger exists, it is impossible to effectually prevent or guard against it. Rumour has it that the switchboard was the origin of the fire; but as to whether there was a short circuit on the switchboard, or whether anything went wrong behind it, nobody has yet supplied reliable intelligence. Sardinia Street was the station which the Directors of the Company had fitted up complete with Westinghouse plant, made in America; and we shall be curious to learn whether the new machinery required to replace that destroyed by fire will be bought at the same shop, or designed upon the same plan. No public intimation was ever made as to the opinion formed by the Directors from their experience of the American plant; but engineering visitors to the station were not at a loss for a decision on the whole outfit, though for more reasons than one they may not have been able to express their views upon the spot.

The accounts of the London and provincial gas companies do

not in all cases supply material upon which an exact comparison of the condition and working of different undertakings can be based; but these accounts are clearness and fulness in a high degree compared with those relating to contemporaneous electric lighting undertakings. The *Electrician*, in its issue for the 28th ult., published what purported to be tables showing the total capital outlay and receipts and expenditure for 1894 of the statutory electric supply undertakings of the Metropolis; but in commenting upon these tables, which give evidence of the greatest care having been bestowed upon their compilation, our contemporary was obliged to confess that their preparation gave abundant illustration of the unreliability of statistics, unless most carefully sifted, as a satisfactory basis for exact argument. Nevertheless, the tables supply some useful information in regard to the state of the electric supply industry in London. Thus it appears that the total capital outlay of London Companies stood at the end of the past year at £3,900,000, which was an increase after the rate of 11 per cent. for the year. Their revenue amounted to £370,000 in round figures—an increase of 30 per cent. on the corresponding figure for 1893. The total expenditure on revenue account only rose 22 per cent. It is remarked that the figures would be considerably improved if the entries relating to the unfortunate London Electric Supply Corporation were eliminated. These, of course, contribute a sadly disturbing element in any comprehensive statement of the finances of the London electric lighting industry. It is a hopeless task to attempt to deduce from the figures relating to the different companies any safe argument for or against their prospects. Even in respect of such a simple matter as coal consumption, or rather cost of coal per unit generated, the differences between the workings of the various undertakings are enormous. Thus the Westminster Company, who stand best in this respect, generate the unit at a cost of 0·63d. for coal, while the Metropolitan Company spend 2·11d. for the same result. Leaving out the Deptford concern, the capital expenditure divided by the number of units sold for the year ranges from a little over 3s. to 12s. If it should ever come to be a question of transferring any or all these undertakings to a public authority, the great heart of Westminster would beat high for joy over the valuations.

It would appear that the Central London Railway scheme has been successfully floated; so that the electricians will have one more opportunity of showing what they can do in the way of rapid underground transit. It is a big affair; the railway comprising a double line, in separate tunnels, to be constructed after the Greathead system, from Shepherd's Bush, along the route of Oxford Street and Holborn to Liverpool Street. The route is, of course, the finest imaginable for traffic prospects; and many schemes for the making of an underground railway along the same line, to be worked by steam, have been proposed London, however, does not want any more metropolitan railways of the kind already in existence; which are eminent examples at once of technical triumph and administrative fatuity. The deeply-buried Greathead tunnels, with their comparatively innocuous electrically-driven trains, represent a new departure in railway enterprise, which should have the most extended trial permitted by the good grace of enterprising investors. It was curious to note how, when the prospectus of the Central London Railway came out, every journalistic reference made to the venture was strictly guarded in tone, so far as the financial prospects of the line were concerned. Nobody doubted that the railway could be constructed and worked according to the selected plans; but whether the Company will pay a dividend was, and is, a very open question. The prospectus itself was very modest in its claims in this regard; anticipating from the carrying of 7 million passengers per mile per annum no more profit than would suffice to pay 4 per cent. debenture interest and 5 per cent. on the share capital, with a margin of 1 per cent. for contingencies. There is no obvious reason why these aspirations, or something not very different, should not be realized. The Metropolitan Railway paid very well so long as it was what its name implies, and only ran from Paddington to Moorgate Street. The Central London Directors disclaim a policy of extension; and so long as they keep this guiding principle in view, steadfastly following Wolsey's advice on the subject of ambition, while doing their best for the public, they will at least enjoy the satisfaction of deserving success. At any rate, the new line will find employment for a good many electricians, which is badly wanted.

The Sale and Burning of Mineral Oils.—It may be remembered that a Committee of the House of Commons last year inquired into the law relating to petroleum, and the precautions to be taken to prevent the sale of dangerous oil-lamps. At the request of the Committee, a number of experiments with lamps of various kinds were made by the Chief Officer of the Public Control Department of the London County Council (Mr. A. Spencer), as mentioned in the JOURNAL for Feb. 19 last; and the results were submitted to Parliament. It is acknowledged that dangerous lamps are largely used; but the Council have no power to prohibit their sale. It has been thought advisable to re-appoint the Committee, with instructions to give this matter special attention. The Home Department have, we believe, agreed to this; but the constitution of the Committee is uncertain in view of the recent change of Government.

GROVES AND THORP'S "CHEMICAL TECHNOLOGY."*

THE appearance of the second volume of Groves and Thorp's well-known work demands appreciative notice at our hands. While not so closely connected with the special industry represented by the JOURNAL as will be the next volume, now in course of preparation under the collaboration of Mr. Charles Hunt, Dr. Garnett, Mr. Boverton Redwood, and Mr. W. J. Dibdin, it deals with a variety of subjects upon which our readers require to be well informed. Lighting by means of candles, oils, or fatty materials constitutes, indeed, a study of vast interest for all who may be concerned with the promotion of lighting by any other means, inasmuch as these are at once the oldest, simplest, and still most generally used means of illumination; and it is the first condition of success, in popularizing other means of attaining the same end, to know all there is to be learnt about the technical history of candles, lamps, and burning oils. The volume now before us claims to supply this desirable information in new, complete, and authoritative form. According to the preface, the Editors have set themselves to deal in it exclusively with the special application of fuel to the purpose of producing light, irrespective of the heat developed at the same time; and in order to do this most effectively, something in the nature of historical or chronological succession has been adopted as a matter of convenience. This arrangement, however, has been followed only in relation to the sequence in which the various methods of obtaining light came into use; for it is evident that as the means of illumination referred to—in their higher developments, at all events—are every one of them still in use, there is no reason to suppose that any of them will be regarded as in danger of becoming obsolete. In regard to the section on "Oils and Fats," written by Mr. W. Y. Dent, in which only those used for lighting are considered, it is remarked that, although the general outline of the technology of these substances remains essentially the same as it was in early times, yet the great progress which has been made in recent years in the machinery used in their extraction and preparation, will doubtless continue; resulting in saving both in cost and in labour, besides improving the purity of the product. This observation illustrates the attitude of the Editors, who are manifestly desirous of warning students against the idea that the chapter of history which deals with any one of the lighting agents treated of in the book can safely be regarded as closed, although it may be traced back to the earliest records of our civilization.

Take, for example, the candle. The question as to whether the lamp or the candle was the earlier attempt of man to render himself partially independent of natural light, may be determined by the answer to the yet unsolved problem of the place of origin of the human race. If this happened in a temperate or northern climate, then the candle suggests itself as an improvement which was made in the course of the ages upon the brand snatched blazing from the wood fire; but if man started his inventive career in the tropics, then the oil-lamp was his more natural improvement upon the torch. As the Editors remark, the candle has remained essentially the same throughout the ages, although the materials of which it is composed, and the machinery for making it, have varied very considerably. And the candle trade of to-day has to meet a large and increasing demand.

Petroleum, the Editors think, is perhaps the most formidable rival of the candle; and they warmly commend the great care and thoroughness with which Mr. Boverton Redwood has dealt with its technology. As to the popularity of petroleum as an illuminant, the Editors declare that it "is, and perhaps will remain, in possession of the field outside towns and the larger villages. Where houses are so scattered that gas or electricity cannot well be supplied, it furnishes the main source of light, and, with the lamps now available, leaves very little to desire either on the ground of cost, health, or safety. The aggregate use thus secured is necessarily very large; and to this must be added what is employed in towns by the poorer classes, not to mention those who prefer it to gas as being more cleanly and less destructive to furniture and decorations, and on this account are willing to forego the conveniences afforded by the use of gas." With all this we are disposed to agree, with reservation of the point of the superior cleanliness of petroleum to gas. Petroleum has lightened the darkness in which dwellers in solitary and country places lived before its advent; and there is no disputing the large use that is made of lamps for reasons of taste. But the petroleum lamp may be, and often is, a very great offender against the canons of cleanliness.

The Editors confess that, in face of the controversy in regard to the flashing-point of mineral oil, they have judged it prudent to preserve silence on the point; contenting themselves with the safe observation that, whatever may be the merits of the question, "it is a distinct advantage to have a lamp so constructed as to prevent access of flame to the interior of the

* Chemical Technology; or, Chemistry in its Applications to Arts and Manufactures." Vol. II. Lighting. (Fats and Oils, by W. Y. Dent; Stearine Industry, by J. M'Arthur; Candle Manufacture, by L. and F. A. Field; the Petroleum Industry, and Lamps, by Boverton Redwood; Miners' Safety Lamps, by Boverton Redwood and D. A. Louis.) London: J. and A. Churchill; 1895.

reservoir, and that the latter should be metallic, and of such a character that, if it be thrown down or inverted, the oil cannot escape." Upon the subject of oil gas, the Editors remark that this is a curious instance of revival. In the early days of gas making, it was used to a considerable extent; and it is now again brought forward for the special purpose of lighting railway carriages and to some extent lighthouses—in both cases because it gives a light of high intensity with a small volume of gas. It ought to be borne in mind, however, that the primitive oil gas referred to here was made from animal or vegetable oils, and the manufacture was only changed to that of coal gas, or rather cannel gas, on account of the high cost and scarcity of the former substances. The high-power cannel gas of Edinburgh and other Scottish towns is, in fact, a representative of the old oil gas, rather than of the more modern coal gas.

So much for the preface, to which, on account of the nature of the volume, as consisting of a collection of writings of various authors only bound together by this common tie, it is right to pay particular attention. Following the preface is a short introductory chapter, likewise attributable to the Editors, and equally deserving of careful reading. Here we find it laid down that, with certain small exceptions, reserved for after-treatment, "the subject of lighting may be considered under two principal heads, one of which deals with the use of fuel to produce a gas which, on reacting chemically with another gas, will produce a temperature so high as to emit light; and the other in which fuel is used directly or indirectly to raise the temperature of a solid refractory body to incandescence." It will be convenient here to notice the peculiar sense in which the Editors understand and employ the word "lighting." What they mean by the term here is nothing more nor less than the production of light. In a sense, of course, to produce light is synonymous with lighting; but we venture to make a protest against the adoption of this sense as anything more than a short and, for the Editors' purpose, convenient form of expression. The word "lighting" may, in a particular connection, signify the production of light. But it has another and a totally different meaning, which is that of using the light; and we cannot afford to sacrifice this meaning temporarily to serve the convenience of the chemical technologist, without at least letting him know that it is a sacrifice. The purist in language might even go so far as to accuse Messrs. Groves and Thorp of having given their second volume a title which is a misnomer. But what they have done they have done; and all we desire to do in this connection is to warn the student of lighting, properly so called, of the sense in which the word is employed in their title.

Yet the Editors are not wholly oblivious of the second meaning of their title; for they conclude their introductory chapter with a couple of paragraphs treating very briefly of the use of lights, or artificial lighting. They first discuss what goes on in a burning candle or lamp. The candle is described as, on a small scale, first an oil factory, and secondly a gas-works, with the wick as the sole representative of mechanism. The oil-lamp is also a gas-works, not always needing a wick. "These operations, which occur simultaneously and on a minute scale in the candle, may be separated, both in time and space, and conducted on a scale of any desired magnitude, and with apparatus of greater or less complexity, as when a liquid fuel is obtained from a solid, or a gas is produced from a solid or liquid fuel, and stored until it is required for use." Water-gas manufacture is described as analogous in operation and results; but the example of the action of a mixture of nitric oxide with the vapour of bisulphide of carbon, which when inflamed yields an extremely brilliant light, is cited to show that the stages of oil and gas making are absent or of an entirely different character from the case of the candle. The Welsbach light and the electric light in both kinds are duly mentioned; and then the Editors say what they have in mind in regard to the application of lights to lighting.

This, as already observed, is not much, though what there is is to the point. Thus we are informed that "the light of the highest intensity is not necessarily the most useful;" and also that "the selection of a source of light will depend chiefly on whether it is desired that the light itself should be seen, or whether it should be the means of rendering visible objects which are not themselves luminous." For the former purpose it is declared that "the more intense the light, and the more nearly it approaches to a true point, the better"—a dictum that would certainly fail to command the support of Mr. J. R. Wigham. "When, however, light is required for the purpose of being reflected from non-luminous objects, and so rendering them visible to the eye, it is desirable to have a large amount of light of low intensity, and generally that it should be distributed about the area to be lighted rather than concentrated at one or a few points. A room which would be well lighted by means of twenty candles will be but poorly lighted by means of a single lamp giving light equal to twenty candles. Moreover, if the flame of such a lamp be surrounded by an opal globe, or a white or opal shade and cup, it will be found that the room is better lighted than by the naked flame, although in all probability the globe or shade will intercept one-half of the light." It is not not to be accepted as following upon this rule that there is any positive advantage in producing a large amount of light merely in order to destroy half of its useful effect by means of a semi-opaque globe. With the following conclusion, however, it is possible to fully agree: "Generally, it may be said that, with a given amount of light, the lower and the more uniform the intensity, the better the illumination." The reason assigned for this is physiological, and has to do with the structure of the eye. The aperture of the iris is adjusted "not to the total amount of light entering the eye, but to the intensity of the brightest spot of the image on the retina; so that while this can be seen perfectly, the aperture will be too small to allow sufficient light to enter to admit of clear vision of the remainder. If the illumination be uniform—that is, free from points of exceptional intensity—the amount of light allowed to enter the eye will be at a maximum." This statement, at all events, is very clear.

We have devoted so much space to the observations of the Editors that there is none left for affording due recognition of the work of the sectional authors, which must therefore be left for another article. A work of this interest and technical value does not appear every week; and it is impossible, in a curt review, to do justice to the writers and the Editors.

THE PORTSMOUTH CORPORATION AND THE WATER-WORKS.

The spasmodic negotiations set on foot by the Portsmouth Corporation with the view of acquiring the highly-successful undertaking of the Portsmouth Water Company are now again engaging local attention; and the outcome, if outcome there is to be, will necessarily be looked for with keen interest outside the limits of Portsmouth itself. The local press is devoting space to the subject; and, judging from a recent article in the *Portsmouth Times*, there seems to be a likelihood of local ratepayers reckoning their chickens some time before they actually crack the shell. "From inquiries which we have made," says the local organ, "we do not believe that the most ardent advocates of the acquisition of the water-works would be prepared to proceed with the gigantic financial operation unless the period for repayment were extended." This entirely confirms the view more than once expressed in the Journal as to the attitude of provincial corporations which as yet are not suppliers of water. To make good the capital raised for the purposes of such a purchase within the span of sixty years, seems to such local authorities a hopeless undertaking. Nevertheless, there is the rule of law, as prescribed by the Public Health Act, 1875, and also the rule of Parliament, as laid down in the Standing Orders. The principle thus established cannot be lightly brushed aside to suit this or that particular community. So long as the general rule remains, it must be followed, unless such special circumstances can be shown as would induce the Legislature to say that the period may justly and reasonably be enlarged. But if all corporations require an exception made to the rule (and that is what it looks like), obviously there must be general legislation to correct the position and convert the exceptions into a new general rule. Otherwise Parliament would simply stultify itself by listening to the clamour of our new race of "municipal statesmen."

There is, says the *Portsmouth Times*, a recent precedent which strengthens the belief that the desired extension could be obtained. Then it turns out that the Sheffield case, upon the special features of which we commented not long ago, is the precedent on which the Portsmouth Corporation build their hopes. This, then, is the way in which they "reckon the chickens before they are hatched;" for, argues our provincial contemporary, Sheffield succeeded in getting the Standing Orders suspended, and the period for repayment extended to eighty years, and "what Sheffield accomplished Portsmouth ought not to find impossible." That, however, is a very dangerous and misleading sort of argument. The circumstances in the Sheffield case were quite exceptional. The Portsmouth case is by no means on all-fours with it. Moreover, though, in regard to Sheffield, Parliament sanctioned an exception to its general rule, Mr. Leonard Courtney, whose authority on the policy and usage regulating such matters cannot be questioned, made an earnest protest even against the encroachment then permitted, and expressly warned all whom it might concern not to calculate on receiving similar indulgence in future. This is a feature of the position to which the Journal has more than once referred, but which it seems advisable to mention again, in consequence of the fallacious reasoning that seems likely to lead the Portsmouth Corporation into deep waters.

Meanwhile, this dilatory body stand by and see the prosperity of the local Company increasing by "leaps and bounds." Since the Municipal Committee reported in August, 1893—nearly two years ago—the Company's revenue has increased by about £1200 per annum. If the Committee again rest on their oars, there will doubtless be a proportionate increase of revenue before they rub their eyes and report again—say, in August, 1897. Already they have to face the manipulation of big figures. The statutory dividends on the several classes of shares amounted in 1893 to £27,450 per annum; and to produce a similar amount by dividend on 3 per cent. stock would require, at its nominal value, £915,000. The mortgage debenture debt of the Company was £101,250 on March 31, 1893. That debt, of course, the purchasers would have to take over, and pay off as the debentures fell due. Compensation for the Directors and officers of the Company would absorb, according to the 1893

estimate, £14,000. In fact, when last the local Committee faced the question, it was reckoned that, for all purposes, stock amounting to about £1,036,000 would have to be created, requiring a dividend of £31,080. Unless, therefore, the period of repayment can be extended, the required dividend will exceed the income. Hence the eagerness of the Portsmouth Corporation to be aided by the Sheffield precedent. If they can get the term fixed at 80 years, the amount required for interest and redemption of principal would be £34,306 14s. 2d. If they are allowed 100 years—a wildly remote contingency—the income required would be £32,785 1s. 8d.; and even allowing for the estimated saving in Directors' fees, and so forth, the income, on the basis of the 1893 accounts, works out at no more than £32,280. Obviously, therefore, the Portsmouth Corporation have a hard nut to crack; and the longer they postpone the effort to accomplish the task, the harder they will find it.

Institution of Civil Engineers.—The Council of the Institution have re-appointed Dr. William Pole, F.R.S., Honorary Secretary; and Mr. James Forrest, Secretary—an office he has filled for the past 39 years. The Institution now contains 19 honorary members, 1873 members, 3726 associate members, 351 associates, and 816 students; making a total of 6785. The new premises in Great George Street are making good progress.

The Physical Properties of Acetylene.—M. Villard has recently dealt with this subject in the *Comptes Rendus*. He says the melting-point of acetylene is -81° C.; and it solidifies by evaporation in the open air. The crystals of solid acetylene, like those of carbonic acid, are absolutely without action upon polarized light. The solubility of the gas has been determined at 0° under the pressure of 4·65 atmospheres; and, under these conditions, the coefficient of solubility is 1·6.

Incandescent Gas Lighting for Winchester.—The persistent efforts of Mr. F. G. Dexter, the Manager of the Winchester Gas and Water Company, to remove what he rightly termed, at the last meeting of the South-West Association of Gas Managers, "the standing disgrace of the ancient city"—*i.e.*, the lighting of the streets of Winchester by oil-lamps—has at length been crowned with success; the Corporation having accepted the conditions of a contract for three years to light the entire city with the incandescent (Welsbach) gas-burners.

Society of Arts.—The Council of this Society have awarded a silver medal to Professor Vivian B. Lewes, F.I.C., F.C.S., for his paper on "The Commercial Synthesis of Illuminating Hydrocarbons," read at the meeting of the Society on Jan. 16 last, and given in the JOURNAL on the following Tuesday. In their annual report, the Council refer to the method of producing acetylene gas from calcic carbide, which was so ably described by Professor Lewes on the above-mentioned occasion as an invention which is likely to have a far-reaching effect on the gas industry. The Council also allude to the course of Cantor Lectures delivered by him on "Modern Developments in Explosives," in which, they remark, he gave a clear and popular account of the great advances made of late years in explosives. The subject had not previously been dealt with in a Cantor course; and Professor Lewes's treatment of it was much appreciated by an audience which included several of the chief authorities on the matter. Another interesting course was delivered by Professor Silvanus P. Thompson, on "The Arc Light," wherein he reviewed the most recent researches into the physics and optics of the electric arc, and described in their most important details, the latest arrangements of mechanism employed in its production.

Society of Engineers.—Last Wednesday, a party of members of this Society, accompanied by the President (Mr. W. G. Peirce), paid a visit to Dover, for the purpose of inspecting the outer harbour extension works, the existing harbour, and the station of the Electricity Supply Company. The electric lighting works comprise an engine-room containing the main engines and dynamos, which are at present one 50-kilowatt, one 75-kilowatt, and two 100-kilowatt Mordey alternators, each coupled direct to vertical compound condensing engines. There is at present provision on the circuit-board for six circuits, two of which are for the control of public arc lamps, and the remainder for the private lighting. Situated on one side of the engine-room are two continuous current dynamos, coupled direct to vertical compound tandem engines. The engine-room also contains two Tangyes centrifugal pumps, coupled direct to vertical engines, which draw water from the River Dour at a point about 100 yards distance, for use in the condensers, one of which is attached to each of the main engines. The boiler-room now contains two Babcock and Wilcox boilers, each of 200-horse power, working at 150 lbs. pressure, with space and foundations for five more of the same size. The engine and boiler rooms are lighted and ventilated from the roof, so as to avoid side windows, and thus reduce any sound to a minimum. The current leaves the station at a pressure of 2000 volts, and is conveyed, by concentric cables, to about eighteen transformer street-boxes in various parts of the town, where it is converted to a pressure of 100 volts, at which it is distributed to the consumers' premises. There are in the streets at present 21 public arc lamps, each of 2000 nominal candle power; and 10 additional lamps have been contracted for, to be suspended from arches.

NOTES.

Lord Rayleigh on Argon.

In his lecture on "Argon" delivered before the Royal Institution, and recently published, Lord Rayleigh describes fully the methods by which the newly-discovered gas was obtained, and the results of the various examinations that have been made of it. Upon the question as to whether argon is really a new gas at all, which has been raised in various technical journals, Lord Rayleigh definitely replies that the spectrum alone is enough to establish the fact. The next question is whether it is in the atmosphere; and Lord Rayleigh answers it in the affirmative for several reasons. In the first place, he argues that, if argon be not in the atmosphere, the original discrepancy of densities which formed the starting-point of the investigation remains unexplained; and the discovery of the new gas has been made upon a false clue. Passing over this, there is the evidence of the blank experiments, in which nitrogen originally derived from chemical sources was treated exactly as atmospheric nitrogen was treated. In the one case, about 1 per cent. of argon is obtained; in the other, a trace of it is found, which is attributable to the water used in manipulation. Another wholly distinct argument is founded upon the method of diffusion introduced by Graham. Graham showed that if a mixture of gases is passed through porous tubes, the composition becomes altered by the quicker escape through the pores of the lighter constituents. In Lord Rayleigh's experiment, eight clay tobacco-pipe stems were joined together by india-rubber junctions, and enclosed in a vacuum. Atmospheric air was aspirated through these pipes so slowly that the remainder collected was only some 2 per cent. of that which leaked through the porosities. If nitrogen is prepared from this residue, a gas is obtained heavier than ordinary atmospheric nitrogen—a result which proves that the ordinary nitrogen of the atmosphere is not a simple body, but is capable of being divided into parts by so common an agent as the tobacco-pipe.

Moissan on Willson's Calcium Carbide.

M. Moissan, whose experiments with the electric furnace are well known, writes to the *Revue Générale des Sciences* to dispute the claim of Mr. Willson to priority for the commercial preparation of carbide of calcium by the same agency. M. Moissan states that his first research in an electric reverberating furnace with moveable electrodes, was published in the *Comptes Rendus* of Dec. 12, 1892. In the first note, he demonstrated the reduction by carbon, under the action of the electric arc, of oxides previously regarded as incapable of reduction. He referred principally to the reduction of the oxides of uranium, manganese, and chromium; but he also mentioned the accidental formation of calcium carbide by the action of vapours of calcium—the furnace being made of quicklime—upon the carbon electrodes. Mr. Willson's American patent is dated Feb. 21, 1893, and is for the electric reduction of refractory metallic compounds. M. Moissan refrains from discussing the form of the Willson furnace, which reminds him of the Cowles and Grabau furnaces. He asserts that Mr. Willson has not in his furnace separated the calorific action of the arc from its electrolytic action. M. Moissan further declares that, whereas at first Mr. Willson regarded the formation of calcium carbide in his furnace as due to electrolytic action, in his later application for a German patent he affirms that it is a simple process of fusion. But M. Moissan's gravest impeachment of the Willson carbide of calcium process is, however, with reference to the question whether the products of reduction are obtained in the electric furnace in the fluid form or in that of powder. In the first Willson patent specification, it is insisted upon that sufficient carbon shall be employed to prevent the formation of a molten bath. Under this condition, M. Moissan declares that it is impossible to obtain titanium, which Mr. Willson claims to have prepared. Finally, M. Moissan remarks that, in a patent treating particularly of alloys of aluminium and magnesium, the claim respecting calcium carbide and other products appears to him to be exaggerated, and to be merely a conventional covering phrase without value from the point of view of priority of discovery.

The Crystallization of Iron.

In the course of a research with high microscopical powers on the micro-crystalline structure of large masses of wrought iron, Mr. Thomas Andrews has discovered certain novel metallurgical facts which may eventually contain a solution of some of the mysteries occasionally observed in the behaviour of pieces of the metal under stress. When large masses, several tons in weight, of practically pure wrought iron were allowed to cool slowly from a white heat, a secondary or subcrystallization of the metallic iron occurred. The normal primary crystals of the iron, or those which have hitherto been regarded as constituting the ultimate structure of the metal, were found to enclose a subcrystalline formation consisting of very minute and much smaller crystals of pure iron also belonging to the regular order of crystallization. These crystals sometimes manifested the hexagonal form; and often they assumed the shape of simple cubes. The linear dimensions of the primary crystals would average about 0·01 inch; the secondary crystals only averaging 0·001 inch linear measurement. Judging roughly from the indications of the average micro-measurements,

there would be approximately 1000 million of the secondary crystals in a cubic inch of the metallic iron. The crystallizing point of metallic iron is about 740° C. In the course of further investigation, Mr. Andrews has also found that the secondary crystals sometimes enclose a still more minute form of crystals of pure iron, of cubical form, which thus constitute a third system of crystallization. It is necessary to look for the second and third systems in large masses of the metal. The crystals of the secondary formation are not often distinctly discernible in smaller masses of metallic iron, such as rolled rods, plates, or sheets; as these in the course of manufacture rapidly cool, and are frequently manipulated during the finishing processes at temperatures below the crystallizing point of wrought iron.

The Principle of the Pohle Air-Lift.

Some observations on the Pohle air-lift for fluids are made in a recent issue of the *Engineering Magazine*. It is remarked, by way of explaining the principle of this most useful device, that it has long been known that a suction-pipe could be made to raise water considerably higher than the height of a solid column of water in a tube balanced by atmospheric pressure, by the simple device of allowing some air to leak into the suction pipe. This is due to the fact that a column of mixed water and air is lighter per foot of height than water unmixed with air; and hence the atmospheric-pressure upon the surface of the water wherein the suction-pipe is placed can push up a higher column of the former than of the latter. Yet it does not seem to have occurred to anybody until recently that water or any other fluid could be raised effectively through an open vertical tube inserted in a mass of liquid, by forcing air into the open end of the bottom of the tube; and that the farther below the liquid surface the lower open end of the tube is placed, the greater and more powerful will be the discharge, provided that the injection of air is rightly proportioned to the work required to be performed. The operation, after the air enters the lower end of the tube, is simply due to gravity. The mixed air and water is lighter than the unmixed water remaining outside, and is therefore pressed upward by the denser fluid. Of course, it follows theoretically that the deeper the lower end of the tube is submerged, the higher the mixed column of water and air can be raised above the surface. In practice, however, there are limits to the application of the principle. It is not advisable to exceed 150 feet, at one lift; but by placing a number of such lifts in series, it is possible to command any elevation. The beautiful simplicity of the arrangement renders it welcome to engineers interested in the raising of either clean water or dirty thick fluids; though few engineers can be made acquainted with the appliance without experiencing a feeling of astonishment, not unmixed with personal vexation, that such a means of raising liquids has remained undiscovered until these later days, when it might have been thought that every possible principle and device in regard to pumping must be well known. The Pohle invention must have been on the verge of disclosing itself thousands of times to engineers having charge of pumps and pumping; and yet it remained for Mr. Pohle to seize upon it in the fulness of time.

TECHNICAL RECORD.

WESTERN (U.S.A.) GAS ASSOCIATION.

(*Concluded from p. 32.*)

A report from the Committee on Federation set forth that as yet no Association had, by its vote, expressed a desire for federation; and they therefore recommended that further consideration of the subject be indefinitely postponed. They considered that the tendency of the times is in the opposite direction; and that "the remarkable display of vicious legislation in many States during the present year seems to demand local combinations, such as State Associations or State Gas Commissions, in order to effectually combat the various forms of pernicious politics."

A paper on "The Storing and Handling of Oils in a Gas-Works" was read by Mr. D. J. Collins, of Chicago. The author stated that Mr. M'Kay's paper, read before the New England Association last year,* fully covered the construction of tanks and the measurement of oil; and he did not intend to go over that ground again, but rather to submit a few practical points of a general character. Mr. M'Kay's paper was especially applicable to the larger gas-works; and the present one would be more for the small and medium-sized undertakings. Though there was less danger and loss by evaporation in working with crude oil than with naphtha, it must be remembered that crude oil in bulk was highly inflammable, and required due precaution, regularly maintained, to ensure safety. As they were used indiscriminately according to market values, the storage arrangements should be suited for dealing with either kind. As to the best form of tank, the horizontal cylindrical form was cheaper than the perpendicular cylinder or "cheese-box" shape; and it answered well in many cases. It could be conveyed for considerable distances; but it required careful handling in unloading and placing on the foundation, to avoid straining seams, &c. It was not easy to gauge the contents of a horizontal cylinder. On the whole, especially for large sizes, the cheese-box form was the best; but, in any case, the tank must be gas-tight as well as oil-tight. The upright form could be provided with a shallow tray top containing a few inches depth of water, which tended towards the maintenance of a uniform temperature, and reduced the risk of strains by expansion or contraction. A manhole on the top, as well as one at the side, near the bottom, was required; and there should be a vent, not open to the air, but connected to the inlet of the gasholder. All risk of danger and loss by the escape of vapours was thus prevented. Good asphaltum or plumbago paints were the best for oil-tanks. If set below the ground-level, the tank should not be buried in earth, but set in a pit of brickwork or concrete, so arranged as to leave the whole open for inspection; but the upright form might be set solid on a strong concrete foundation. The very best form of foundation was an outer ring of solid stone or brickwork, with radial cross walls according to size, and cross girders set flush with the top of the wall, to receive the bottom plates. It must be well drained, and provided with manholes to admit inspection of every part. It was the safest plan to put the tank in a water-tight pit, as, in case of rupture, the oil would be prevented from flowing over the premises; and there should be a light corrugated iron roof (not wood) to protect the tank from the summer suns and winter snows. A coil of steam-pipe inside the tank might or might not be necessary, according to the climate and the kind of oil used. A stock equivalent to from 30 to 60 days' requirements, depending upon circumstances, should be kept on hand; and the tanks must be located at a reasonable distance from buildings or places where lights were used. Pipe-lines should not be buried, but might be carried through old gas-pipes, fitted with drip-boxes as was usual for conveying gas, as any leakage could thus be detected. The main discharge-pipe from the tank-car to the storage-tank should not be less than from 2½ to 3 inches diameter. All threads should be truly cut; and a good plumbago grease was the best jointing material to employ. There ought to be no elbows or tees; and curves should be as easy as possible. Every run of pipe must be thoroughly tested before being used. These pipes should not be continued under the railway track, but should rise at the side; and even where the trend of the land admitted of discharging by gravity by a connection to the bottom of the tank, it was well to provide for pumping from the top if desirable. Some companies made a rule that the tank should be emptied by pumping. The rising pipe should be enclosed in a wooden case with lock and key. An 8 or 10 feet length of good rubber hose would be required for connecting up; and in pumping it should be remembered that oil could only be lifted about 22 feet vertically with ordinary pumps, on account of its volatile nature. In cold climates, a portable steam-boiler might be required for thawing any ice formed in the tank-car during the journey. Every cargo of oil should be tested by the hydrometer; and it was well to take a sample in a gallon jar and preserve it, in case the oil should turn out to be of bad quality. A handbook giving the capacity of every tank-car used for hauling oil in the United States had been published, and would prove useful to purchasers. In measuring the stock of oil, it must be remembered that oil expands 1 per cent. for every 20° Fahr. increase in temperature, and shrinks to an equivalent degree by cold. The inlet and outlet pipes of the storage-tank should be separate and distinct, and should be carried through the top, extended to the bottom, and then turned up about 12 inches, so as to avoid the disturbance of sediment or water. A third pipe carried close to the bottom was required for the removal of these matters; and all pipe-connections should pass through the top of the tank, and not through the sides or the bottom. Oil-meters were useful; but, as they were apt to vary, a small tank of known capacity should be fixed, so that they might be tested at least once a week. The use of lights, or smoking, in the vicinity of the tanks should be strictly forbidden. Pipe-lines might be up to a mile in length; but if they could not be used, a tank-waggon drawn by horses would be required. Gas companies situated at a distance from the railway need not be deterred from adopting water gas on this account, as it was as cheap to convey oil as it was to haul coal, taking their respective gas-producing capabilities into account.

Discussion having been invited, Mr. Humphreys said the statement as to horizontal tanks being cheaper than upright ones applied only to those of small capacity. As the size was increased, the cheese-box form became much the cheaper. He was inclined to think that the better practice was to leave out the manhole at the side. It was not used more frequently than about once a year; and any bolted joint on the side of the tank introduced an element of weakness. Before connecting the vent to the gasholder, he advised that the whole subject should be thoroughly investigated. Under some circumstances, a sufficient quantity of vapour would pass off to altogether upset the manufacturing records, especially if the storage-tank was unprotected, and exposed to the sun. He was in favour of having all connections through the top of the tank, if possible; but some tanks were so deep that the oil could not be lifted the entire depth. Too much attention

* See JOURNAL, Vol. LXIII., p. 635.

could not be given to provision against danger by fire. As water was often valueless, a good plan was to keep a stock of dry sand ready for emergencies. If the storage-tanks were well protected, and cooled with water when necessary, he did not object to connecting the vents to the foul main; but even then a lot of vapours might pass over and be lost. If storing heavy oils, he did not mind connecting with the gas-mains; but with light oils, he would have two relief-valves—one in and one out—open to the air, and risk the loss of naphtha vapours, rather than interfere with the quality of the gas. Mr. Thompson said he had two tanks, placed under a covered shed, which had been worked for nine years; and the vents were connected to the gasholders. The loss of vapour was slight; and no trouble had arisen. They held 17,000 gallons each; and a third, having a capacity of 107,000 gallons, was connected in a similar manner last year. Under ordinary circumstances, the stock was kept about the same. The length of pipe between the gas-main and the storage tanks was 400 feet. It was fitted with a syphon; but there was very little deposition of liquid. Mr. A. S. Collins said a steam-pipe in the tank was very useful in case of fire. If the contents of the tank caught fire at the top, the flames could be easily extinguished by blowing in steam. He asked if the correction for temperature which had been quoted represented the actual expansion of the oil, or the differential expansion between the oil and the iron tank. Mr. Odiorne said he once connected a vent-pipe from a storage-tank to a gas-service that happened to be handy. But he found that sufficient vapour passed over to interfere with the supply on the service; and he consequently had to discontinue the plan. Mr. Clark remarked that he could not believe that any bad result would follow from joining the vent to the gasholder, if the tank was protected as suggested in the paper. He had recently connected a tank of 300,000 gallons capacity to the foul main, and found that very little vapour passed over. Sand was a good thing to use in case of small outbreaks of fire; but steam was better for large ones. Mr. Forstall said he unloaded his supply of oil by gravity, and carried it through some 250 yards of pipe without the slightest difficulty. The siding was 30 feet higher than the works. Mr. Collins, in replying, said the correction for temperature was a practical rule which was approximately correct. He reminded the meeting that his remarks applied more particularly to the smaller class of gas-works. The suggestion to keep a stock of sand for extinguishing fires was an excellent one; but a good fire-extinguisher would also successfully cope with small fires.

A paper on "Natural Gas as a Pioneer for Artificial Fuel Gas," by Mr. Donald M'Donald, of Louisville, was not read, on account of the author's absence; but it was ordered to be printed in the official report. Mr. M'Donald states that natural gas has been the means of spreading instruction on the advantages of gaseous fuel, and has also demonstrated that the demand for gas for fuel purposes will be at least ten times as great as that for lighting. It has also afforded the means for practical experiments that have led to great improvements in the efficiency of gas appliances. Not only that, but pipes and fittings were laid that could, without alteration, be used for artificial gas. The result was that, if natural gas were to fail in any city where an artificial substitute could be supplied at 3s. 4d. or less, there would be a large demand for the latter. But old gas companies, saddled with large capital, should consider their position, and lay themselves out to supply gas at a price that would prohibit competition. There would be such a large demand for gas at the lowest possible price, that if the existing concerns could not meet it, new ones would be rapidly formed. He believed that gas could be supplied with profit at a rate that would induce the wealthier classes to use it to the entire exclusion of coal. Attention was then directed to the use of gas for heating and cooking purposes. The necessity for good ventilation was insisted on; and the author thought that gas companies should do more than they have done in the way of instructing gas consumers. At present the gas was blamed for defects really attributable to the ignorance of makers of showy, but badly constructed, appliances. Returning to the subject of the paper, he said he considered that the apparatus eventually adopted for making cheap fuel gas would combine the coal and water processes. The volatile matters would first be driven off, and the residual coke completely gasified. Natural gas had also shown that large fluctuations in demand would have to be provided for; and he thought these would need not only capacious storage, but also large generating plant, including generators that could be set to work in a few hours. It must be remembered that the stoppage, or even the shortness, of the fuel-gas supply would be a very serious matter. With the insufficient supply of natural gas, the artificial substitute would be gradually adopted as an auxiliary. It would be used in mild weather; reserving the coal for prolonged winters. While the adoption of gas for fuel in anything like a general way would be a question of time, he instanced the advance already made; and he urged gas companies to turn their attention to the supply of cheap gas for fuel purposes, and to the encouragement of substantial improvements in gas-stoves.

Mr. G. T. Thompson, the Editor of the "Wrinkle" department, submitted a number of suggestions received from various members. Mr. F. Egner, having been greatly troubled with naphthalene deposits in the purifiers, while running ordinary water-gas apparatus, traced the cause to too much surface in the carburettor and fixing-chamber. He connected an oil-inlet to the bottom of the superheater, and ran the supply of oil in at that point occasionally. This not only removed the deposits, but enriched the gas; so he supposed that the naphthalene was retained in the gas. This difficulty would not have arisen with retort-house coke in the generator, as it heated up more quickly; but he had to use anthracite. He preferred this plan to blowing away some of the producer gas, admitting an excess of air, or taking out some of the fire-brick from the superheater or the carburettor. This suggestion was criticized by Mr. Humphreys and Mr. Miller, who preferred reducing the temperature in the superheater, if necessary, by other means, to bye-passing the oil. They thought there was some risk of unfixed oil vapours going through with the gas. Good results might be shown at the works; but the gas might not be permanent.

Another "wrinkle" was a simple device for testing a length of pipe, or a system of house fittings, for soundness. It consisted of a Woulff bottle, with a junction between the inlet and outlet. The inlet-tube is lightly sealed in water; and the apparatus is connected to the system to be tested from the outlet. The inlet is joined up to any convenient source of pressure. The bye-pass is opened, and the whole put under inlet pressure. It is then closed; and if there is any leak, the pressure falls. A series of bubbles going through the liquid from the inlet roughly indicates the extent of the leak.

Several other "wrinkles" were also discussed; and Mr. Thompson received a hearty vote of thanks for his labours. The "question-box" was then opened; and its contents somewhat hurriedly read. After this the meeting closed with the usual vote of thanks.

Extensions at the Matlock Bath Gas-Works.—The Matlock Bath Gas Company have lately increased their capital by £3000, to enable them to carry out extensions at their works. They comprise a gas-holder of 60,000 cubic feet capacity, with a steel tank; an improved tower scrubber, 50 feet high; annular condensers and washers; a new exhauster; and regenerator furnaces on Mr. W. R. Chester's principle. Land adjoining the Company's present property at Matlock Bath Station will be utilized for the new works, the Contractors for which are Messrs. R. Dempster and Sons, Limited, of Elland. The foundation and preparatory work is being carried out under the direction of Mr. A. W. Elton, the Engineer and Manager of the Gas Company.

Lisburn New Water-Works.—Mr. C. P. Cotton, M.Inst.C.E., held an inquiry at Lisburn last Tuesday respecting an application by the Town Commissioners for the sanction of the Local Government Board for Ireland to an additional loan of £5000 for the extension and improvement of the water supply. Mr. Young, who appeared for the Town Commissioners, stated that they had already paid in cash on the new water-works £10,487; and in miscellaneous expenses, including fees and law costs, £1020. The contract for the construction of the works was for £16,000; and it was estimated that the extras would amount to £2000, and the miscellaneous expenses to £2012. The total sum already sanctioned for the works is £27,000; the total required being £32,000.

The South Staffordshire Water Company and the Water Supply of Wednesbury.—Complaint was made at last week's meeting of the Wednesbury Town Council as to the inadequate supply of water in various parts of the town. The district is supplied by the South Staffordshire Water Company; and the Gas and Water Committee reported that they had written to the Company urging them to deal with the matter forthwith. Alderman Williams asked that some allowance should be made for the difficulties which the Company had had to encounter. During February and March they lost, he said, seven million gallons of water owing to the frost; and since then the drought had very severely affected their supply, which had never been shorter than at the present time. They were doing all they could in the way of pumping; and at the last meeting of the Directors, the wants of Wednesbury were specially considered, and arrangements were made, irrespective of pressure on the part of the Corporation, to lay down additional pipes in the town. Several councillors afterwards supported the complaints on behalf of different districts, and argued that, if the Company could not furnish a full supply, they ought not to exact full charges.

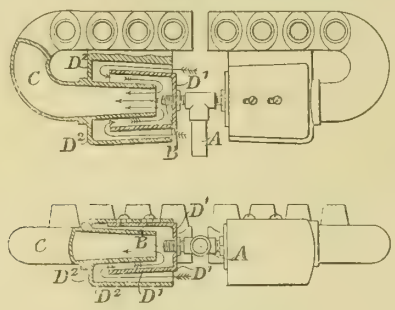
The Production of Gas at Oldham.—There has been some disagreement, at recent meetings of the Oldham Corporation Gas Committee, relative to the gas-producing quality of the coal used at the gas-works. Statements were made on the subject by Mr. Shaw and the Chairman (Alderman Smith); and these were remitted to a Sub-Committee for inquiry. The matters considered were the cost and quantity of coal and cannel used, the amount of gas made per ton, and the illuminating power at each station during the twelve weeks ending April 13 last, and the twelve months ending March 25. After taking into account the quantity of gas produced per ton at each station, the Sub-Committee found there appeared to be a difference of 1d. per ton of coal in favour of Hollinwood as compared with Higginshaw; but they could not ascertain to which particular coal, if any, this apparent advantage was to be attributed, seeing that there were five different kinds of material used at Hollinwood during the twelve weeks ending April 13. The statement for the twelve months ending March 25 showed that the average cost of coal, cannel, and haulage at each of the works was: Oldham, 11s. 11·288d. per ton; Higginshaw, 11s. 6·389d. per ton; and Hollinwood, 11s. 6·502d. Comparing the Higginshaw and Hollinwood stations as in the former case, by taking into account the increased make of 88 cubic feet per ton at the former station over the latter, and also the increased illuminating power of 0·6 candle, Higginshaw showed an apparent advantage of about 11d. per ton over Hollinwood. The Gas Committee have accepted as correct the findings of the Sub-Committee.

REGISTER OF PATENTS.

Atmospheric Burners for Gas-Fires.—Wright, G. E., of Birmingham. No. 13,243; July 9, 1894.

This invention is directed to minimize the risk of "lighting back" at the gas-inlet nozzle, when the gas is being burnt at a low pressure, or when there is a draught acting on the burner.

In the accompanying illustration, two gas-burners for a gas-fire are shown in part sectional plan and part sectional elevation.



A is the pipe conveying gas to both burners as usual, and B is the gas-inlet nozzle. C is the mixing pipe or chamber, having an inlet orifice at one end for the gas and air, and outlets at the other end where the mixed gas and air are burnt. The outer casing round the inlet end of the inner chamber C consists of two parts—D^1 D^2—the former of which is like a bell, rather larger than the inlet end of the chamber C. It encloses and extends some little distance along it. The outer part D^2 is like a larger bell enclosing the part D^1; so that the air, before entering the inlet orifice, has to pass along the spaces in the outer casing, in the direction shown by the arrows. In the event of the flame flashing back through the mixing chamber, the explosion in the chamber will force the mixed air and gas back towards the outer casing D^1 D^2, where the various turns will so baffle the mixed air and gas as to form an air-buffer, the elasticity of which will force the flame forward again, and thus prevent the gas lighting at the gas-inlet nozzle.

Gas Motor Tramcars.—Holt, H. P., of Manchester. No. 14,002; July 20, 1894.

This invention relates to engines and driving-gear for gas-motor cars, and to means of reversing the rotation of the motor shaft.

The crank-shaft is mounted in a vertical position about the middle of the car; having on its lower end a horizontal fly-wheel, from which, by bevel and suitable intermediate gear actuated at one side of the car, the wheels of the car are driven. To the crank on the vertical shaft are connected the pistons of two horizontal cylinders, one at the side of the car opposite to the gearing, and the other towards one end. The latter cylinder is provided with means for cutting off the gas supply, and allowing the piston to move idly, when the other cylinder is sufficient to give the necessary power. It is thus possible to dispense with a second set of slow-speed gear for starting and ascending gradients. Besides the second cylinder mentioned as being situated towards one end of the car, there may be a third cylinder towards the other end—this cylinder also being provided with means for cutting off the gas supply.

For the purpose of reversing, the patentee in the first place arranges the ignition-gear so that the cylinder charge is always ignited a little before the piston reaches the end of its instroke. Thus, when the engine is going slowly (the fly-wheel having little momentum), the combustion of the charge propels the piston in the direction opposite to that in which it was proceeding towards the extreme of its instroke. An arrangement of cams work the gas and air supply valves, the exhaust-valve, and the ignition-gear. They are not fixed in position on the valve-shaft, but are driven by stops fixed thereon; so that, when the rotation of the shaft is reversed, they take a position relatively to the crank to suit the reversed motion.

A centrifugal governor controls the gas-supply valve, according to the speed of the engine; and a spring bearing against the sliding sleeve of the governor aids the centrifugal force. There is connected to a lever, on which one end of this spring bears, a pair of slides (faced with leather, wood, or the like), one of which—by means of a hand-lever—can be pressed upon the engine-shaft or the valve-shaft, to effect reversal. When the slide is so pressed, it is caused by the friction on the revolving shaft to travel in such a direction as to compress the spring, which, aiding the centrifugal force, causes the governor to operate as if the speed of the engine were excessive. This cuts off the gas supply, until the speed is so far reduced that the fly-wheel has scarcely sufficient momentum to carry the crank over its back centre. A gas charge then admitted to the cylinder is fired by the ignition taking place just before the back centre is reached; and thus the engine is reversed, as stated above. The slide is now caused, by its friction on the reversed shaft, to travel backwards; relieving the governor sleeve from the spring, and so restoring the governor to its normal condition.

Retorts.—Teisser, N., and Nègre, G. L. A., Uzès, France. No. 14,553; July 28, 1894.

The object of this invention is "to provide retorts which shall have as great a resistance to heat, which shall be as easily manipulated and adapted for transport as those hitherto generally employed, and which shall have a greater extent of heating surface, and be more permeable to heat." To this end, the patentees propose, instead of making the retorts with thick and smooth walls, as hitherto, to form them with walls of comparatively less thickness, and with undulating surfaces, such undulations being arranged either longitudinally or transversely, and extending either over the whole surface or over only a part, as may be desired.

Prepayment Gas-Meters.—Simmonds, H., of Colne. No. 15,747; Aug. 18, 1894.

This coin-freed gas-meter has its supply-valve connected to gearing which can be thrown into gear either with a handle capable of being rotated to open the valve, or with the index mechanism of the meter to close the valve—the connection for operating it being provided by the insertion of the coin. There is also a combination of mechanism, for stopping or preventing the movement of the meter when the valve is in gear with the operating handle.

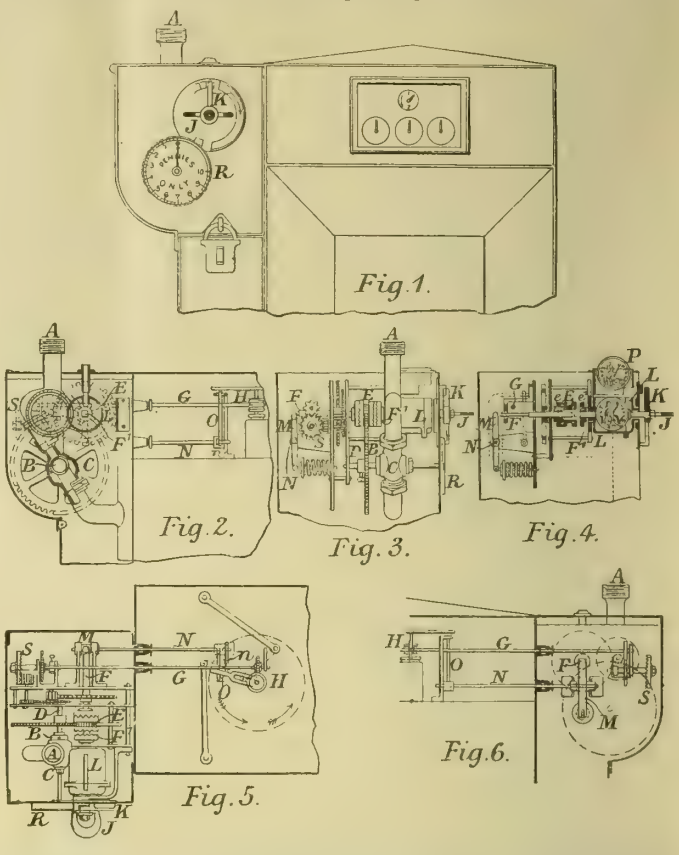


Fig. 1 is a front elevation of the meter, showing the apparatus fixed to the side. Fig. 2 is a longitudinal section; fig. 3, an end elevation; fig. 4, a transverse section; fig. 5, a plan with the top cover removed; and fig. 6, a back elevation.

To the inlet-pipe A is connected a valve B, fitted in a chamber C; the valve being attached to, and operated by, a spindle D, capable of being rotated in either direction. The valve may be of such construction that it can be opened by the rotation of the spindle in one direction, and closed by its rotation in the opposite direction. The form of valve preferred is a plug-valve, cut away to such an extent that it remains open during the greater part of the revolution of the spindle; and the spindle is operated in either direction by a toothed wheel fixed thereon, gearing with the wheel E on the driving shaft or spindle F. This driving-wheel E is loose on the shaft; and it is provided at each side with clutch teeth. On the shaft at either side of the driving-wheel, are placed two clutch wheels made fast to the shaft, so that the direction of rotation of the driving-wheel and of the valve B are consequent upon which of the clutches is in gear with the wheel. The second or driving shaft F is divided in its length into two parts; one of the clutches being affixed to each part. One end of the shaft is connected, by a train of wheels and a shaft G, with the index mechanism H of the meter; while the other end F^1 is connected by the coin-receptacle L with a knob or handle J (outside the apparatus) by which it can be rotated. The handle is carried by a spindle, to which is also affixed a radial arm or finger K.

On the outside of the casing is fixed a quadrant guide and two stops for the radial arm. This arm rests against the top stop; and when the knob is to be rotated, it is removed from the stop and pressed inwards. But as it rotates, it is held in this position by the arm K pressing against the inner side of the quadrant guide. When it completes half a revolution, the finger emerges from beneath the quadrant-guide, and comes against the stop—the coin being released. Between the spindle which carries the handle J and the end F^1 of the driving-shaft is pivoted a chamber L, of cylindrical or other shape, to receive the coin passed into it through a slot. Into this chamber, the ends of the spindle project; and the position of the coin is edgewise between them. The ends of the spindle and shaft are made square, so that, as the knob J is rotated, the receptacle L, and with it the shaft F^1, is rotated.

The clutches at either side of the loose driving-wheel E are attached respectively to the parts F F^1 of the driving-shaft; and on the shaft being moved in either direction longitudinally, one of the clutches engages with the loose wheel E and rotates it—the motion being conveyed to the spindle D operating the valve B. In its normal position, the clutch in connection with the shaft G and index mechanism H is in gear with the wheel E. After the coin P is inserted in position, by pressing inwards the handle J before rotating it, the end F^1 of the driving-shaft is also pressed inwards, one clutch thrown out of gear, and the other brought into gear with the loose wheel E. The driving-shaft F is moved back again into normal position by the spring lever M, which bears against the end, and is actuated by a spring. The lever M is fixed to the shaft N, which is rotated part of a revolution at each movement of the lever. At the other end of the shaft N is another lever or rod, connected to a bolt O. When the driving-

shaft F is pushed backwards or inwards, by the action of the handle J and coin P, this bolt is thrown up to engage with the moving part of the meter, and stop all motion thereof, so that the passage of gas through the meter is stopped during the time the coin is in the apparatus. This prevents a supply of gas being obtained should an attempt be made to block the supply-valve open.

To the valve-spindle D, a dial R and indicating-finger may be connected, to show to what extent the valve B has been opened, and how far it remains off being closed. To this, any additional counting or recording mechanism may be applied. The edge-wheel S can be changed to one of greater or less diameter, to alter the speed of the mechanism and the rate at which the valve is closed, according to the amount of gas for which one coin pays.

In operation, the coin P is inserted in the slot, and dropped down into the chamber L; and the handle J is rotated and pressed inwards. The finger K on the spindle then passes behind the inner side of the quadrant or cam, which holds it until half a revolution has been made. The inward movement brings the outer clutch into gear with the loose wheel E, and throws the other clutch out of gear. At the same time, the bolt O is thrown up to stop the working of the meter; and the rotating movement causes the clutch and wheel E to rotate, and with them the spindle D of the valve B, which is thereby opened for a certain distance. When half a revolution has been made, the finger K emerges from behind the quadrant, draws back the spindle, and releases the coin—allowing it to fall out of operation. The driving-shaft F is then moved back by the spring, and brings into gear with the wheel E the clutch, which communicates with the index mechanism H; and at the same time the bolt is drawn down, allowing the meter to work. This clutch moves in the opposite direction to the other, and slowly closes or returns the valve to its seat as the gas is consumed.

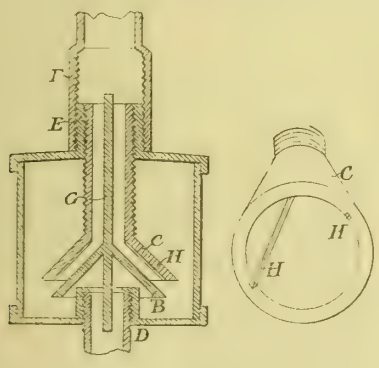
Igniting and Extinguishing Gas-Jets Simultaneously from a Distance.—Morstein, O. von, of Berlin. No. 4670; March 5, 1895.

This invention has for its object to provide means for igniting and extinguishing any number of gas-jets, with the use of only one conductor and one contact.

For this purpose, an electro-magnetic gas-closure opener, common to all the jets, is applied at any convenient part of the common gas-supply pipe; but the ignition of the jets is effected by secondary induction currents. The electric opening and shutting-off of the gas-pipe is effected by means of two different electro-magnets or two different conductors; and the gas-pipe may serve as the one conductor for the battery current, as well as for the secondary currents. The gas-cock opener and the inductor are in intimate connection with each other; both being set in activity by the same battery current, the same conductor, and the same contact. The same current—that which excites the opening electro-magnet—produces in the secondary bobbin the secondary current required for the ignition of the gas-jets, by means of intermittently springing sparks. This may be accomplished either by employing the opening electro-magnet itself as a primary bobbin, and placing the secondary bobbin directly over it, or else by practically separating a portion of the opening electro-magnet, and employing this portion as a primary bobbin.

Gas-Burner Regulators.—Feeny, V. I.; communicated from the "Faultless Gas-Saver Company," of San Francisco, California. No. 7709; April 17, 1895.

This device for regulating the flow and pressure of gas is shown in the illustration—a vertical section and a perspective view of the valve-seat.



The casing is of sufficient size to contain the valve B, and the valve-seat C. At its lower end, it can be secured to the upper end of the gas supply-pipe D; while from the top of the case a tubular extension E is provided, on which the burner-tube F is screwed. The valve-seat is in the form of a hollow cone, having a hollow extension adapted to screw into the inner threads of the extension E at the top of the case, so that the valve-seat will be but a short distance above the open end of the pipe D and the apertures through which gas flows into the case. The valve B has a stem G, extending up within the hollow extension of the valve-seat, and also down through a hole made in the part into which the pipe D is secured; so that the stem is suitably guided, and the valve allowed to rise and fall at will. The interior of the valve-seat has grooves H made in it (extending from the bottom up to a point where they connect with the interior passage), for the purpose of allowing a small flow of gas when the valve has been closed.

The valve B is so arranged with relation to its seat and the inlet opening, that, under a certain pressure of gas, the valve will remain open sufficiently to allow the desired amount of gas to flow through the extension of the valve-seat, and thence to the burner. If the pressure be increased, the valve will be closed against the seat C; but the grooves or channels H would still allow the proper proportion of gas to flow to the burner under the higher pressure, so that whatever increase of pressure takes place within the supply-pipe, no greater amount of gas will flow to the burner.

Overhead Regenerative Gas-Lamps.—The Lamp Manufacturing Company, Limited, of Leonard Street, City Road, and Welch, W. H. I., of Coborn Road, Bow. No. 8318; April 26, 1895.

This invention relates to a compact construction of the passages for the entering air and the issuing products of combustion in an overhead regenerative gas-lamp.

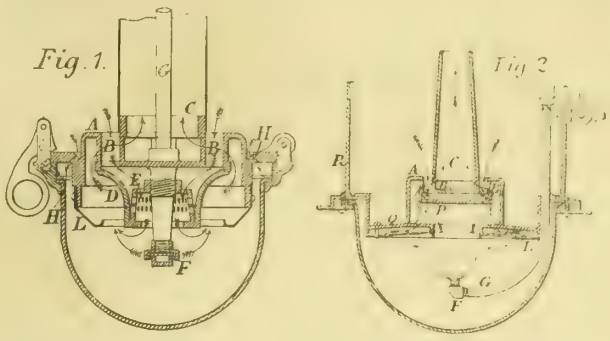


Fig. 1 is a vertical section of a lamp, with the passages adapted for a circular flame. Fig. 2 is a vertical section of a flat-flame lamp.

The passages for the entering air and for the issuing products of combustion are formed in a casting A, having its upper and lower sides integral with a number of tubular bosses B connecting them. Air entering to supply the flame flows through these bosses; while the products of combustion flow around and through between the bosses on their way to the chimney C. When the flame is circular, the heated air passes into a casing D, and through a perforated shell E, to supply the upper side of the flame of the gas issuing from the perforations of the burner F. The casing D is held up to the casting A by the shell E, which is screwed on to the gas-pipe G. The air to supply the under side of the flame enters by perforations H in the flange of A, and flows into the interior of the globe. The products of combustion flow through an annular opening in the reflector L, ascend outside the shell D, and flow through, between, and around the bosses B to the chimney C. The casing D and the casting A, being heated by the products of combustion, impart heat to the air entering to supply the flame.

When the lamp has a flat-flame burner (fig. 2), the products of combustion flow through an elongated aperture into an arch P; thence each way and up; then between and around the bosses B to the chimney C. The air enters through the bosses B; descends on each side of the arch P into a space above the reflector L; and thence through perforations in the reflector into the globe, being highly heated on its way. The arch P is formed through a cylindrical boss projecting upwards from a horizontal disc Q, to which the reflector is fixed, and which has a flange resting on the internal flange of an outer casing R.

APPLICATIONS FOR LETTERS PATENT.

12,105.—Crocker, S. H., "Radiant tissue for lamps." June 21.

12,216.—Radclyffe, D. E., and Burrows, T., "Preventing water-pipes of lead or the like bursting through freezing." June 24.

12,222.—Gordon, J., "An improvement in water-pipes by which water is delivered free from lead poisoning and the chances of damage by frost are greatly diminished." June 24.

12,234.—Powlesland, T., "Illuminating apparatus." June 24.

12,245.—Sweetster, A., "Production of oxygen gas." June 24.

12,247.—Singer, P., "Gas or oil engines of the 'Otto' cycle." June 25.

12,289.—Brock, L., "Gas heating apparatus." June 25.

12,344.—Exley, J. H., "Generating acetylene gas." June 26.

12,355.—Thorp, T., and Marsh, T. G., "Gas-producing lam ps." June 26.

12,356.—Thorp, T., and Marsh, T. G., "Production of heating and illuminating gas." June 26.

12,385.—Bark, J. P., "Improvements in or appertaining to domestic water supply apparatus or the like." June 26.

12,437.—Watkinson, W. H., "Rotary motors of the reaction type, applicable for the utilization of steam, gas, or hydraulic pressure." June 27.

12,527.—Bergmann, F. J., "Extraction of distillation products from sawdust, wood waste, and the like." June 28.

12,528.—Linde, C., "Liquefying gases or gaseous mixtures, producing cold, and separating oxygen from atmospheric air." June 28.

12,560.—Wheatley, W., and Somerville, J. M., "Manufacture of carburetted water gas, and apparatus therefor." June 29.

Belfast Corporation Gas-Works.—The Belfast Gas Committee have accepted a tender of the Gas-Meter Company, Limited, for the supply and erection of a station-meter, to pass 100,000 cubic feet of gas per hour.

Compensation in Respect of an Easement for a Water Conduit of the Bradford Corporation.—Arbitration proceedings have recently been conducted before Mr. B. S. Brundell, at the Bradford Town Hall, in respect of an easement for a water conduit belonging to the Corporation of Bradford, through the estate of Mr. W. Ferrand, of St. Ives, Bingley. Mr. W. Middleton acted as Arbitrator for Mr. Ferrand; and Mr. T. Fenwick for the Corporation. The claim was for £3028 for the easement of a conduit 1499 yards long, and 740 square yards of land, which it is proposed to acquire as freehold for water-valves and for the erection of an aqueduct over the River Aire. The Corporation contended that the claim was greatly exaggerated. Evidence was called to show that £360 would be an ample price for the easement area, for which £562 was asked. A claim of £400 for the land to be occupied by the valves was regarded as most unreasonable; as was also the supposed depreciation of £60 each to twenty sites for villas. The other items making up the total claim were, it was argued, equally absurd. The Umpire's award has not been published.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Professor Lewes's Report on English Gas Fires, Stoves, &c.

SIR,—I regret that my deafness prevents my attendance at The Gas Institute meeting, or I should have called attention to some very important points overlooked by Professor Lewes.

So far as our patterns of incandescent fires are concerned, these are designed to give their maximum duty with a gas-pressure not exceeding 7-10ths at the jet. At this pressure, a consumption of 40 cubic feet per hour is impossible with any of our fires tested. The fact that flame was visible at the flue outlet, shows that more gas was passing than could be consumed in the fire; and it would appear that this may be the cause of the average low duties obtained with every make of fire tested. The maximum gas-pressure with a fire is quite as important as with a lighting burner, if economy is to be considered; and, to judge fairly of the comparative duties, the gas-pressure in each case is a necessary factor.

With regard to the production of a high temperature flame of small size, and a perfectly explosive mixture, this is a very simple matter with a properly proportioned mixing-tube and jet; but there are in many cases practical objections to such a burner, if placed in unskilled hands. Unless of very small size, it is sensitive to every variation of pressure, and requires minute adjustment to every small variation in the quality and composition of the gas used. It is, in fact, a burner for small work, or for experts only, and one which cannot be sent out by the hundred thousand, to be used by the ordinary domestic servant, however perfect it may be theoretically. Flames of this class under some conditions, not well understood, are also occasionally sensitive, jumping in the most erratic way to certain sounds—in fact, one pattern of burner, designed to give a short flame of high temperature without mechanical aid, had to be withdrawn from sale for this reason only, although at times it would burn with perfect steadiness for days together. The use of an electric motor to every burner is out of the question in ordinary practice. The same result has been obtained in a well-known petroleum lamp, and also in the Lewis incandescent burner, by the use of a supplementary air supply, under low pressure obtained from a fan driven by clockwork—one fan supplying any number of burners. The Denayrouze burner referred to by Professor Lewes does not appear to be the form originally patented, which had the objections of a possible red-hot fan bearing, and a revolving shaft, which would always be at a red or white heat. The new form requires a current of electricity to work it, and a separate motor for every burner, which is certainly no recommendation. The Lewis burner, although a commercial failure, possibly was so only because it was before its time, coming as it did, when expense and complication of parts were fatal to commercial success.

These mechanical aids are all more or less troublesome and expensive; and in practice the same result could be obtained without any supplementary aid, by an increased gas-pressure, provided this pressure is kept constant. Given this, or its equivalent in a fan or other method of increasing the supply of air, the prevention of lighting-back, with nearly perfect explosive mixtures, is easy, in such small burners as are used for incandescent lighting, either by reducing the diameter of the tube, using a cluster of small bore, instead of one larger size, or by the lengthening of the ordinary tube, and introducing two or three sharp curves—neither of these being at all practicable without some mechanical aid to increase the speed of the current, or a heavy gas-pressure.

With the fullest appreciation of Professor Lewes's work, it must be remembered that makers of burners for heating purposes have to consider the majority of the users, and their absolute ignorance of the necessity for any care or knowledge of conditions which may be required. Gas engineers have to consider the uneducated crowd, not the expert. He is no trouble; and what he wants is usually an easy matter, as the manufacturer is not hampered by the ignorance of the user.

With regard to the shortening of the flame, and consequent increase of temperature, this, except on the smallest scale as previously stated, is not practicable without mechanical aid of some kind to increase the speed of combustion. I have carried this system out in practice to the extreme extent of doing without flame entirely, and for the last 15 years have made, and my present firm still make, large quantities of absolutely flameless burners, which will produce a blinding white heat. But these are for laboratory use only, and are totally unfit for the average user of gas as a fuel.

I think those who are fully acquainted with the necessities of commercial practice, and also with the work done by English and Continental manufacturers, will acknowledge that the English are far from being the last in the race, and are quite in a position to hold their own. I fully appreciate Professor Lewes's work in every way, and trust, as a personal friend, that he will take my criticism as it is intended, in a purely practical and commercial sense.

Warrington, July 6, 1895. THOS. FLETCHER.

New Water Pumping Machinery for Liverpool.—Messrs. Hathorn, Davey, and Co., of Leeds, have secured from the Liverpool Corporation the contract for the supply and erection of pumping machinery at the Aubrey Street high-level station, for the sum of £3800.

New Water Reservoir for Preston. The Preston Corporation have commenced at Alston the construction of a new reservoir which it is estimated will cost about £60,000; and the amount to be spent on new mains in connection therewith is put at £35,000. The work is being carried out under the direction of Mr. H. Beah, the Borough Surveyor. The area of the new reservoir is about [illegible] acres, and it will have a storage capacity of 275 million gallons, being 354 feet above the level of the sea, a good pressure is assured from it. Its greatest depth will be [illegible] feet. The total capacity of the existing reservoirs is something like 253 million gallons.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress was made with Private Bills down to the prorogation of Parliament (last Saturday):—

Bill reported, with amendments: Bray Township Improvement Bill.

Opposition withdrawn: Croydon Corporation Bill.

Bills read the third time and passed: Bray Township Improvement Bill; Cranbrook District Water Bill; Croydon Corporation Bill; Local Government Provisional Order (Gas) Bill.

Bills Royal Assented: Bray Township Improvement Bill, Bridlington and Quay Water Bill, Brighouse Corporation Bill, Chesterfield Gas and Water Board Bill, Cranbrook District Water Bill, Croydon Corporation Bill, Merthyr Tydfil Local Board Water Bill, Water Orders Confirmation Bill.

HOUSE OF COMMONS.

The following further progress was made with Private Bills down to the prorogation of Parliament:—

Bill read the first time: Dewsbury and Heckmondwike Water Bill.

Bills read a second time and committed: Chesterfield Gas and Water Board Bill; Gas Orders Confirmation Bill; Gas and Water Orders Confirmation Bill; Water Orders Confirmation Bill.

Bill reported, with amendments: Merthyr Tydfil Local Board Water Bill.

Bills reported, without amendment: Chesterfield Gas and Water Board Bill; Water Orders Confirmation Bill.

Bills read the third time and passed: Chesterfield Gas and Water Board Bill; Merthyr Tydfil Local Board Water Bill.

Petitions against the Barnsley Corporation Water Bill have been presented from the Corporations of Doncaster, Rotherham, and Wakefield, the Stockbridge, Swinton, and Hemsworth District Councils, the Duke of Norfolk, Messrs. S. Fox and Co., Limited, the Wakefield Rural District Council, the West Riding County Council, the West Riding Rivers Board, and Owners, &c., of works and property on the River Don.

Under a Standing Order passed on the 2nd inst., in view of the dissolution of Parliament, the following Bills in which our readers are interested have been suspended at the stages named: After first reading—Barnsley Corporation Water Bill, Chelsea Water (Transfer) Bill, Dewsbury and Heckmondwike Water Bill, East London Water (Transfer) Bill, Grand Junction Water (Transfer) Bill, Kent Water (Transfer) Bill, New River Water (Transfer) Bill, Rotherham Corporation Bill, and West Middlesex Water (Transfer) Bill. After second reading and committal—Chelsea Water Bill, Lambeth Water Bill, Lambeth Water (Transfer) Bill, and Southwark and Vauxhall Water (Transfer) Bill. The Gas Orders Confirmation Bill and the Gas and Water Orders Confirmation Bills, received from the Lords, are also suspended.

HOUSE OF COMMONS COMMITTEE ON LONDON WATER BILLS.

Dissolution of the Committee.

Last Wednesday a quorum of the Hybrid Committee on London Water Bills assembled for the purpose of making a final pronouncement as to their course of action in view of the recent change of Government and the impending dissolution of Parliament.

The CHAIRMAN (Right Hon. D. Plunket) said that, according to the decision come to by the Committee on the previous Friday (*ante*, p. 41), as there was no reasonable prospect of their being able to hold continued sittings probably beyond the next Monday or Tuesday, they had nothing to do but to dissolve. As would be remembered, the meeting that day was only summoned in case there might be any alteration in the prospects of an early dissolution of Parliament. There was no such alteration; and therefore he had nothing more to do but to thank Counsel for the assistance they had given the Committee in the course of their somewhat arduous labours.

The Committee then dissolved.

The Chairman subsequently presented to the House the following report from the Committee: "That, in the case of the Lambeth Water (Transfer) Bill, the Committee were of opinion that, as it would not be possible to conclude the case before the rising of the House, the consideration of the Bill, which had been partly considered by them, should not be further proceeded with during the present session; that, in the case of the Southwark and Vauxhall Water (Transfer), Lambeth Water, and Chelsea Water Bills, the Committee were of opinion that the consideration of the said Bills should not be entered upon during the present session."

HOUSE OF COMMONS COMMITTEE.

The Salford Gas Provisional Order.

A Select Committee of the House of Commons, presided over by the Hon. A. de Tatton Egerton, had under consideration last week the Bill prepared by the Local Government Board to confirm certain Provisional Orders; among them being one applied for by the Salford Corporation for power to raise a further sum of £85,000 for the purposes of their gas undertaking. The application was opposed by the Swinton and Pendlebury Urban District Council, whose district is supplied with gas by the Corporation.

Mr. BALFOUR BROWNE, Q.C., the leading Counsel for the Corporation, said they had power to borrow on the security of the rates, for

gas purposes, a sum not exceeding £134,000. This had been found insufficient for the wants of Salford and the outside districts they supplied; and the proposal now was to increase the amount by £85,000. The matter had been inquired into on the spot, and had been sanctioned by the Local Government Board. The only opposition now was that of the Swinton and Pendlebury District Council, who complained that they had to pay higher prices than were charged within the borough. The fact was that in Salford the small consumers were charged 2s. 4d. per 1000 cubic feet, as compared with 2s. 6d. in the Swinton district; the large consumers paying 2s. 3d., as against 2s. 4d. In other outside districts, the charge was higher than in Swinton and Pendlebury; but this was inevitable. The prices were, as a matter of fact, very low indeed; and the £85,000 would be spent in such a way as would enable the Salford Corporation to reduce them both within and outside the borough.

A number of witnesses were called on behalf of the Corporation, to show the necessity for the additional loan; and it was stated that part of the works proposed to be erected would be within the Swinton district.

The cross-examination on behalf of the District Council was mainly directed to the accounts; it being alleged that too large profits were made by the Corporation out of the gas undertaking, and that the Swinton district did not get the benefit of these. It was also alleged that the capital expenditure had been considerably in excess of the legitimate requirements of the undertaking. The petitioners asked that, if the Order were granted, it should contain provisions for abolishing the differential rate now existing in their district, and providing that the price charged for gas should be the same in Swinton as in Salford; for reducing the price from time to time, either by adopting a sliding-scale or otherwise; for limiting the amount of profit to be hereafter made by the Corporation in respect of their gas undertaking, and defining the amount of capital on which the profit was to be based, for enabling the Swinton district to participate in a fair proportion in any profits; for abolishing the depreciation fund of the Corporation in relation to the gas undertaking, or limiting its amount, and providing for its application solely to the purposes for which it was authorized to be established; for applying to the Corporation, in relation to their gas undertaking, the general law relating to gas-works, with the necessary modifications; for requiring the Corporation to provide a testing-place with proper apparatus, within the Swinton district, for testing the illuminating power and purity of the gas supplied; and for the publication by the Corporation of the accounts relating to their gas undertaking, and the inspection of these accounts by the Swinton Council. It was submitted that while the difference in the price charged was nominally only 2d., the real difference was 8d. or 9d.; and it was alleged that the Corporation were charging too much all round, and taking, for the purpose of the rates, profits they were not entitled to.

A discussion took place as to whether there was time for the Order to become law in the session; and what would be the effect if the Committee stage were unfinished.

Mr. Boyce, of the Local Government Board, stated that the officers of the House had informed him that, if the Committee stage were unfinished, the Bill would have to be taken up again at that stage.

Mr. Balfour Browne stated that the promoters did not intend to call their Accountant.

Mr. Bidder, Q.C., who led on behalf of the petitioners against the Order, was about to call witnesses, when

The Chairman said it might shorten the proceedings if he stated at once that the Committee were of opinion that Salford should not alter the present proportion of the differential rate; and that the Committee were not prepared to change the whole incidence of the gas undertaking of the Corporation on the Bill before them. They thought there should be a limit of profit; and they suggested a margin not exceeding that of the year 1892-3. They further considered that the existing capital should be taken as a basis for a fresh start; that the depreciation fund should not be abolished, but be limited in amount, and applied solely to the purposes for which it was authorized; and that the Swinton Council should have power of inspection of the gas accounts.

Mr. Bidder said he was prepared to accept these terms, with the addition that the actual limitation of the profits should be settled by the Local Government Board. He understood that the profits should provide for the payment of interest, and the sinking fund for depreciation, and leave a margin, so as to be on the safe side.

The Chairman: That is our intention.

Mr. Balfour Browne said he could not accept the decision of the Committee. Salford provided 94 or 95 per cent. of the profits, and no profits were made on the gas supplied to Swinton and Pendlebury. Under these circumstances, the Corporation would have to go without the additional capital, and would withdraw the Order.

The Bill was then amended by striking out the Salford Order.

Mr. Bidder asked for costs.

Mr. Balfour Browne opposed the application.

The Committee, however, decided to allow them; and in reporting the Bill to the House, they made the following statement: "In the case of the Salford Order, the Committee were unanimously of opinion that the petitioners against the confirmation of the Order had been unreasonably subjected to expense in defending their rights proposed to be interfered with by the Order, and are entitled to recover from the promoters—namely, the Mayor, Aldermen, and burgesses of the borough of Salford—their whole costs in relation to the opposition."

A Supply of Water for Wilsden from Bradford.—The District Council of Wilsden have provided for the area under their jurisdiction a supply of water from the Thornton Moor reservoir of the Bradford Corporation. The reservoir is situated at a height of 1250 feet; and the Wilsden levels are from 900 to 600 feet. Wilsden has therefore an excellent pressure of water—being at the higher level 200 lbs. to the square inch, and at the lower level 250 lbs. The Chairman of the District Council (Mr. A. Ambler) turned on the water at the meter-house last Saturday week; the occasion being one of much rejoicing on the part of the inhabitants.

LEGAL INTELLIGENCE.

The Litigation between the Alliance Gas Company and the Dublin Corporation.

The proceedings taken by the Alliance and Dublin Consumers' Gas Company against the Dublin Corporation to compel them to fix proper meters to the public lamps (see *ante*, p. 42) were brought to a close last Saturday, when the Company obtained the injunction for which they applied. Our report of the conclusion of the case is unavoidably held over.

The Arbitration between the Yeadon Water Company and Wright.

This matter, which has been several times before the Courts (the last occasion being on March 5 last, when Mr. Justice Kennedy delivered the judgment of the Divisional Court in favour of the Company—see Journal for March 12, p. 544), came on for argument on Monday last week before the Master of the Rolls and Lords Justices Kay and Smith in the Court of Appeal. Mr. Lawson Walton, Q.C., and Mr. Manisty appeared for Mr. Wright. They argued at some length that the Company were not entitled to deduct, as they had done, £1745 from the retention-moneys as liquidated damages for delay in the completion of the reservoir for which Mr. Brigg had contracted, and which Mr. Wright, one of his sureties, had undertaken to complete on the failure of the original contractor to carry out the work satisfactorily. Mr. Tindal Atkinson, Q.C., and Mr. Willes Chitty, who appeared for the Company, were not called upon. Their Lordships held that the decision of the Divisional Court was right; and they dismissed the appeal, with costs.

Deposits and Contracts.

At the Highgate Petty Sessions, on Monday last week, George Myers, of No. 5, Wellington Road, Walthamstow, was summoned for £4 15s. 9d. for gas supplied to 121, Turnpike Lane, Hornsey. Mr. Forbes appeared for the defendant. It appeared that the defendant signed the usual contract for gas, and for some time the matter went on very well, and the money was paid to Mr. W. D. Ovens, the collector to the Hornsey Gas Company; and the amount claimed was now due. Notice to discontinue was given on Feb. 1. Mr. Forbes said credit had not been given for the deposit. His client had not occupied since Dec. 18. The person who ought to pay was Mr. Gomm, who took over the premises. He had now left. Mr. Ovens said he told Mr. Myers he should hold him responsible till he received notice to discontinue. In answer to Mr. Tubbs (the Chairman), he said he was willing to take half the amount that was owing up to the time he gave notice. An order to pay £2 7s. 10½d., and 3s. costs, was made. In another case, the defendant, Mr. Youll, of Dartmouth Road, Forest Hill, was summoned for £1 5s. 1d. for gas supplied to his house in Tivoli Road, Crouch End. Defendant said a deposit of 10s. was paid; and if credit was given for that, he would pay. Mr. Ovens said this 10s. was paid for fitting the meter and connections in 1886. At that time, this was the amount they always charged; but now the fitting was done free. An order to pay the full amount, with costs, was made.

Bythesea v. Stroud Water Company.

This was a debenture-holder's action, which came before Mr. Justice Stirling in the Chancery Division of the High Court of Justice last Saturday. The plaintiff, represented by Mr. M'Swinney, is the holder of six debentures of the second issue; and he sued on behalf of himself and all other debenture-holders. The interest due on March 1 last was not paid; and on the 30th of that month an order was made appointing a receiver of the rates and tolls. An order was now made, in the usual form, directing an account of what was due to the plaintiff and other debenture-holders, with inquiries as to who were the holders of the debentures, and giving the Liquidator liberty to apply to the Court from time to time as to the payment of the moneys coming into his hands.

The Water Supply of Newcastle.—Mr. Riley Lord informed his colleagues at the meeting of the Newcastle City Council last Wednesday, that the Water Company had 1675 million gallons of water in store on June 29; being 230 million gallons less than the quantity in store on the corresponding date of 1894. This large decrease, together with the fact that the total quantity in store was now only a little above the quantity in 1893, when there was such a great scarcity, made it imperative that the utmost economy should be exercised in the use of the water. The Water Company commenced to pump water from the Tyne for trade purposes on the 1st inst. The consumption of water per day—18¾ million gallons—was 2 millions more than the normal quantity; and the Water Company were taking steps to find out where the leakage was. Subsequently, Mr. Lord proposed the adoption of the report of the Gas and Water Committee, who recommended that Mr. Mansergh be requested to complete his report upon the water supply of the city. They were bound, he said, to look to the future with regard to the water supply. The Water Company were now proceeding with the Reed scheme; but seven years or more would probably elapse before its completion. He thought they might take it that before then some effort would have to be made, in order to ascertain where their next supply would come from after the Reed scheme had been completed. They had never had a report from an expert on the capacity of Northumberland to supply the city with water; and the cost of such a report would be between £300 and £600. It was thought by one member that this would be a waste of the ratepayers' money; and another said it was not for the Council to tell the Water Company where water was to be found. The voting being equal, the report was not adopted.

MISCELLANEOUS NEWS.

NOTTINGHAM CORPORATION GAS SUPPLY.

Annual Reports of the Gas Committee and the Engineer.

The Gas Committee of the Corporation of Nottingham have issued their report on the working of the undertaking during the year ending March 31 last. It is signed by the Chairman (Mr. Alderman Barber), and is accompanied by an abstract of the receipts and expenditure up to the date named, as certified by the Accountant Auditor (Mr. H. E. Hubbart), as well as by the report of the Engineer and Genera Manager (Mr. W. R. Chester, M.Inst.C.E.).

The Committee remark that in their previous report they had to record a winter of exceptional mildness, with an unusual amount of sunshine and a remarkable absence of fogs; the combined result being a diminution of nearly 11 million cubic feet in the quantity of gas sent out, as compared with the year 1892-3. This time they have to deal with an entirely different condition of things—a winter of extraordinary severity, with intense and prolonged cold. The consumption of gas consequently largely increased; the total output being 1,474,368,000 cubic feet, as against 1,391,753,100 cubic feet—an addition of 82,614,900 cubic feet. Of this no less than 47 millions were sent out in the last quarter of the year. The Committee attribute the whole of the increase to the unusual severity of the frost which prevailed for seven weeks out of the thirteen constituting the Lady-day quarter; the gas being very freely used during that time for heating purposes. This is shown by the extraordinary demand for gas during the daylight hours, which was 29 per cent. more than in the previous year; while the gas sent out during the dark hours only showed the very moderate increase of 6 per cent. Of course, complaints were received at the Gas Offices, and some appeared in the local papers, from consumers with regard to the increase in their gas bills; but in every case these had the most careful attention of the officers of the department, and no pains were spared to show how this had arisen. The net profit for the year was £30,341 14s. 8d., as compared with £21,855 4s. in the previous year, or an increase of £8486 10s. 8d. The Committee have already paid over to the Finance Committee £2096 10s. 1d. out of the year's profits; and this, together with £21,903 9s. 11d. previously paid, raises to £24,000 the amount contributed by the department for the past year.

In the course of his report, Mr. Chester states that the plant at the various works was kept in good condition, and its efficiency fully maintained, during the year. At the Eastcroft works, the enlargements and renewals were completed; and the whole of the modernized plant worked throughout the past winter with very satisfactory results. At Basford, plant has been put down, in connection with the new retort-house, for conveying the coke direct from the retorts to the outside of the house, where it is quenched, elevated, sorted, and distributed by mechanical means into separate overhead hoppers, from which it can be loaded either into railway waggons or carts. For many years a very profitable business has been done in preparing, washing, and sizing coke for smithy and other purposes; but the new appliance places at the disposal of the Committee an additional size of coke specially suited for domestic use, which can be supplied without the extra cost of preparation which the cut and washed coke has to bear. This plant has been at work for several months with entirely satisfactory results. Further installations of regenerator furnaces have been completed; and rather more than half of the retort power has now been converted to this system. The modifications are effected out of revenue—a section of retorts being completed each year. At the Giltbrook Chemical Works, additional storage-tanks for naphtha and creosote have been provided, and other modifications have been made to meet the requirements of the Alkali, &c., Works Regulation Act and the Local Government Board Inspector. Some considerable extensions have been made to the distributing plant during the year, with the object of facilitating the supply of gas from each of the works, and enabling the various districts to be served from any two of the works, should one become disabled by accident. The severe frost of the past winter brought with it, in addition to a large increase in the consumption of gas, a number of serious and somewhat unusual troubles to the distribution department. The number of complaints as to frozen meters, services, and public lamps increased by 10,000 individual cases over the figures of the previous year; and in addition to these, the frost penetrated the ground to such an extent as to cause the fracture of no less than 40 mains, ranging from 8 inches in diameter downwards. These fractures resulted in considerable loss of gas; and they might have caused other troubles of more serious importance, which, however, the Committee fortunately escaped. The concreted foundation on which the pavement of many of the streets is laid compelled the gas to find an outlet to the surface very often long distances away from the fracture; and thus increased the difficulty of promptly making good the escape. The average illuminating power of the gas for the year was 18·69 candles; and the sulphur compounds were kept down to 16·70 grains of sulphur per 100 cubic feet of gas. With regard to distribution, the total mileage of mains at the close of the year was 282·75; there having been 2·66 miles added during the twelve months covered by the report. The number of meters fixed to March 31 last (including 321 lamp meters) was 39,203; being an increase of 471 on the previous year. Of these, 37,005 belong to the Gas Department, and 2198 to the consumers. The demand for prepayment meters increases. At the end of the financial year, 2193 of these meters were in operation; being an increase of 872 on the previous year. There were 949 new services laid, compared with 1039 in the previous year. The application of gas for trade and domestic purposes, other than for lighting, continues to increase. There are at present in use about 3650 gas-stoves, 4260 gas-fires, and 256 engines, besides a large number of other appliances of almost every description, which have not been numbered. Of the 3650 cookers in use, 3300 are rented from the department.

The accounts accompanying the reports show that, at the close of the financial year, a net sum of £[illegible] had been expended upon the gas undertaking (£12,66[illegible] in the past twelve months) out of the £929,919 raised; leaving an unexpended balance of £6750. The revenue from the sale of gas amounted to £178,224; from the hire of meters and stoves, £7417; residuals produced £52,412; and sundry receipts made up a total of £241,567. The manufacture of gas cost £130,929 (coals figuring for £81,943, and wages for £23,936); its distribution, £17,079; management expenses were £6122; and the total expenditure was £163,870—leaving a balance of £77,697 to go to the profit and loss account. After paying £42,754 for interest, &c., carrying £500 to the capital account, for depreciation of gas-stoves, and adding to the sinking funds, there was a balance of £30,342—being the net profit for the year. Appended to Mr. Chester's report are analyses of the gas accounts for the past and the preceding year. In 1893-4, the amount expended for the manufacture of gas worked out to 18s. 7·18d. per ton of coal carbonized, and to 1s. 11·35d. per 1000 feet of gas sold; whereas last year the figures were 17s. 4·42d. and 1s. 9·31d. The total expenditure was at the rate of 22s. 7·72d. per ton of coal and 2s. 4·42d. per 1000 cubic feet of gas sold in 1893-4, as compared with 21s. 8·86d. and 2s. 2·67d. in 1894-5. The gas sold and meter and stove rents produced at the rate of 24s. 4·81d. per ton of coal carbonized and 2s. 6·63d. per 1000 cubic feet of gas sold in 1893-4; the residual products yielding 7s. 0·94d. and 8·88d.—the total receipts being 31s. 11·03d. and 3s. 4·06d. Last year the sales and meter and stove rental yielded at the rate of 24s. 7·51d. and 2s. 6·22d.; residuals, 6s. 11·43d. and 8·53d.; and the total receipts were 32s. 0·54d. and 3s. 3·32d. The following are the carbonizing results for the two years: 1893-4.—Coal carbonized, 145,569 tons; gas made, 1,483,932,000 cubic feet; gas sold, 1,391,753,100 cubic feet; gas unaccounted for, 92,178,900 cubic feet; or at the rate of 6·21 per cent. 1894-5.—Coal carbonized, 150,769 tons; gas made, 1,574,686,000 cubic feet; gas sold, 1,474,368,000 cubic feet; gas unaccounted for, 100,318,000 cubic feet, or 6·37 per cent.

COVENTRY CORPORATION GAS UNDERTAKING.

The Disposal of the Profits.

In the report which the Gas Committee presented at the meeting of the Coventry City Council on May 31, it was proposed that of the net surplus profits for the year 1894-5, amounting to £5600, £2500 should be paid into the sinking fund; leaving available for the relief of the district rate assessment £3100, which was equivalent to 6d. in the pound. The portion of the recommendation referring to the £2500 was referred back to the Committee for reconsideration. Reporting upon the subject at last Tuesday's meeting, they said: "The sinking funds, established for the repayment of the capital borrowed for the purchase of the undertaking, mature in sixty years from the date of their establishment. But there is a small sinking fund (No. 3) established for the repayment of the sum of £1523, borrowed for the expenses of promoting the Act sanctioning the purchase of the gas undertaking, which matures in twenty years from its establishment—*i.e.*, in 1906. The amount in this fund is now £659 14s., leaving £863 6s. to complete it. Your Committee recommend that of the above sum of £2500, £863 6s. be paid into sinking fund (No. 3), enabling it to be closed, and that the balance of £1636 14s. be handed over to the general district fund. This will make the total amount paid into the general district fund for the past year, £4736 14s." Mr. Andrews, in moving the adoption of the report, said that personally he had not altered his opinion as to the policy recommended in the first report. The remark was made when it was considered on a former occasion that they were not bound to do anything for posterity, for posterity had not done anything for them. He would point out that posterity had undertaken to do a great deal for the present generation. They had undertaken to pay nine-tenths of the cost of the gas-works, or, rather, the present generation had saddled posterity with that burden; and it was owing to this that they were now able to have cheap gas, and also the annual surplus to relieve the district rate. He should have himself preferred to see the City Council adopt the former recommendation, because he believed it would have been the safer, sounder, and indeed the nobler policy. The Gas Committee had, however, deferred to the opinion of the Council in their present recommendation. Mr. Haywood seconded the motion. Alderman Tomson quite concurred in the recommendation; saying he thought it only wise that they should pay off the fund. He congratulated the Committee on the very handsome profit they had made, which the Council accepted with great pleasure. The report was adopted.

BRIGHOUSE CORPORATION GAS UNDERTAKING.

In last week's issue, a paragraph appeared recording generally the result of the working of the Brighouse Corporation Gas Department during the year ending March 25 last. A detailed statement of the expenditure and receipts has since been received; and we give the items, omitting shillings and pence: Stock—coal, residual products, fittings, &c., £1072; manufacture of gas, wages, &c., £5281; maintenance of works and plant, £1265; fittings and meters, £454; manufacture of sulphate of ammonia, £392; establishment charges, £1074; instalment of loans, £1115; interest and repayment of loans, £968; discount off gas-rents, £763; sundry creditors, £1466—total, £13,851. Receipts: Sundry creditors to March 25, £1169; gas and meter rental, &c., £8902; residual products, £1517; sulphate of ammonia, £504; gas for public lighting, at 1s. 6d. per 1000 cubic feet, £584; stock—coal, &c., £319; residuals (500 tons of sulphate at £10 per ton), &c., £846; fittings, £195; meters, £469; payments for establishment charges, £85; making a total of £14,592. In moving the adoption of the minutes of the Gas Committee at the last meeting of the Town Council, Alderman Sugden said the accounts showed a profit of £740 on the year. The establishment charges had been entered at more than their proportion, which, of course, would make the profit larger. Then as to the cost of the public lamps, 1s. 6d. per 1000 cubic feet was 10d. less than the price they had to pay for the lamps in Rastrick; so that if they charged the same price in Brighouse as in Rastrick, there would

have been about £300 extra to add to the balance. Regarding sulphate of ammonia, although it was reckoned at £10 per ton, they were almost certain to realize £12; and this would make an additional £110. So that altogether, instead of a profit of £740, they had at least a profit of £1000. He thought they might safely say that the department, considering everything, had done very well. Of course, they were forced to admit that for two years in the history of the works there was a loss—one year when the price was lowered, and the other when coal rose above 100 per cent.; but this year, although the price had only been advanced for three months, they had made a very handsome profit. Alderman Sugden cited further figures to show that, although 5,389,300 cubic feet of gas more than in 1894 had been made, 178 tons less coal had been consumed. This showed that the money laid out was recouping itself. During the year two mortgages had been paid off—one of £1300 and another of £800; and this would save £208 a year. The debt on the gas-works was, in round figures, £26,000. But they had been valued this year at £80,000; and he reminded the members that the £54,000 balance had not come out of the rates. It had simply been taken from the profits of the department in the past; and at the price they were at present charging, they would go on adding to those profits, and paying off the debts, so that the gas-works in the future as in the past would prove a very profitable undertaking to the Corporation. The minutes were passed.

LARGE GAS-WORKS EXTENSIONS AT WALLASEY.

In the presence of several members of the Wallasey District Council, officials, and others, the extension of the gas-works at Poulton, and a new refuse-destructor, erected on the same site, were formally opened last Wednesday. The extent of the land on which these works stand is 52,300 square yards. The new retort-house (which has been completed) contains 188 retorts, capable of producing 750,000 cubic feet of gas per twenty-four hours. The building has been erected on a plan which permits of the number of retorts being doubled should the necessity arise. Adjoining the retort-house is a boiler-house containing two Lancashire boilers. In the same building are the men's room, lavatories, &c. The annular condensers are twelve in number, 28 feet high, and 4 feet external diameter. There are two exhausters, with steam-engine to each. Adjoining the exhauster-house is a pump-house containing steam, tar, and liquor pumps, and a battery of circulating pumps. The tower scrubbers are two in number, 30 feet high and 12 feet in diameter, with improved distributors and machinery-room. The purifier-house contains four purifier-boxes, fitted with Weck's patent valve. The mains throughout the works are 20 inches in diameter. There are also iron tar and liquor wells. The whole of the levelling, draining, and railways, and the erection of buildings and office alterations have been carried out by Messrs. Lawrence Marr and Son, of Liverpool. The retort-bench fittings, condensers, and tower scrubbers are by Messrs. W. C. Holmes and Co., of Huddersfield; the exhausters and pumps, by Messrs. George Waller and Co., of Stroud; and the purifiers, by Messrs. C. & W. Walker, of Donnington, near Newport.

The opening ceremony was performed by Mr. W. G. Ellery, the Chairman of the Gas and Water Committee; and the party present were conducted over the works by Mr. J. H. Crowther, the Gas Engineer. In formally declaring the gas-works open, Mr. Ellery said the old works were constructed in 1861 at a cost of £15,000. Since that time the consumption of gas in the district had doubled itself every ten years; and recently it became necessary to extend the plant. The Gas Committee decided to enter upon an expenditure of £100,000. But some of the ratepayers thought it wise to curtail this amount; and it was agreed for the present only to spend £50,000 in the extensions. They did not, however, extend the works one day too soon, because the consumption of gas for the year ended March 31 last was 182,428,500 cubic feet. It must be a supreme satisfaction to their former Engineer (Mr. H. Ashton Hill) and Mr. Crowther that the works had been completed in such a short time, and had not exceeded by a penny the estimated expenditure of £50,000, although the Committee had considered it advisable to build the retort-house sufficiently large for the requirements of the original £100,000 scheme. All the other works had been carried out with equal efficiency; and it afforded him the greatest pleasure in declaring them open. The visitors afterwards drove to New Brighton, where dinner was partaken of at the Victoria Hotel.

ELECTRIC LIGHTING NOTES.

The Gas Committee of the Belfast Corporation have made a further grant of £5000 to the Electric Lighting Committee. Some main extensions are in contemplation by the latter, who report that they have now 6500 lamps in use, and the only thing they are not quite satisfied with is the fact that the manufacturers within the district have not made use of the power at their disposal.

Gas-meters are frequently charged by consumers with capricious conduct; and it appears that, in the eyes of some, electric meters are not altogether blameless. One of the customers of the Portsmouth Electric Lighting Committee—a Mr. F. Edwards, of the Wiltshire Lamb, Southsea—has been summoned for £5 alleged to be due for 36 days' supply of electricity. His defence was that the light had only been used for ten days; and it was suggested that the meter had continued to register, although no current was passing. It was also pointed out that a workman had disconnected the meter, and taken it to the office, instead of an inspector calling to examine it; and it was contended that the pointers might have shifted on the dials in transit, or that the wrong meter might have been returned to Mr. Edwards. The case was adjourned, in order that expert evidence might be called.

The Portsmouth Electric Lighting Committee have accepted a tender of Messrs. Ferranti for the elaborate extension of mains that has been resolved upon. The figure is £7619; but, of course, the Committee's decision will have to be endorsed by the Town Council. Messrs. Ferranti were the contractors for the original work.

THE NEW WATER-WORKS FOR BILSTON.

Last Friday week, the memorial stone of the new water-works buildings of the Bilston District Council was laid by Mr. T. Holcroft, who is one of the oldest of the leading men of the district, and has given unremitting attention to this important scheme. The Engineer of the works is Mr. Baldwin Latham, who presented to Mr. Holcroft a silver trowel, which he used in the laying of the stone. The water supply is at present provided by the Corporation of Wolverhampton, who derive from the district £3500 a year. Before resolving to sever the contract with the neighbouring borough, the Bilston authority entered upon careful investigations, and were fortunate, after making trial borings at the Bratch, in discovering that water in abundance and of undoubted quality could be secured. A well has since been sunk to a depth of 150 feet, from which, it is stated, above a million gallons a day have been lifted, while the permanent overflow, without any pumping, has been between 160,000 and 170,000 gallons a day. The reservoir, which has been completed and is ready for the reception of water, is on Goldthorn Hill at Wolverhampton, and consists of an underground chamber, built almost entirely of concrete, 116 feet long and 106 feet wide, with a water-level 12 feet deep. The reservoir is covered by a series of concrete arches, 10 feet in span, which are supported by walls 2 feet thick, and archways to allow of the circulation of the water. It is provided to hold 750,000 gallons of water, or sufficient for a day-and-a-half's supply. The works at the Bratch consist of the well, engine-house, boiler-house, workshop, and pump-room. The buildings are being erected by Messrs. H. Willcock and Co., of Wolverhampton; and they are of a very ornamental character. The contract for the machinery has been taken from the original contractor, and placed in the hands of Messrs. Thornewill and Warham, of Burton-on-Trent. Two triple-expansion engines will be laid down; and it is anticipated that each of them will be capable of raising and forcing to Goldthorn Hill a million gallons of water per twenty-four hours. Nearly £3500 has been expended in sinking the well; and the reservoir has necessitated a similar outlay, while the engine-house and other buildings will cost about £6000. To these sums will have to be added the expenses of laying down the pipes from the Bratch to the reservoir (about four miles in length), and the cost of the engines and other items. In addition, there will be the payment of an agreed sum to the Corporation of Wolverhampton for relinquishing their contract to supply Bilston with water, and the value of the mains hitherto used in Bilston township by that body. The reservoir has been constructed by Mr. H. Hill, of Maidenhead; and the well, by Mr. John Hughes, of Dudley. It is expected that the distribution of water from the new works will be commenced in about a year's time.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week the Edinburgh and Leith Gas Commissioners appeared before the Dean of Guild Court, to answer to the charge of proceeding to erect a temporary chimney at the Edinburgh Gas-Works without the warrant of the Court. The Procurator Fiscal moved for damages and costs. Mr. Waterston, one of the Commissioners, explained that the fact of the present stalk having gone some five feet off the perpendicular got into the newspapers, and caused a perfect uproar among the people in the district. Perhaps the Commissioners had been a little too hurried in proceeding with the work; but it was done entirely in the public interest. Dean of Guild Miller pointed out that the Court was a special court of urgency; and a meeting could have been held on very short notice. People surely knew they were going to build the day before they dug out the foundation. He imposed a fine of five guineas, with costs. The Commissioners, having purged their offence, may now proceed with a clear conscience to the remedying of the defect in the foundation of the tall chimney.

A managing director of one of the Scotch oil companies, calculates that there will be a loss to the companies on sulphate of ammonia this year, as compared with last year, of £75,000; but that there will be a gain of £120,000 on burning oils, £15,000 on naphtha, £20,000 on gas oils, and £85,000 on candles—making a total gain of £240,000, and a net gain of £165,000. This throws some light upon the prospects of oil-gas making. The rise upon gas oil, as it is called, is, according to this estimate, equal to 1½ farthings per gallon, or 7s. per ton. As the price of these oils has been about £2 10s. per ton, the rate now should be about £2 17s. Mr. Linton, of Leith, in his report in April, 1893, estimated that the limit of price at which the manufacture of gas from oil would become unprofitable would be between 70s. and 80s. per ton; so that there is still a considerable margin left in favour of oil.

It is reported (but the details have not yet come to hand) that the revenue in connection with the Paisley Corporation Gas-Works for the past year amounted to £40,815. The expenditure was £30,481; leaving a balance of £10,334. From this, there required to be paid £2913 for sinking fund, interest on mortgages, &c., leaving a profit of £7421 on the year's transactions.

The Bothwell and Uddingston Gas Company, which is managed by Mr. L. Hislop, last year reduced the price of gas from 3s. 9d. to 3s. 6½d. per 1000 cubic feet, and abolished meter-rents; and the result of this, together with the increased cost of coal and higher taxes, was that the balance of revenue for the year just closed was £760 less than the sum reported a year ago. The amount was £1747; and this sum, with the balance brought forward a year ago, enabled the Company to write off £319 for depreciation, to add £590 to reserve fund, and to pay their customary dividend of 10 per cent.—carrying forward £1085. There was an output of gas of 26,694,000 cubic feet—a gratifying increase of 588,000 cubic feet, which accounts for the Company maintaining their financial position. The severe weather of the past winter told its tale, as in other places, by an increase in the leakage, which rose from 6·7 to 7·6 per cent., still a very moderate quantity in a district which is riddled with coal-pits. On account of the yearly increasing consumption of gas, the Company are about to erect a new retort-house, with

improved benches, the designs for which have been prepared by Mr. Hislop; and to create £3000 of additional capital. At the annual meeting of shareholders the other day, Mr. Hislop was congratulated on his year's working.

The Galashiels Gaslight Company had an output of gas last year amounting to 55,870,900 cubic feet—an increase of 3,645,600 feet on the previous year; and a leakage of 1,393,173 cubic feet, which is less than 2½ per cent. Last year the Company reduced the price of gas from 3s. 6½d. to 3s. 4d. per 1000 cubic feet; and the profit for the twelve months has been reduced from £2104 to £1869. There was a total revenue of £10,278, of which £8835 was from gas, and £1304 from residuals. The profit for the year would have been larger, but for an extra outlay of £102 in consequence of the strike of miners, the expenditure of £155 upon a hydraulic main, and compensation which was paid for two accidents. With regard to the accidents, it was explained that in one case the insurance company declined to meet the claim; but they agreed to give a gratuity to the widow, to which the Directors made a contribution. In the other case, some boys had pushed a companion into an excavation, which was followed by a claim for £100; but the claim was compromised. In future, the Company have resolved to pay a little more insurance premium, in order that no claim shall be called in question by the insurance company. The Company have also laid in a large stock of coal, to be in a position to meet any future strikes. This latter is a sensible policy; and it could not have been adopted at a more favourable time. It is not likely that coal will long remain at its present low price. The Company are well pleased with the past year's working, which enabled them to earn the usual dividend of 10 per cent.

Among the smaller gas undertakings, the following may be noticed: The Motherwell Gas Company had an increased output of gas last year to the amount of 7 per cent. They have paid a dividend for the year at the rate of 8 per cent. The Hawick Gas Company last year sold rather less gas than they did in the preceding twelve months; but they have paid their usual dividend at the rate of 10 per cent. The price of gas has been continued at 3s. 6½d. per 1000 cubic feet. The Coupar Angus Gas Company have paid a dividend for the past year at the rate of 6 per cent. The price of gas has been reduced by 5d. per 1000 cubic feet; making it 6s 0½d. per 1000 cubic feet. The Pittenweem Gas Company have paid a dividend at the rate of 10 per cent., and continued the price of gas at 4s. 2d. per 1000 cubic feet. The Brechin Gaslight Company have paid the same dividend as last year—25s. per share; and have continued the price of gas at 4s. 7d. per 1000 cubic feet. The Directors are dissatisfied with the profit which was made. They ought to set about enlarging the town, as it is impossible to earn an increasing profit in a decaying, or a stationary community. They also seem to forget the loss of gas through pipes damaged by the steam road-roller. The Crieff Gas Company have paid their customary dividend of 10 per cent. for the past year; the price of gas to remain at 4s. 2d. per 1000 cubic feet. The Pitlochry Gas Company had an increased output of gas last year of 135,000 cubic feet; and in view of the advance in the price of burning oils—and taking into account also, I suppose, the capabilities of the place for extension—the Directors have resolved to apply for a feu of half an acre of land adjoining the gas-works, upon which extensions may be built. It almost sounds ludicrous to acquire so much for so small a concern; but if the Company think they can bear the burden, they will undoubtedly get the land cheaper now than they would at any future time. They have paid a dividend at the rate of 5 per cent. for the past year.

Monifieth is at present a burgh in search of light. Taking advantage of the amended General Police Act, the community had their little town last year created into a burgh. Having acquired the powers of a burgh council and magistracy, with their advantages, they are face to face with the responsibilities of their new position. One of these is the lighting of the burgh—that is, of the public thoroughfares; but "what is sauce for the goose is sauce for the gander," and the light which is suitable for the streets will also be suitable for the inhabitants. Accordingly, the ratepayers were called together on Thursday night, to consider what scheme should be adopted. There was a large attendance, which is a healthy sign. The suggestions put forward were: First, the procuring of a supply of gas from the Broughty Ferry Gas Commissioners; second, the erection of local gas-works; and, third, the construction of an electric lighting installation. Mr. Barrie, the Convener of the Lighting Committee, said that the Broughty Ferry Commissioners had offered to supply Monifieth with gas at the boundary of the burgh at the same price as they charged the ratepayers within their own district. He calculated the price of laying the pipes through Monifieth at £1600. The idea of local gas-works was next alluded to; and he was of opinion that works such as would be suitable for Monifieth could be put in operation for £2500. Mr. Barrie referred to the erection of an electric station at Milton, taking advantage of Dighty water for the motive power; and he said he was of opinion that this could be done at a cost of £5000. After a general discussion, it was agreed that the matter be delayed for nine months; and that in the meantime the Commissioners approach the Broughty Ferry authorities asking them to lay pipes, put in meters, &c., and supply gas to Monifieth at 1s. per 1000 cubic feet above the price paid by householders within their own boundary.

The Dunbar Gas Commissioners seem to be mending their ways; and I am glad to see it. On Friday of last week, the whole of the Police Commissioners were invited to the gas-works to inspect them. This step was taken on account of the fact that, at one of the former meetings at the works, suggestions were made by some of the Commissioners; and these having been now executed, it was thought right that the Commissioners should see what had been done. Everything, it is stated, was found in excellent order. The new Manager (Mr. Richmond), who was appointed last January, would appear to have been very diligent; for he has not only had the whole of the plant made tidy and respectable, but every piece of spare ground in the works has been converted into a flower or vegetable garden. The Commissioners were highly pleased with the appearance of the works, and congratulated the Convener and Manager on the state of affairs. Let us hope this is the opening of a new era of peace. I am afraid the Commissioners need scarcely look for brilliant results from the gas works, because they are so far from the railway station that carting charges must be heavy. They are not a great distance from the railway; and a siding to the works would not cost very much.

The Dundee Town Council on Thursday approved of estimates for the current year, which provide for a revenue of £49,082, and a surplus of £125. The water rates have been fixed at the same as last year—1s. 1d. per pound for domestic purposes, and 1d. per pound for public purposes.

In a report which has been submitted by Mr. G. D. Macdougald, the City Analyst of Dundee, regarding the filtration of the water from Lintrathen and Monikie, it is stated that experiments were carried out in a special filter from last summer till the end of May. The results were that in the Lintrathen water the highest number of bacteria registered in unfiltered water was 500 per cubic centimetre, and the lowest 24. In Monikie unfiltered water, the highest number registered was 8938 bacteria per cubic centimetre, and the lowest 80. In the case of the Lintrathen water, there is practically no chance of objectionable matter reaching the water after it has left the loch, where natural purifying processes are constantly at work; but in the case of Monikie water, there is, under certain circumstances, more or less serious pollution taking place at the Gagie aqueduct. On Feb. 27 a sample at the Monikie end gave 2272 bacteria per cubic centimetre; and at the city end of the aqueduct, the number had risen to 3606. It is therefore evident that a large amount of land water, or material rich in bacterial life, enters the aqueduct through its walls. Mr. Macdougald recommends that the water-way from the Monikie ponds to the city should be made tight; that provision be made for the filtration of Monikie water at the rate of 450 to 700 gallons per square yard per day; and, although not so urgently required as the above, that provision be made for the filtration of Lintrathen water at the rate of 600 to 800 gallons per square yard per day.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 6.

Sulphate of Ammonia.—Throughout the week the market has been quiet; the tendency of prices being rather in buyers' favour. Prices are somewhat irregular; but the value may be quoted at about £9 12s. 6d. per ton. The production at this season is small; but there has been rather more offering by makers; while, on the other hand, the requirements for home consumption are just now very limited, and the demand for export only on a moderate scale. The price reached is, however, approaching a tempting level; and a little further concession would probably induce a very considerable amount of buying. Dealers continue to offer for forward delivery at a moderate premium upon spot value; but makers generally, hoping for better prices later, are still shy about offering ahead.

Nitrate of Soda is steady but quiet; and spot value is 8s. 3d. per cwt.

LONDON, *July* 6.

Tar Products.—A somewhat languid feeling prevails in this market. Creosote and common oils are realizing poor values, and look as if they are being produced in excess of requirements. There is a moderate demand for carbolic acid products, which is likely to increase as the summer develops. A very little more inquiry is said to exist for solvent for foreign consumption; but the price is exceptionally low. Pitch is firm at rates quoted below: but no important new business has been reported. Prices: Tar, 17s. to 21s. Pitch, 35s. to 37s. 6d. Benzols, 90's, 1s.; 50's, 11½d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent. naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d.; salts, 18s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 5½d. Anthracene, nominal, "A quality," 1s. 1d.; "B," 10d.

Sulphate of Ammonia appears to be utterly demoralized. Notwithstanding the small production which is now going on, during the past week values have continually receded; and, although little or no business has been done, prices have ranged between £9 10s. and £9 15s., less 3½ per cent., according to terms and port of shipment. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With one or two exceptions, the principal gas-coal contracts of this district are now practically settled; and one of the largest Lancashire colliery companies is reported to have secured the bulk. In fact, a representative of a large competing colliery told me on 'Change that the Company above referred to had practically swept the decks; having gone in at low competing prices, to secure all the business possible. The basis of prices on which further contracts have been settled remains very much what I have reported previously; and the average for this season's contracts may now be taken at about 6s. 6d. per ton at the pit for good Wigan four-feet and 7s. for partially screened, or what may be really termed through-and-through. good Arley mine coal. These prices represent quite 1s. below what was got last year for gas-coal contracts. In the general coal trade, business continues extremely limited in weight; and with collieries in most cases only working three days, supplies of round coal are hanging upon the market. House-fire qualities are necessarily only meeting with the most limited demand. Prices, however, for these are nominally unchanged, at 10s. to 10s. 6d. per ton at the pit for best Wigan Arley, 8s. 6d. to 9s. for seconds Arley and Pemberton four-feet, and 7s. to 7s. 6d. for common house coal. But it is only on very small hand-to-mouth sales that these figures are being got. The lower qualities of round coal are in but slow request for iron-making, steam, and general manufacturing requirements; and supplies are in excess of the demand, with prices, consequently, cut very low to secure orders 6s. to 6s. 6d. per ton being the full average figures for ordinary steam and forge coals. Engine fuel moves off without difficulty; collieries, in some cases, owing to the limited demand for round coals, being short of supplies of slack to meet customers' requirements. Buyers have, however, no difficulty in obtaining what they want in the open market; and prices are not more than maintained at 3s. to 3s. 6d. per

ton at the pit for common slack, to 4s. 6d. and 5s. for better qualities. For shipment, business is quiet, with no improvement in prices, which remain extremely low; common steam coal being obtainable at 7s. to 7s. 6d. per ton, delivered at the ports on the Mersey.

Northern Coal Trade.—There has been an increase of the demand for steam coals in the last few days; the exports having been enlarged. There has also been a slight increase in the shipments of gas coals to London, now that the new contracts have begun; so that in both parts of the coalfield of the North, the change is for the better. Best Northumbrian steam coals are steady at from 8s. 9d. to 8s. 10½d. per ton f.o.b.; and there is rather fuller work at most of the collieries than there has been of late. Second-class steam coals are still rather quiet at from 8s. to 8s. 6d. per ton; and steam smalls are unaltered at 3s. 6d. In regard to gas coals, the demand has been slightly better since the turn of the half year, and must now be expected to improve. The large contracts for the year are about concluded; and the price has been so much reduced that the gas companies should profit considerably. For odd cargoes, the rates vary from 6s. to 6s. 6d. per ton f.o.b. There is a steady demand for manufacturing coals; but the price shows no alteration, though one or two collieries have a very strong demand for smithy coals. After the broken time at the pits, through the recent local holidays, there is now a steadier production, concurrent with a fuller demand, though for gas coal the latter is still far below the average. The coke trade has felt the benefit of an increased demand for the north-western furnaces; more being now in blast in West Cumberland. The exports of coke do not very materially vary; and the price is maintained at from 13s. to 14s. per ton f.o.b., for best Durham coke, other kinds being obtainable at as low as 12s. 6d. per ton. Gas coke is quiet; but there is now a limited output, and the prices are unaltered this week.

Scotch Coal Trade.—The demand still continues at a low ebb; and little improvement is expected until about the middle of next month, by which time most of the tradesmen will have had their holidays. Even then, however, it is not expected that there will be much advantage to the coal trade, as it is well known that many users of coal have been taking advantage of the low prices to lay in stocks, and that stacking has also taken place to a large extent at pit heads. An improvement in the foreign demand was expected about this time; but it has not yet come, and, all over, the trade appears yet to be a waiting one. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 164,802 tons—an increase on the previous week of 19,809 tons, and on the quantity in the corresponding week of last year of 86,158 tons. For the year to date, the total shipments have been 3,287,595 tons—a decrease on the same period of last year of 306,016 tons.

Extensions at the Halifax Gas-Works.—Last Wednesday, the Gas Committee of the Halifax Corporation were authorized by the Council to expend £10,000 upon improvements at the gas-works. The following are the detailed items: Boiler and house, £1000; exhausters and house, £1000; washers, £2000; purifying-house, £1000; new purifiers, £3000; station meter and house, £1000; and connecting-pipes, &c., £1000.

The "Penny-in-the-Slot" System at Burnley.—At the last meeting of the Burnley Town Council on Wednesday, Alderman Collinge, the Chairman of the Gas Committee, expressed his satisfaction with the working of the "penny-in-the-slot" gas-meters. He said that the Gas Department had about 500 of these meters out, and there was an increasing demand for them from the poorer classes of people. He added that, though there were so many in use, he had not heard of any irregularities in the registration.

The Darwen Corporation Gas and Water Undertaking.—The Darwen Borough Treasurer (Mr. J. H. Ellison) has issued his annual abstract of accounts. Dealing with the Gas Department, he states that the profit on the year's working was £3729, as compared with a loss of £158 in the preceding financial year. This satisfactory result, he adds, has been brought about by a decrease in the cost of coal, and an augmentation in the bulk of gas sold, together with an increase of 3d. per 1000 cubic feet of gas. The amount standing to the credit of the profit and loss account at the end of the year was £4499. In the Water Department, there was a loss of £379; and the sum of £826 has been carried to the debit of the profit and loss account for the current year.

Burglary at the House of Mr. W. R. Cooper, of Banbury.—Gas managers who live in fancied security from the attacks of burglars, from the fact of their residences being upon the works, and men and lights being about the place, will probably have that confidence shaken by a perusal of the following account of what happened at the house of Mr. W. R. Cooper, the Manager of the Banbury Gas-Works, on the night of the 30th ult. On his servant going downstairs on Monday morning last week, she found that drawers, &c., in different rooms had been ransacked, and she raised an alarm. On making an investigation, Mr. Cooper found that the office, front, and back doors had been opened, and that a candle had been used by the intruder in looking round the rooms. Some cooked food and some spirits had disappeared. Several coats hanging in the hall had been removed to the back door; and a large case of silver-plated goods was found on the copper near that door, having been taken from the sitting-room. The only property missed was a silver watch (No. 90,104) and a few postage stamps, which had been taken from the office. The police have ascertained that two of the men employed at the works, on leaving the retort-house about half an hour after midnight on Sunday, noticed a light in one of the downstair rooms of Mr. Cooper's house. One of them crossed the lawn to within a few feet of the front door, and saw a man moving about the room and carrying a light in his hand. But, strangely enough, the men do not seem to have attached sufficient importance to the occurrence to lead them to make further investigation; and neither of them is in a position to give a description of the burglar. The doors and windows of the house are stated to have been properly fastened on Sunday night; and it is believed that the thief must have secreted himself in the house before the family retired.

The Public Lighting of West Hartlepool.—In a report which has been prepared by the Borough Surveyor of West Hartlepool (Mr. J. W. Brown), he gives the cost of lighting the public streets according to the sizes of the lamps. Including gas, repairs, labour, &c., it averaged £2 1s. 6d. for the ordinary lamps, and rose to £14 9s. 9d. for the largest gas-lamps used. The total yearly cost is about £3000 for street lighting, spread over some 1400 lamps.

The Whittington District Council and the Gas-Works.—The Clerk of the Whittington District Council has, in compliance with his instructions, been in communication with the Directors of the Whittington Gas Company regarding the proposal to purchase their property. The Secretary of the Company (Mr. A. H. Ceaser) has informed him that the Directors have no desire to sell the undertaking. At the same time, if an offer were made to purchase at a reasonable figure, they would give the matter their consideration. The only condition would be a cash payment of the price agreed upon. The paid-up capital of the Company is £5000; and the dividends paid have reached 8 per cent. The Whittington Council have inquired of the Brimington Parish Council whether they would be willing to join in the purchase.

Unaccounted-for Gas at West Bromwich.—At the meeting of the West Bromwich Town Council last Wednesday, the Gas Committee reported that an honorarium of £20 had been awarded to the Outdoor Superintendent (Mr. W. H. Wayte) for extra services rendered during the severe frost of last winter, and also in consideration of the low percentage of unaccounted-for gas in the district. The Mayor (Mr. Alderman R. Farley), in moving the adoption of the report, referred to the careful manner in which Mr. Wayte attended to the distribution of gas, as shown by the prevention of waste. In this respect, West Bromwich occupied, he said, a remarkable position, and compared very favourably with all the other undertakings in the United Kingdom. The unaccounted-for gas in the whole of the undertakings averaged 6·97 per cent.; while in West Bromwich during the last few years it had been only 5·38 per cent. This would make a difference of more than £200 in the profits of the gas undertaking. The members would agree with him that the Gas Department was well looked after, and that in Mr. Wayte they had a good officer. The motion was carried unanimously.

Sales of Shares.—Shares in the *Wakefield Gas Company* were sold by auction last week at the following prices: £5 "B" 5th shares at £9 7s. 9d. each; £5 ordinary shares, at £11 6s.; and £10 shares (£4 paid), at £7 7s. 6d. Original £20 shares in the *Colchester Gas Company* have been sold for £42 apiece, and "B" £20 shares for £31 to £33. ——At Durham, some £5 shares in the *Hartlepool Gas and Water Company* were disposed of last week for £9 7s. 6d. each; and shares of a similar nominal value in the *Consett Water Company* realized from £8 7s. to £8 14s.——At Laker's Hotel, Redhill, last Wednesday, Messrs. Lees and Burchell, of Reigate, sold by auction some consolidated stock of the *Reigate Gas Company, Limited*, at the rate of £248 per £100 of stock—one lot of £50 of stock fetching £127; £5 fully-paid shares in the *Redhill Gas Company*, at an average of £13 each; stock of the *Reigate Water-Works Company, Limited*, at the rate of £186 per £100 of stock; shares in the same Company (£7 paid) at £18 10s. each, and ordinary fully-paid £10 shares in the *East Surrey Water Company*, on which the maximum dividend is 7 per cent., at £13 5s. per share. The total amount realized by the sale was £3835.

New Joint-Stock Companies.—The following new joint-stock undertakings have been registered: "Pintsch's Patent Lighting Company, Limited," with a capital of £60,000, in £5 shares, to adopt and carry into effect an agreement made between Pintsch's Patent Lighting Company, Limited (the old Company, now in liquidation), of the one part, and this Company of the other part, for the acquisition of the business of the Company, and also certain patents, patent rights, and inventions for improved means of lighting railway carriages, buoys, sea-lights, and for other purposes, and to develop and turn to account the same; and as manufacturers of, and dealers in, every description of appliances connected with the manufacture of gas or gas lighting. The "Town and Village Electric Light and Power Company, Limited," with a capital of £100,000, in 19,800 ordinary shares of £5 each and 1000 founders' shares of £1 each, to acquire as a going concern, and carry on, the business of supplying electric light, heat, and power, as now and hitherto carried on by the Western Counties Electric Light and Power Syndicate, Limited, at Kingswood, Gloucestershire, and Keynsham, Somerset, and, with a view to the foregoing objects, to adopt and carry into effect two agreements. "Levinstein, Limited," with a capital of £90,000, in £10 shares, to acquire all or any part of the business of Messrs. J. Levinstein and Co., Limited, the well-known chemical manufacturers.

Gas-Works Extensions at Bangor, Ireland.—The Chief Engineering Inspector of the Local Government Board for Ireland (Mr. C. P. Cotton, M.Inst.C.E.) inquired last Tuesday into an application for a loan of £4600 required for extensions at the Town Commissioners' gas-works at Bangor. The present plant, it appears, is insufficient to meet the continuously growing demands; and it is proposed that the public thoroughfares shall be more efficiently lighted than they now are during the winter months. The Town Clerk (Mr. F. Pollock) stated that gas was supplied at 4s. 9d. per 1000 cubic feet. The charge for ordinary street-lamps was calculated at £1 3s. 9d. a year; and for each of the large 80-candle power lamps, at £3 10s. each. They had had a number of applications for private lighting; but, owing to the insufficiency of the storage and inadequacy of the works, they had to be refused. The Gas Engineer (Mr. E. F. Bunyar) submitted plans of the contemplated additions to the works; and the Town Surveyor (Mr. Lamon) produced the plans of the proposed extended mains. Mr. Bunyar estimated the cost of the extension of the works at £3629; and Mr. Lamon, the cost of the new mains and lamps at £771. Mr. Danskin, the Gas Manager, gave evidence of the inadequacy of the present works, and read from a tabulated document a statement of the gas produced within recent years. The works, he mentioned, always produced a profit to the Board after defraying expenses and maintenance, and paying interest on loan and principal. Only one ratepayer appeared in opposition.

Reduction in Price.—The Directors of the Wandsworth and Putney Gas Company announce that the price of gas will be reduced from 2s. 6d. to 2s. 4d. per 1000 cubic feet after the taking of the meter-indices at the Midsummer quarter.

Improvements at the Chorley Gas-Works.—At the last meeting of the Chorley Town Council, the tender of Messrs. R. and J. Dempster for supplying and fixing three retorts on the Peebles system was accepted. In other ways the plant is being improved, so as to secure the best possible results and to meet the growing requirements of the Gas Department consequent on the increase of consumers.

Proposed Improvements at the Knaresborough Water-Works.—Last Tuesday, Colonel J. O. Hasted, R.E., held an inquiry at the Town Hall, Knaresborough, with respect to an application by the Knaresborough District Council for authority to raise £1800 for improving their water-works. The Clerk (Mr. T. Mainman) gave a history of the water undertaking, and explained that, owing to serious and continuous breakdowns—the last taking place early in the present year—it had been decided by the Council, on the advice of their Gas and Water Manager (Mr. T. Settle), to put down a turbine in place of the old water-wheel, erect an additional storage-tank, and lay a length of new main; and also to apply to the Local Government Board for permission to borrow £1800 for these purposes. Plans, specifications, and tenders had been obtained and submitted to the Board. The rateable value of the town in 1872 was £11,264; in 1895 (for water purposes), £11,050. The population was probably now about 5000. With regard to the water of the Nidd, the two last analyses showed it to be of "good quality and well fitted for drinking and general use." He went on to say that the Council had authority to raise £12,000, repayable in fifty years; but they had only borrowed £11,000. The Inspector remarked that it was a question whether the Local Government Board could sanction the borrowing of £1000 more without a Provisional Order. Mr. Settle then read a long and interesting report on the water-works; furnishing full details of the proposed improvement. The new turbine would, he said, develop 50 brake horse power with 3920 cubic feet of water per minute. It was guaranteed to develop from 65 brake horse power down to half power. The cost would be £428. The proposed new tank would contain about 900 tons, or 200,000 gallons of water, which, with the present storage, would give about three days' supply. The tank would furnish an additional pressure of 6·5 lbs. per square inch on the mains at its base, and would increase in direct proportion the pressures throughout the whole area of supply. The cost of the tank, to be constructed of steel, was £724, including a concrete bed 34 feet in diameter and 2 ft. 6 in. thick. The tank would be 50 feet high and 30 feet diameter. He concluded by dwelling on the benefits of a constant service, as compared with an intermittent one. Mr. W. Mason opposed the turbine scheme as the result of practical knowledge gained by more than 21 years' experience as mechanic and engineer in the mill where the town's pumps and the water-wheel were. He gave his reasons for his objections; and stated that if the existing wheel were put into proper repair, shielded round, and re-paved, it would be worth a dozen turbines in a dry summer, and would not take half the quantity of water to drive it, while it would cost £250 less to do it. He asked the Board to refuse their sanction to the application. After some further evidence, the inquiry closed; a vote of thanks being accorded to the Inspector, who was subsequently shown over the works.

The Scarcity of Water in South Wales; Proposed Purchase of the Ystrad Water-Works.—A resolution passed by the Rhondda Chamber of Trade respecting the drought in the Rhondda Valleys (which has been recently referred to in the JOURNAL) was presented by a deputation at a recent meeting of the District Council. The resolution asked that the Council should take immediate steps to force the Ystrad Water Company to discharge their obligations to the residents; and, if necessary, that an Inspector of the Local Government Board be requested to investigate the matter, so as to prevent a recurrence of the present "deplorable" condition of affairs. The matter was fully discussed by the Council after the deputation withdrew. It was stated that the Company had no water in store; and that their reservoir would only hold at the utmost 8 million gallons. It was also alleged that the Company had not carried out the undertaking according to the powers granted them by Parliament, although there was plenty of excellent water running to waste in the district. A suggestion was made by Alderman Matthias that a letter should be written to the Company stating that, as the Council were satisfied that the Company were unable and unwilling to supply the district with a reasonable amount of water, they desired an interview with the Directors, with a view of arranging for a proper supply, or, if the Company were willing, of purchasing the works at their value. A conference between representatives of the two parties accordingly took place last Wednesday week at Pontypridd. The Council asked that a reservoir should be constructed for the valleys of sufficient capacity for a two months' supply. The Directors maintained that the Company had done everything that could reasonably be expected of them to furnish the consumers with an adequate supply of water for domestic purposes. The members of the Council emphatically told the Directors that, unless the Company provided adequate storage, they would proceed without delay to construct a reservoir for the whole of the district supplied by them. The Directors, after further discussion, observed that they would not be able to give the Council a definite answer until a meeting of the full Board had discussed their demands. The Pontypridd District Council recently asked Mr. G. F. Deacon to take observations as to the quality and quantity of the water supplied by the local Company; and his report has been under the consideration of the Council. It included several important recommendations; and the Council have resolved to consult Mr. Balfour Browne, Q.C., as to their position with reference to the Company. The latter body are energetically pushing forward the construction of an additional reservoir (of 2 million gallons capacity) on the Mardy Mountains, the contract for which is in the hands of Messrs. J. Aird and Sons. In view of the rapidly decreasing area in Wales available as gathering ground for the supply of water, and of the possibility of still further inroads being made by English corporate bodies, the Glamorgan County Council have appointed a Committee to report as to what steps, if any, ought to be taken for the conservation to the county of its watershed areas.

New Boiler for the Lymm Gas-Works.—The tender of Messrs. W. C. Holmes and Co., of Huddersfield, has been accepted for the Cornish boiler for the Lymm Gas-Works, advertised in the JOURNAL on the 18th ult.

A Hitch in the Oil-Gas Experiments at Bradford.—With reference to the appointment of Mr. Lewis T. Wright to superintend an experiment to ascertain the real value of the oil-gas process which has been under trial at the Bradford Gas-Works, some misunderstanding appears to have arisen between him and Dr. Dvorkovitz; and, in consequence, the latter has withdrawn from the test. Last Friday, the Corporation Gas Committee had an interview with Mr. Isaac Smith, who is largely interested in the process; and it was decided to have a fresh trial—Mr. Wright to watch the experiment on behalf of the Corporation, and another gentleman to be selected by Mr. Isaac Smith to safeguard his interests.

Exhibitions of Gas Appliances.—The newly-appointed Manager of the Wakefield Gas Company (Mr. H. Townsend) is working energetically to extend the use of gas in the city. With the support of his Directors, and in conjunction with Messrs. J. Wright and Co., he recently arranged an interesting exhibition of gas lighting and heating appliances, which had a successful run during the four days ending June 28. The exhibition was held in the Corn Exchange; and it was opened by the Deputy-Chairman of the Company (Mr. T. Howden), in the absence through ill-health of Dr. Statter, who has been Chairman of the Company for more than half a century, and who in a few days will attain his 89th year. As mentioned by Mr. Howden in his remarks, one of the chief features of the exhibition was the penny-in-the-slot meter, of which the Company, it was stated, have already nearly 100 in use. Three varieties of the meter have been introduced by them; the makers being Messrs. W. & B. Cowan, Limited, Messrs. J. & J. Braddock, and Messrs. Glover and Co. Messrs. Wright and Co. made a prominent display of their cooking and heating appliances; and the incandescent gas-light was well in evidence. Mrs. J. B. Thwaites, as usual, ably demonstrated the advantages of gas cookers. Messrs. W. Parkinson and Co. held an exhibition from Tuesday to Friday last week at Exeter; Miss E. Sanderson giving a series of practical demonstrations in cookery twice daily.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 86.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22—23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15—16	..	4 13 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	10¼—106*	+1½	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	6¾—7¼	..	4 9 8
40,000	5	,,	6½	Do. New	4	5—5⅛	..	4 14 7
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	250—255	..	4 10 2
180,000	,,	,,	8½	Do. New	100	200—205	..	4 2 11
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220—225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	122—125	..	4 0 0
320,000	20	28 Mar.	11¼	British	20	53—54	+½	4 3 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾—8	+¼	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	99—102*	+2	5 17 8
150,000	20	28 Feb.	8¼	Cagliari, Limited	20	26½—27½	..	6 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	292—297	+2	4 10 10
165,000	,,	,,	10½	Do. New	100	225—230	+8	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	142—145	+4	3 2 1
800,000	Stck.	12 June	13	Continental Union, Limited.	100	255—260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	.	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	122—127	..	4 2 8
486,090	10	31 Jan.	11	European, Limited	10	24½—25½	..	4 6 3
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	285—290	..	4 2 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	277—282	..	3 10 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190—195	+2	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	129—132	+1	3 0 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	190—195	+4	3 1 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	247—252	..	4 15 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5½—6*	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	+1	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	15½—16½	..	6 1 2
150,000	5	24 May	8	Oriental, Limited	5	7—7½	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾—5¼	..	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	9—10	+½	7 0 0
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	300—305	+3	3 18 8
290,000	,,	,,	13	Do. C do.	100	307—312	..	4 3 4
775,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	170—175	+2	2 17 2
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290-295*	+5	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	235—240	..	3 6 8
651,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	152-157*	+2	2 17 4
700,000	50	26 June	7	Grand Junction	50	113-117*	..	2 19 10
708,000	Stck.	14 Feb.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	255-260*	+2½	2 17 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	205-210*	..	3 11 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	140—143	..	2 15 11
500,000	100	14 Feb.	12½	New River, New Shares	100	375-385	+5	3 6 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	142—144	..	2 15 7
902,400	Stck	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157—163	.	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	135—140	..	2 17 2
1,155,066	Stck.	12 June	10	West Middlesex	100	285—290*	..	3 9 0

*Ex div.

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EDITORIAL NOTES.

Mr. Carr against the "Time-Spirit."

MR. W. CARR writes to say that everybody, the JOURNAL included, misunderstood that remarkable speech of his at the meeting of The Gas Institute we reported last week, in which he took strong exception to the "inhumanity" of the idea, fathered upon Mr. Stelfox and Mr. William King, that it is always desirable to reduce the number of labourers in gas-works. We are always most pleased to hear from any reader of the JOURNAL whose individuality is so well marked as Mr. Carr's; and we are not at all offended at his calling us obtuse on matters affecting "the larger "questions of humanity." It is quite true, as he observes, that specialist writers are liable to become narrow. But, so far as the JOURNAL and the labour question are concerned, conscience absolves us from this impeachment. Remembering, indeed, how roundly we have been abused for treating the subject of workmen-directors as even debateable—remembering how many articles we have published dealing with this and other developments of the question of the day with a detachment from the purely technical standpoint for which we have frequently felt disposed to apologize—this accusation of Mr. Carr's may be allowed to pass. It appears that what he is protesting against is the principle which he detects underlying Mr. King's observation concerning the desirability of reducing the number of gas-works hands quite independently of the economical consideration. Where labour-saving means reducing the cost of production, by all means save it, says Mr. Carr; but where the inducement to eliminate or reduce hand labour is only that of saving managerial worry, then, he holds, it is a temptation that should be resisted. "I protest," he says in his letter, "against it being taken "as an axiom that it is better in every respect to employ "20 men instead of 200, apart from economical considera-"tions. I say the reverse is the case—that the man who "can feed or provide a good living for 200 men is ten times "the benefactor of the man who only provides for 20. To "speak of throwing 180 men out of employment for no "other consideration than that it shall save you a little "trouble, is inhuman." This is Mr. Carr's real position, as defined by himself; and we are sorry if any comment we have offered upon his speech was misdirected, or tended to misrepresent him before the technical world. Whatever men talk about, it is a prime necessity that they should understand what are the exact points at issue.

Now, having had this issue made clear for us by Mr. Carr himself, we regret to be compelled to remark that the matter is not thereby seriously advanced. Before one man accuses another of partiality for inhuman practices, it is desirable for the accuser to make sure that the accused cannot object to the terms of the indictment, whether he is to be found guilty or not guilty by the opinion of his peers. In the present case, it seems to us that the subjects of Mr. Carr's attack might well object, if they chose to do so, to the language in which it is couched. When one calls a man a thief, there is at least no possible misunderstanding of what is meant, and the issue of his guilt or innocence turns wholly upon the solution of the question of whether he has or has not stolen something. It is very different with the class of ethical considerations now invoked by Mr. Carr; for it is impossible even to specify the nature and extent of the evidence that would have to be heard on both sides before it could be determined whether his ascription of such a term as inhumanity to an assumed principle of action in the world of industry is justifiable or not.

To go no farther into this matter, it may be observed that what Mr. Carr calls "saving yourself a little trouble" —his alleged reason for some men's preference of machines to men—covers a very wide and varied order of considerations, from many of which what he elsewhere allows to be valid economical reasons cannot be excluded. Is it conceivable that a works' manager ever found himself in a position to decide, on grounds of purely personal convenience, whether he should employ 200 men without machinery, or 20 men with machinery, to effect a particular object? We think not. But until such a position is created, it is idle to argue as if the personal equation determined everything in connection with labour problems of the kind. And even then, when we have made the manager personally chargeable with the consequences of actions performed in his managerial capacity, how often would not

the term "saving himself trouble" be found to mean ultimately saving his employers' money, and protecting the interest of the public?

The displacement of workers by labour-saving machinery is a process which, however motived, has gone on ever since the dawn of intelligence upon the earth, and will continue to extend into more branches of industry as mechanical science improves. Mr. Carr would admit that machines are improved upon year by year and day by day. They are the productions of men who are themselves improvements upon their precursors in their chosen employment. It is consequently obvious that, if other men are to live at all, they must likewise improve themselves. They are doing so, on all hands. Whether or not gas managers personally desire to eliminate the labourer, say of the gas-stoking variety, is their own affair, and will soon be immaterial; for the race is becoming extinct. How many of the Board School population of to-day will care to be gas stokers when they are grown up? Everybody knows that it is difficult enough to catch a sufficiency of them to make the required number of blacksmiths, bricklayers, plumbers—tradesmen who can never be dispensed with, whatever the triumphs of the mechanician. Will the rest become coalies, cokeys, or stokers? Not a bit of it; but they may yet be converted into more efficient carbonizers than their fathers by giving them a machine-handle to manipulate, in place of the shovel and rake which they would not touch.

If Mr. Carr will look into this subject a little more deeply, refraining from gratifying the desire to use hard terms for labelling other persons withal, he will see that the competition between men and machines is really a contest of brute strength with intellect, and that the individual predilections of those who look on or employ either of these forces have not the smallest influence upon the course of the struggle or its result. These things are of the working of the Time-Spirit, which is uncontrollable by man, though it is his creation and collective presentment.

A Profitless Prophet.

The paper by Mr. F. H. Medhurst on "Electricity Supply "from Town Gas," which appears in another column (with the discussion), brings to a close our report of the proceedings of the Incorporated Gas Institute last month in Edinburgh. The finish cannot be regarded as a brilliant crown to the technical work of the meeting; for the paper in question is a particularly feeble production. Mr. Medhurst is the first electrician who has addressed an audience of gas managers in this way; and it is a great pity that the novelty of the occasion was not reflected by the same quality of his matter. When giving our preliminary notice of the programme for Edinburgh, we remarked, in regard to this particular paper, that if there were any of the author's professional brethren in the city, it would be a satisfaction if they would attend the reading, and help to elucidate the subject. The aspiration was not gratified—the author was without support; and when the character of the paper became known, it was possible for those who heard it to appreciate the astuteness of those who stayed away. The failure of Mr. Medhurst to impress his audience favourably is to be regretted, as the opportunity provided by the good will of the Council of The Gas Institute for blending gas and electrical engineering in a really interesting and instructive conference, was thrown away. We trust that gas managers will always be ready and willing, at their meetings and otherwise, to extend a patient hearing to any outsider, be he electrician or anything else, who shall have something to say to them that is worth listening to; but when a reader of a paper comes before an assembly of technicians with a composition set in a key that would hardly harmonize with the tone of a small Mutual Improvement Society, and has to admit, before he gets very far, that he is "only prophesying," he commits a trespass upon the good nature of his company.

The paper began well by laying down the propositions that "the electric light has come to stay; and that in "every town, of even average importance, there is a fair "and increasing number of persons desirous of having "their business or private premises electrically illumi-"nated—even though the cost, in the great majority "of cases, be greater, light for light and time for time, of "the electric than the gas light." It was unnecessary to write a paper to support these unquestioned observations, which go no farther than has often been admitted in these columns. Electric lighting is one of the luxuries of the age; and it would be ridiculous for a gas engineer or for any other individual pretending to a reputation for sanity to deny the fact. The weakness of electricians and their partisans, which is so peculiarly irritating to gas engineers, is the trick they have of affecting to regard the gas industry as moribund from the instant of their appearing in the market with this luxury to sell, and gas engineers as unscientific, ignorant, stupid persons immeasurably beneath their own lofty attainment. If Mr. Medhurst had confined himself at Edinburgh to the strict technics of his subject, he would have had a very different reception. But no—he at once "mounts the high horse," and talks about the approaching extinction of the gas industry as certain to come to pass so soon as the trifling *desideratum* of a full and equal load on electricity generating plant throughout every hour of the twenty-four, shall once have been provided.

If a competent electrician will attend a meeting of gas managers, and say: "Come now, we are engaged in inde-"pendent industries which all experience shows to be "quite capable of co-existence in time and space. I "believe there are points of contact between these in-"dustries, where it is possible for one to help the other. "Let us discuss these points"—such a man, speaking in such a spirit, will be ever welcomed by such an audience. They will listen to him; consider what he has to say; and give him their own views and experiences fully and freely. The day is now past, however, for papers like this of Mr. Medhurst, which do not advance any cause, and which it is only a waste of time to criticize in detail.

More Dublin Gas Litigation.

Another legal tussle has just taken place between the Corporation of Dublin and the Alliance and Dublin Consumers' Gas Company, with the usual results that the Company come out on top, and the ratepayers are left to pay another little bill of costs. Whoever it is that inspires the Corporation with this insane rancour against, and predilection for fighting, the Gas Company, it would be cheap to the City to pension him or them off handsomely, and let the public lighting go on under rational, business-like supervision. This time it was a question of street-lamp meters; and the comment of the *Freeman's Journal* on the incident is that "the judgment of the Master of "the Rolls shows that the Committee proceeded in the "matter as if their sole desire was to invoke an action-at-"law under circumstances that would ensure their being "beaten." The Gas Committee had to do the metering of the public lamps; and they bought for this purpose 180 meters at a cost of £230. The Company objected that these meters were not fit and proper articles; and they required satisfactory ones to be substituted. Of course, the Corporation refused to do anything of the kind; and the Company availed themselves of their legal remedy. It was proved that the Committee were not misled as to the meters they selected. They were told that "they "might do," which, as the Master of the Rolls observed, meant "they might not do." Yet the Secretary of the Committee was instructed to write to the Company and state that the meters were the best that could be had for money. The Dublin newspaper comment upon this "extraordinary "statement" is that it "needs explanation." We know, unfortunately, as much about the whole state of Dublin gas affairs as any explanation likely to be forthcoming could tell us, and rather more. It is now a long time since the Corporation, in dealing with the Company, in the name of the citizens of Dublin, adopted a policy the only fruit of which is "costs on the higher scale." They have persisted in carrying out their policy with childish vindictiveness and a degree of misdirected ingenuity in making occasions for lawsuits which are alike amazing to people with sober minds. It is not necessary to be a partisan of the Company to see the folly of this ridiculous warfare. If there were anything to be gained by it for the citizens of Dublin, we should admit the existence of some excuse for the litigiousness manifested by the Corporation. There are people who would rather win something as the result of a lawsuit than come by it amicably; but in their litigation with the Gas Company, the Dublin Corporation are invariably the losers. Nor can it be pretended that their policy in this regard is popular; for the last Bill promoted by the Corporation, which was sweetened for the public taste by the insertion of confiscatory gas proposals, was

rejected by the ratepayers. This history may be commended to the study of those perfervid apostles of Municipalism who profess to believe that local authorities are always truly representative of the people, and that they can do no wrong. So far as their schemes of legislation and their gas litigation are concerned, the Corporation of Dublin are both unpopular and always in the wrong; yet nobody is able to suggest a way out of this sad perversion of the principle and powers of local self-government.

The Society of Comparative Legislation.

An article by Sir C. Ilbert in the current number of the *Nineteenth Century* explains in an interesting manner the aims of the newly-founded Society of Comparative Legislation. The Society appeals for support not merely to professional lawyers, but also to all those who are concerned in the manifold political and social problems which English-speaking peoples all over the world are endeavouring to solve; and it is an attempt to save labour and prevent mistakes by collecting all available information as to what the different Legislatures are doing, and how the laws which are enacted from time to time are found to work. It is unnecessary to argue for the usefulness of such an organization. The only marvel is, as Sir C. Ilbert observes, that such a society has not long been in existence. Readers of the Journal are naturally concerned in a very intimate manner with a large number and great variety of those subjects of legislation which bear relation, not, as the Roman historian would have it, to the degeneracy of each State, but to the variety and complexity of its needs. Then, again, there is a striking similarity between the subjects of legislation in different States. Everywhere various solutions are being attempted of similar problems. Sir C. Ilbert refers, for example, to the attempts which are being made by Australasian colonies, with more or less success, to enforce the eight-hour day. In most colonies also boards of conciliation or arbitration in labour disputes have been established, with or without compulsory powers for enforcing their decisions. The factory legislation of Australia is said to be in some respects in advance of our own. Yet it is a standing reproach to our newspapers that very little information respecting Colonial or American experiments of this kind finds mention in their reports of current events. The conductors of these vehicles of information and public opinion appear to entertain very peculiar notions of what their subscribers prefer to read about, and constantly occupy their columns with matter derived from Continental journalists, and dealing with the most ephemeral and unprofitable trash, to the exclusion of what is of sterling interest. The new Society will endeavour to fill the void, so far as records of legislation are concerned. "It will apply to jurisprudence the comparative method of "investigation, which has already proved so fruitful. It "will gather together, epitomize, and arrange materials "now scattered through many periodicals, or to be found "only in official documents, of which few libraries contain "copies; and it will endeavour by other means to promote "the study of comparative legislation. One of its chief "aims will be the collection of information as to the statute "law and the forms and methods of legislation in the British "Empire and the United States." Most of the work of collection and compilation will be done by Committees; and we venture to hope that one of the subjects to which attention will be directed as soon as possible will be the application of legislation to the regulation of the great supply industries, such as that of gas lighting. The relations of central and local governments to such industries are questions of law and of fact which have never yet been brought under one compendious review; and nothing but benefit can follow upon an attempt, which could very naturally and easily be made by Sir C. Ilbert's Society, to establish the principles by which these relations can best be regulated.

Mr. W. J. Sturges, the Secretary of the gas undertaking of the Smethwick District Council, has had his salary increased by £25 per annum.

Mr. John T. Sheard, F.C.S., has been appointed Chemist to the Sheffield United Gas Company, in succession to the late Mr. S. H. M. Davy, F.C.S.

The New Chairman of the Canterbury Gas and Water Company is Mr. Daniel Amos, J.P. He was elected to the post at the meeting of the Board on Monday of last week, in place of Mr. George Furley, whose resignation was recently announced in these columns.

WATER AND SANITARY AFFAIRS.

The kind of paralysis which has fallen on the Metropolitan Water Question leaves the way open for considerable freedom of conjecture as to the development which awaits this subject. Before any definite conclusions can be reached, it is necessary to forecast the result of the Parliamentary Election now in progress. Apart from all political considerations, we may infer that a change such as now seems to be impending will establish a Government disposed to deal with the water question in a very different manner from that pursued by a party having sympathy with County Council designs of the Progressive type. As for the plans which the Council may now be expected to adopt, the scheme embodied in their Transfer Bills must, as we signified last week, be essentially modified if any respect is to be paid to the views expressed by Mr. Plunket's Committee. But let the County Council concede what they may, the chance of the Bills getting through Parliament this year is so remote, that these measures may as well be looked upon as defunct. The entire water question, as it affects the Metropolis, seems destined to stand over till next year. In what shape it will then come before Parliament it is difficult to say, except that the County Council will doubtless renew their attack on the London Water Companies. What line the Corporation of the City will take, is a matter which ought not to be so settled as it is supposed to be. It would redound to the dignity and honour of the Corporation if they would shake themselves free from the County Council in respect to the water supply, and were to bring in a measure of their own. They could propose a Water Trust covering the entire area of supply; a proper system of representation being devised for the constitution of the new authority. Representatives from the outer areas would naturally form part of the organization; and a thoroughly harmonious plan could thus be perfected. The Corporation have little to fear now from the Unification scheme which the County Council prepared and the late Royal Commission adopted; and the formation of a Water Trust or a Water Board might be undertaken by the civic authorities with a very fair chance of success.

Still, as we have already signified, the London Water Companies have no desire to sell their property; and, if the popular voice could be distinctly heard, it is very probable that London would be found by no means anxious to effect a purchase. There remains the method advocated by Sir John Lubbock, providing for the further control of the Companies, in lieu of buying them out. Opinions may differ as to the precise shape this control should take; but that which immediately affects the consumer consists in a careful inspection of the water, and the completion of the constant supply. If further guarantees are wanted with regard to the purity of the water, these could be given. Yet an undertaking in which many millions of capital are invested must necessarily partake of a commercial character; and the control to be exercised over it by external authority could not be allowed a degree of power which would play havoc with the finances. If control is to take the shape of interference, the supply must forthwith change hands—the control being made to rest where the financial responsibility exists. But if there is to be a reasonable plan for vesting the water supply of London in one representative public body, it is very clear that we may not look for it as emanating from Spring Gardens. Either the Government must bring in a Bill for the purpose, or the Corporation must undertake the task. The County Council have made themselves impracticable on the subject. Their last resort will be to propose an entirely new supply. But such a project presupposes the buying-up of the supply that now exists; and to do this in accordance with the principles of equity and fair dealing, is something to which the County Council appear to be unequal.

The weekly publication which is specially devoted to the interests of the London County Council, remarks on the comparative absence of London topics from the addresses of the candidates for London constituencies. Mr. Costelloe, as might be expected, has something to say about the water question in his appeal to the electors of East St. Pancras. He refers to the Bills for "the transfer of "the Water Companies" to what he is pleased to call "the London public authority." Mr. Costelloe says that, in promoting these Bills, he has had to take "an important

"part;" but he looks upon the water question as "only "one amongst a multitude of domestic reforms," all of which are at present "blocked at every point by the "bitter and unreasoning opposition of the London Tory "members." But we cannot see how these members are to be held responsible for the backward state of the Transfer Bills. The County Council are mainly accountable for the slow progress made with these measures, especially the six which have been held back from the second reading stage. The "multitude" of other reforms is a significant phrase, which well accords with what we find in most of the addresses which advocate the acquisition of the water supply by the Council. Mr. W. C. Steadman, in addressing the electors of Hammersmith, declares himself particularly anxious for the municipalization not only of the water supply, but of "gas, tramways, omnibuses, markets, docks, and electric "lighting," the profits of which he estimates at £4,000,000 a year. This splendid revenue he desires to see swept into the treasury of the County Council, "to be devoted "to public purposes." Of course, in such a golden age, there would be no rates to pay, or at least there ought not to be. But we have hitherto found that the spending power of the Council is only limited by the available sources of income. Mr. Mark Beaufoy, at Kennington, has expressed a wish to see the powers of the County Council extended, so as to include "the control of the "water supply." Mr. E. A. Cornwall tells the Fulham electors that this control should be placed "in the "hands of the people." The County Council will doubtless say: "We are the people." But throughout the contention for municipalizing the water supply, we find clear indications that other interests are to be absorbed in like manner; and there seems no end to the programme.

Mr. Geoffrey Drage, whose name will be remembered by our readers in connection with the Labour Commission, the arduous secretarial duties of which he discharged with conspicuous ability, was last Saturday returned to Parliament for Derby. Mr. Drage polled 7076 votes; and his colleague (Mr. Alderman Bemrose), 7907 votes. Both of the new members are Unionists. The unseated members (Sir William Harcourt and Sir T. Roe) polled 6785 and 6475 votes.

Death of Mr. W. C. Humphrys.—This event occurred at Warton, near Carnforth Lane, on Wednesday last. Mr. Humphrys, who had attained the age of 86 years, retired from active business some time ago. A large portion of his life was devoted to the promotion of gas and water companies; and he held the appointment of Secretary to the Barnet District Gas and Water Company for several years. He was connected with the undertaking—which was in the hands of private individuals—during the early years of its existence, from the date of its commencement; and his experiences date back to the introduction of gas lighting in our smaller towns. He was a member of the British Association of Gas Managers. His two sons—Mr. Norton H. Humphrys, of Salisbury, and Mr. F. C. Humphrys, of Ilkeston—are well known to many of our readers.

Presentation to Mr. John Tindall.—Mr. John Tindall has just completed a quarter of a century's service as Manager of the Walsall Gas-Works; and on the evening of last Saturday week, the workmen, to the number of 150, assembled at the Pleck station in honour of the event, and to present Mr. Tindall with a token of the respect and affection in which he is held by the employees. In one of the buildings, an excellent dinner was served, after which the chair was taken by Mr. John Webster, the Works Foreman, who said he believed the whole of the workmen had contributed to make the testimonial a success. The Outdoor Superintendent (Mr. J. O'Farrell)—having spoken of the goodwill which existed between Mr. Tindall and his men, and acknowledged his consideration for them, and the principles of justice which had marked his control of the works—presented the address, which was beautifully ornamented, and which tendered to Mr. Tindall the congratulations of the workmen on his having completed so long a term of office, and requested that he would accept the address and the accompanying photographs of himself and Mrs. Tindall as a small recognition of their goodwill. Mr. Tindall, in responding for himself, his wife, and family, said he as captain of the works had been greatly blessed with a loyal crew. The good feeling which had existed, and of which that gathering gave proof, would always be remembered by him as long as he lived. Of course, there had been some little matters and difficulties to get over, of which the public had known nothing, such as the provision of sufficient gas in the depth of winter, and in seasons when long-continued fogs prevailed; but he was happy to say that he had never called upon his men to do their utmost without having a ready response. The Gas Department of the Walsall Corporation was like the town—it was rapidly going ahead. Other speeches followed; and the proceedings closed with songs and conviviality.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-SECOND ANNUAL GENERAL MEETING,

HELD AT THE

QUEEN STREET HALL, EDINBURGH, JUNE 11, 12, & 13, 1895.

ROBERT MITCHELL, Esq., President.

PAPERS AND DISCUSSIONS.

ELECTRICITY SUPPLY FROM TOWN GAS.

By F. H. MEDHURST, of London.

It is with great diffidence that I venture to submit for the consideration of this influential Institute a few important questions in connection with the supply of electricity from central generating stations for public and private purposes. It will probably be freely admitted by every member of this Society that the electric light has come to stay; and that in every town of even average importance there is a fair and increasing number of persons desirous of having their business or private premises electrically illuminated—even though the cost, in the great majority of cases, be greater, light for light and time for time, of the electric than the gas light.

It is no longer necessary to urge, in a paper like the present, the numerous and unique advantages of electric light, because they are now almost as freely recognized by gas engineers as by electricians. But if the proposition that electricity supply from central stations has been established on a thoroughly sound financial basis be not accepted without doubt or question, then I think that the fact that local authorities are everywhere establishing electricity supply works, and that in 1894 these works were in the proportion of 10 to 1 as compared with those started in the same year by companies, must carry conviction to the minds of the most sceptical; for we do not find local authorities in Great Britain recklessly investing public funds in undertakings that have not given unquestionable proof of their lucrative character.

Nevertheless there can be little or no doubt that the number of electricity supply works in existence, and in immediate contemplation, would be greater than is actually the case but for the strenuous opposition which the electric lighting industry has from the commencement sustained from almost all those interested in the maintenance and development of the gas industry. From time to time it has been attempted to pacify this opposition by reminding shareholders in gas companies and gas engineers and managers that actual experience has hitherto demonstrated that in towns where central electric lighting stations have been erected, the consumption of gas has actually increased instead of decreased. It has been plausibly and not altogether unreasonably asserted that the advent of a public and private supply of electric light has improved the general standard of lighting; and that those who have preferred to retain gas have been forced by sheer competition to add considerably to the numbers of jets in their shop windows and shops, in order not to be outdone by those in the same line of business who have adopted the new illuminant. Then, again, I think it must be admitted that heating and cooking by gas have received a great impetus since the advent of the electric light; and, generally speaking, the fact that the managers, directors, and engineers of gas undertakings have been "put on their mettle" owing to competition with what was formerly almost a monopoly, must in some measure account for the apparent paradox that in districts possessing a public and private supply of electricity the consumption of gas has continued to increase.

But to infer from this undoubted fact that the last word has been said with respect to the competition between gas and electricity would, I think, be highly injudicious. My own opinion is most emphatically that the effects heretofore observed, and that I have tried to explain, are merely transient in their nature; and I think that a very little calm consideration must show that to maintain that because hitherto the consumption of gas has not been seriously affected by the use of electricity, therefore it never will be prejudicially affected, is to display ignorance or disingenuousness. With respect to my contention that, in the

long run, an increased demand for electricity in a particular district must decrease the demand for gas in the same district, I will say at once that if electricity could only be used for lighting I should be of a contrary opinion, because so long as the demand for the electric current be satisfied by a use of the generating plant in the twenty-four hours equivalent to only an output of the plant for from three to five hours at full load, so long, I say, as electricity supply works continue to suffer from very small load-factors and from very imperfect means of storing electrical energy, will it be impossible to sell electricity for less than from 4½d. to 8d. per Board of Trade unit. And I do not think that gas companies have much to fear while these rates are a necessity. On the other hand, I believe there are abundant indications tending to show that these prices are certain to be shortly materially reduced Cooking by electricity has produced excellent results; at least one London theatre has been heated throughout by electric radiators; and electric motors are probably the cheapest, most efficient, and most convenient motors for small powers. In a word, I do not think it too much to say that electricity from town mains is capable of accomplishing everything that may be done by town gas, with the almost single exception, if I may be permitted to say so, that electricity will not contaminate the atmosphere we breathe.

Electrical engineers recognize that the cheapening of the electric current produced at central stations depends, in a very great measure, on the extent to which electricity comes to be used during the daytime, and generally during the time when the generating plant is not required for lighting purposes. I have purposely gone rather fully into the question of the bye-uses of electricity, because it is by their development that electricity will, I believe, before this Institute has held many more meetings, be sold for all purposes for from 2d. to 3d. per unit. I admit that I am only endeavouring humbly to prophesy, and it is for you to examine the premises which have led to my conclusions; though I would beg you to bear in mind that already in Newcastle electricity is being sold for 4d. per unit. At all events, it is certain that if the plant at our generating stations could be worked at full load, and without the intervention of electric accumulators, for twenty hours out of the twenty-four, then the electricity produced could be very profitably sold for considerably less than 3d. per unit.—even in towns like London, where coal is expensive.

But if this thing comes to pass—as, rightly or wrongly, I am convinced it will—what will be the effect on the gas undertakings? If the electricity be produced—as is now usually the case—through the intervention of steam-boilers and steam-engines, then I make bold to say the result will be to very seriously cripple at least a great number of the gas undertakings in this country. It is, I fear, too late in the day for gas companies in important towns to apply for Electric Lighting Provisional Orders, because in most cases they would be met by a counter-application from the local authority; and the latter would certainly succeed. But in Great Britain—especially in Scotland and the North of England—many of the gas undertakings are in the hands of the local authorities themselves. In some of these towns, electricity supply works have been erected by the local authorities; but in every case, with the single exception of Belfast, the dynamos have been driven by steam-engines, though in one or two instances coke breeze—which has formerly been worth little or nothing—has been used for raising steam in the boilers. In these cases, forced draught has, of course, been a necessity. No doubt this plan is economical for the present; but what of the future? What of the time when electricity comes to actually, and most seriously, decrease the demand for gas? Then the demand for electricity will be greater than that for gas; and as the demand for gas decreases, less will be made, and there will be necessarily less breeze to burn in the boilers, so that steam coal will have to be at least partially resorted to.

Hitherto, then, with the single exception of the Corporation of Belfast, no local authority appears to have recognized that there is no great advantage to be derived from founding one kind of lucrative business if that business is to proportionately reduce the profits of an existing and a paying undertaking already in the possession of the ratepayers. In my opinion, there is one way, and one way only, whereby electricity supply works can be so carried on as to permanently benefit, from a commercial standpoint, the gas undertaking. Obviously this is a consummation devoutly to be desired—at least in those cases where the gas and electricity supply businesses are in the possession of the local authority, or where (if there be such an example) both belong to the same company. In my opinion, the problem is only to be solved on a permanent and sound financial basis by the employment of gas-engines, actuated by town gas, to drive the dynamos. It may, of course, be said that if this plan be adopted, we shall be forced to employ secondary batteries and low-tension direct-current distribution, because it is frequently urged that the speed of gas-engines fluctuates too much to render direct driving advisable. Personally, I must dissent from this view, because I have had opportunities of testing the gas-engines of some of the leading makers, with the result that I am convinced of the possibility of manufacturing gas-engines whose momentary variations of speed under sudden differences of load and whose cyclical variations are no greater than those of a well-governed steam-engine. I admit that in the case of the gas-engine, an even turning moment with rapidly fluctuating loads is obtained solely by storing up, as it were, a relatively great number of revolutions in the fly-wheel—*i.e.*, by employing a very heavy fly-wheel, rendering advisable a substantial outer bearing. The result is, of course, to increase the consumption of gas at all loads, though the increase is especially felt at light loads. Nevertheless, there is a greater margin for improvement in the gas-engine than in the steam-engine; and I trust that before long we shall have gas-engines running not with fewer explosions at light than at heavy loads, but with weaker explosions, as it will then almost certainly be possible to reduce the heavy gas-engine fly-wheels, which have attained almost alarming dimensions.

But taking the gas-engine as it is, I propose to try and demonstrate the effect that would be produced in the event of a local authority owning the gas undertaking deciding to employ these engines for its electricity supply works. I assume that the electrical system adopted be the alternating high-tension system, with transforming sub-stations. Whether steam-engines and boilers, or gas-engines and no boilers be employed, the capital outlay on mains and transformers would be the same. In the case of a plant of 180 units, split up into three sets of 60 units (one spare) each, I find that the cost, using Lancashire or water-tube boilers, steam alternators (alternators coupled direct to high-speed steam-engines of the single or double acting type), a feed-water heater, and economizer is about £600 more than a plant for the same output employing three gas-engines of 110 brake horse power each, to drive the three alternators with direct coupled exciters, by means of ropes or belts. In the former instance, I have assumed that the exciter engines are to be coupled direct to their dynamos, but that the exciter dynamos are not coupled direct to the alternators. I believe that no adequate advantage would be gained by employing separate gas-engines to drive the exciting dynamos, because I am of opinion that, for various reasons which need not here be discussed, parallel running would not, in the case of the gas plant, be practicable. By parallel running, I mean two or more alternators feeding into the same main. But that parallel running of alternators is by no means essential to commercial success, is sufficiently proved by the fact that the Newcastle and District Electric Lighting Company—one of the most successful electricity supply companies in England—has never attempted it.

I do not think it unreasonable to count on a saving of about £400 in the buildings and foundations necessary to accommodate the gas plant I have just named, as compared with the outlay that would be requisite for corresponding steam plant. In the former case, neither chimney-shaft nor boiler-house are necessary; whilst in the latter, the engine and dynamo room must be rather larger, and its foundations more substantial than that for the steam plant. If, then, the total capital saving due to the employment of gas plant be £1000, and if the local authority borrow at 3 per cent. and set aside 2½ per cent. for redemption of the loan, we have a saving of £55 per annum due to the employment of gas plant. Assume that there be no public electric lighting, but that the equivalent of 6000 lamps of 8-candle power and 30 watts be connected to the mains, it is fair to reckon on a yearly consumption of 18 units per lamp. The output would therefore be 108,000 units per annum.

The following table, compiled from the Board of Trade

returns, printed weekly by *Lightning*, shows the costs of production and distribution per unit, delivered to consumers from central stations whose outputs in 1894 varied between 60,000 and 200,000 units. A Board of Trade unit of electricity will maintain an 8-candle power lamp (of 30 watts) for 33 hours.

Name of Town.	Number of Units Delivered to Consumers.	Costs of Production and Distribution.				
		Coal.	Oil, Waste, Water, &c.	Salaries and Wages.	Repairs and Maintenance	Total.
		d.	d.	d.	d.	d.
Aberdeen .	65,012	0·65	0·21	0·85	0·07	1·78
Hanley . .	65,871	0·79	0·23	0·74	0·38	2·14
Huddersfield	156,169	0·64	0·02	1·08	0·11	1·85
Taunton . .	100,495	1·95	0·48	0·70	0·32	3·54
Northampton	59,474	1·51	0·20	1·55	0·31	3·57
Scarborough	86,594	1·87	0·13	1·57	0·70	4·27
Oxford . .	157,257	0·65	0·05	0·92	0·58	2 20
Sheffield. .	192,220	1·00	0·14	1·20	0·42	2·76
Average .	110,386	1·13	0·18	1·09	0·36	2·76

As the average output of the stations named is 110,386 units, I think we may take the average costs of production as representing what might reasonably be expected to follow the completion of such an installation as I have described, using steam plant, and designed so as to economically meet the requirements of the case.

Now we have to consider what are the costs of production under the four separate heads mentioned in the table, and what the total cost of production would be if the steam plant were replaced by gas plant. It is well known that gas-engines of 100 brake horse power and upwards are now made to consume not more than 20 cubic feet of town gas per horse power per hour at full load. But unfortunately the conditions of electricity supply are such that the engines would, for the most part, be working much under full load; and I should not anticipate an average consumption of gas of less than 80 cubic feet per unit sold to consumers, taking into account the trying conditions under which the engines would be working. Now I am informed on excellent authority that 1s. 2d. is a fair price to allow as the cost of producing 1000 cubic feet of gas, including interest on capital expended on the works (but not on mains), and also cost of labour and material. I am assuming that the town has a population of about 50,000; that the electricity supply works are erected at the gas-works; and that the latter are well designed and efficiently managed. The cost of production must vary between fairly wide limits. But it is necessary to assume a definite figure for the purposes of this paper; and those engineers who know that their costs are lower or higher can make the necessary deductions for themselves. But allowing the above assumptions, the cost of gas per unit sold to consumers works out at 1·12d. per unit. In the case of the steam plant, the average cost of coal was 1·13d., and the highest was 1·95d. Oil, waste, water, and engine-room stores would probably be about equal in both cases. I should expect salaries and wages to be rather less in the case of gas than of steam plant, because in the former the wages of stokers will be saved, and the gas engineer and manager may, with a little technical assistance, manage the electricity supply works as well. Repairs and maintenance will most likely cost somewhat more for a gas than a steam plant, though the difference must be small. The saving in salaries and wages would probably rather more than cover the extra cost of repairs and maintenance. The net result, then, would be that the costs of production would most likely be almost identical in both cases; whereas the advantages, in point of view of decreased capital expenditure, and hence of interest and sinking fund, appear to me to be decidedly in favour of the gas plant.

It should also be borne in mind that the profits of the two undertakings together should rather more than cover the interest and sinking fund on their total capital expenditure; and hence if, as I anticipate, the consumption of gas will in the near future decrease in towns possessing electricity supply works driven by steam plant, then it follows that the profits from the gas undertaking must decrease also, and those from the electrical works may actually be required to pay part of the interest and sinking fund on the capital borrowed for the gas undertaking. But, on the other hand, if the two undertakings be worked so as to be inter-dependent, they must necessarily exercise a beneficial influence on one another's paying capacities. An increase in the demand for electricity will necessitate the manufacture of a proportionately greater quantity of gas. There will be a series of actions and reactions; and there will be no rivalry between the businesses of gas and electricity supply, because there will be no clashing of interests. The gas engineer will regard the electrical engineer as his best friend; and the Journal of Gas Lighting, the pillar of the gas world, will forget to insist on the infancy and unreliability of the electric light. Surely such a consummation is worth working and hoping for.

Discussion.

Mr. C. S. Ellery (Bath) remarked that it was rather hard to say whether he admired most Mr. Medhurst's boldness or his sanguine temperament. He (Mr. Ellery) was a little staggered at some of the statements in the paper, which did not coincide with his own experience. They happened to know something about electricity in the town in which he was interested; and he must say that they did not see there such effects as were shadowed forth in the paper. If the electric current could be generated at the low figures suggested (he did not say it could not), it showed that very rapid strides were being made. But he should like Mr. Medhurst to explain a little further with regard to one of the towns he had referred to. He said that at Taunton electricity was being manufactured at a cost of 3½d. per unit. Now at Taunton it had been sold at 6d. a unit; and yet the concern had been in a very shaky condition for some years, and when *in extremis* they sold their works to the Corporation at about one-half of what they cost. If electricity could be produced at the low figure mentioned, and sold at nearly as much again, how was it that they fell into such a calamitous state? Of course, now they were in the hands of the Corporation; and corporations "managed" things well—very well! There was one significant item omitted from the table in the paper—nothing was said as to the return on capital; and what it would be, Mr. Medhurst would perhaps tell them in his reply. They might not be over-sanguine in suggesting that, as means were found for cheapening the electric light, improvements in some other directions might not be altogether impossible; suppliers of gas might consequently be able to improve and cheapen the light which they sold, and so live a little longer. Even during the present meeting, they had seen that, without the aid of the electric light, it was possible to produce a very brilliant light—something that would at least be creditable to gas undertakings. He referred to the "Denayrouze" burner, developing 27 candles per foot of gas consumed. Personally, he was very sanguine as to the future of some of these newer gas-lights. It would be interesting to know that the suggestion of using gas for producing electricity was actually an accomplished fact, though not quite in the way Mr. Medhurst had suggested. He had recently had a very interesting conversation with a manufacturer of gas-engines, who told him of a large factory in their district which even now was being fitted up with electric lamps, and the power was gas. He went so far as to say that some of the most formidable opponents electric light companies would have in the near future, were private installations provided with gas-engines. This was a very important point for the Institute to keep before them—to cherish and assist in every way these private installations of electric light. He agreed with Mr. Medhurst on one point—viz., that the electric light was, under some circumstances, a light that people would have, and ought to have. But whether it was to come from a central station or from gas-engines on the premises, was a question for gas engineers to assist in solving. One point was to maintain such a day pressure that there should be no difficulty in obtaining an ample supply of gas for such purposes. Some gentlemen suggested that 18-10ths day pressure was rather excessive. But in his case they maintained the full 20-10ths, and had been doing so for a considerable time; and the leakage account was only just over 4 per cent. Their day consumption for engines, &c., and for domestic purposes was from 20 to 30 per cent. of the whole; and it seemed to him that it was in this direction that they should look to meet the competition which was coming upon them. In a town he knew of, where a company was in existence supplying the electric light, the increased sale of gas this year was 3 or 4 if not 5 per cent. Therefore, from all present appearances, instead of falling into the "slough of despond," their spirits were about on the same level as formerly; and they might well believe there was some little future still before them.

Mr. John West (Manchester) said only recently, when he was speaking on gas matters, he was told by some gentleman in the lecture-room that, of course, he was interested in gas. Now they had been listening to an electrician; and like all electricians he laid claim to have almost extinguished gas. However, he (Mr. West) did not think any amount of prophecying would do that. There was a great deal of prophecy in the paper; but he doubted if the prophecy would ever be fulfilled. The author indicated that they ought not to be sceptical, seeing there were so many local boards taking up the electric business, instead of private individuals. But it occurred to him (Mr. West) that this was a sign of weakness rather than otherwise; because if the electric light was so good a thing, he fancied there would have been more private companies taking the matter up, and showing some advantageous results in their balance-sheets. He for one should, therefore, still continue to be sceptical. He was not inclined to think that because a local authority took up a matter, it must be right. His only fear was that public authorities, having the ratepayers' money to resort to, would be not so particular as private people who were simply depending on their own pockets. He had many friends among electrical engineers in Manchester; and he was not aware that he entertained any prejudice against electricity. He did not think, as scientific men, they should be accused of not accepting what the writer of the paper supposed to be accomplished results, and of requiring to be pacified. He did not want to be pacified, in the way the writer of the paper indicated—he wanted to see some hard facts presented to him. Electricians had now been at work for a very long time; but they had not yet produced such results as to induce a large amount of capital to be invested in electrical enterprises. He believed very much in what they had done in two particulars. They had done a great deal in perfecting engines for generating electricity; and, from an engineering point of view, he gave them much credit. But it seemed to be forgotten that the electrical engineers had to obtain their force or energy from the same source as the gas engineers—they had to get it from coal; and the question was which was the most scientific and the cheapest mode of producing light from coal. He, as a gas engineer, said that he was producing it with closed vessels more scientifically and more cheaply, and that he could produce more light from a ton of coal than they could by electricity, and he had the coke to boot. There was the energy in the coal; and they had to extract it and utilize it in the best way they could. The gas engineer retained most of its properties in the shape of gas, coke, tar, liquor, and other things; whereas the scientific electrician asserted that he first of all used coke, or coal, or breeze under the boilers to generate steam. What heat did he get out of the coal there? Then, again, the steam was taken to the engines; and however admirable they might be, there was a considerable loss there. Then he went on to produce his electric current; and so he was carrying forward and losing part of his energy through a long series of mechanisms. It was not for him (Mr. West) to despise mechanics, because he was almost living by the application of mechanism properly applied; but in this case he did think it was a little divergent from the straight course. Mr. Medhurst had prophesied that if people would use the electric supply during the whole 24 hours, so that they could maintain a full load on the engines, then they might reduce the cost of electric lighting. But gas engineers might say the same thing—if people would use the same quantity of gas hour by hour through the 24 hours, they would have their distributing plant fully occupied, and so be able to dispense with holders altogether for storing the gas. Then there was another "bogey" raised up about heating by electricity. They had no doubt seen the frying of a pancake or some little thing of that kind; but he should want a lot of that sort of food to satisfy him. What he wanted to see cooked by electricity was a good thick steak. When the electricians could do that as cheaply as by gas, there would be some probability of electricity coming into competition with gas engineers. As to the likelihood of reducing the current to 2d. or 3d. a unit, that was sheer imagination. They had heard the same sort of nonsense talked time after time. The question was, could they as gas engineers make gas to compete against the electric light? and it was well known that they could. They had shown by the introduction of new burners and so on that, instead of the electric light approaching them, the distance between them was getting greater and greater. He looked upon the electric light as a kind of luxury, for which some people no doubt were willing to pay. Mr. Medhurst had indicated that he thought the gas-engine was the best means for producing the requisite power. But that was no novelty. Mr. Denny Lane had pointed it out many years ago; and he (Mr. West) had repeatedly done the same thing in Manchester. There were a great number of installations in London and other places where gas-engines were being already used for the purpose. There was no doubt that, in either small or large installations within small areas, a gas-engine would be more economical, because of the great loss which always occurred in distributing the electric current. The advantage of only having to distribute it within a few hundred yards was one of the conditions which electricians were trying to bring about. They could convey more horse power through gas-mains, and much cheaper, than the electricians could through the cables they laid down for the electric light. In the table given in the paper, he noticed a very great difference in the cost of production in different places; and he should be glad if the author could give a reason for the difference. At Taunton, it was 1·95d.; at Scarborough, 1·87d.; and at Oxford 0·65d. He (Mr. West), could not understand why this difference arose, because there was not a corresponding difference in the price of coal to account for it. Perhaps in one case they were using expensive coal; and in the other, coke or breeze. At the end of his paper, the author suggested that the time might come when electricity would be able from its profit to assist the gas industry; but, at any rate, they already knew of several instances where the gas department of a town had had to subsidize the electric light. He should like some instances to be given of dividends being paid by electric companies for supplying the electric light. In conclusion, he must again repeat that he was not prejudiced, and it must not be assumed that any of them were prejudiced, against electricity; they came there for scientific purposes. The gas engineer and the electrical engineer were brothers in arms; and it remained to be proved which would be the most successful.

Mr. Alderman Miles (Bolton) was not prepared to take the sanguine view which Mr. Medhurst did. On the other hand, he was not prepared to be so severe on the electric light as Mr. West. He thought, as the result of his experience, that the middle course would be nearer the truth. No doubt many of the members had studied the paper read by Mr. Chew, of Blackpool, at the last meeting, when he (Mr. Miles) made a statement as Chairman of the Bolton Corporation Gas and Electricity Committee (for they had combined the two together), that he would take care, if it was within his power, that the gas department should not subsidize the electric light department. In that endeavour, he had partially succeeded and partly failed. They had now had four months' full working of the electric department—it having been opened in October—and, in making up their accounts to the 25th of March, they had four months' good working. He was rather pleased to observe that the accounts turned out fairly well. If the Local Government Board did not compel them to repay their capital in 25 years, they would have been able to meet every charge in the way of establishment, and everything else, and be only £11 to the bad for the first four months' working, which was not so very bad. Their charge per unit was about 5¼d. The works were admirably well placed. They used breeze for the boilers. He believed that electricity had "come to stay;" and that they must make up their minds to this being so. He was not at all afraid that the supply of electricity given by public companies or corporations would in the long-run materially affect the supply of gas. Their increase this year in the gas supply had been 4½ per cent.; and the profits were larger than ever before. On the other hand, he was inclined to agree with Mr. Medhurst somewhat that these conditions would not be so nearly allied as they were at present; and he could scarcely agree with what Mr. West said, that the gas industry was beating the electrical industry. Of course, that was a problematical question; and after the lecture they had had from Professor Lewes, describing an improved burner and the marvellous advances made in gas-heating, it was impossible to say what would be the result. Speaking generally, however, they might fairly believe that gas would hold its own. One of the chief difficulties that

arose was one which occurred in their own town—namely, the probability of mills and other large works providing installations of their own, and working them by their own engines. They had a case in Bolton last year, where they had lost a consumer of £500 a year; and the manager of the concern informed him (Mr. Miles) that he was entirely satisfied with his own installation of electricity. Of course, they could not hope in cases like this that gas-engines would be used to supply the power. In small private installations, gas-engines would do very well; but it was in the case of the larger works that he saw danger ahead. He was very much interested when Mr. Chew read his paper, in the suggestion that there would be a probability of gas-engines being used for the purpose of central station lighting; but he had not heard of it yet, except in the case of Belfast. He should be very glad to know if the engine used there was satisfactory. They did everything in their power at Bolton to induce the electrical engineer to adopt a similar plan; but, after the most elaborate inquiries, he failed to find a gas-engine which would answer his purpose, though he was desirous of doing so. No doubt, if such a thing could be done, it would be a great boon to corporations and gas companies. Taking the thing as a whole, he should not have had the temerity which Mr. Medhurst showed when he talked about electric works being called upon to pay part of the interest and sinking fund on the capital borrowed for gas undertakings; and he did not consider they need be alarmed at the statement. He did not think that it would come to pass at any rate within the next ten years. To return to what happened at Bolton, with regard to the gas department subsidizing the electric department. There was a deficiency of something like £580—being the amount of capital which had to be repaid. This had to come from somewhere; and while he was very anxious that it should be carried over to the next half-year's account (to see how the accounts would work out), the Town Clerk advised him that it could not be done—that it must be provided out of the rates. It had therefore to be so arranged for; and as the Gas Committee handed over the sum of £23,000 in relief of the rates, out of that amount had to come the £580. He was right in saying, therefore, that he was partially successful, but not wholly so, in preventing the subsidizing of the electric department by the gas department.

Mr. Isaac Carr (Widnes) said not only must they all agree that the electric light had come to stay, but they must also accord it the first place as to the quality of the light it afforded. Everyone who had seen the charming effects obtained by the electric light in window decoration, knew that such effects were impossible with gas-light; and the electric light would therefore always hold the first place on that account, and gas must come second. He was sorry he could not speak of the other portions of the paper so favourably, but must follow somewhat on the lines of those speakers who had taken an adverse view. It had been said that the cheaper production of electricity depended on the more constant use of the generating plant. But they also knew that, if gas plant could be kept working at anything like its maximum capacity, how much cheaper gas could be supplied. There was one important point in the paper to which he wished to take exception—viz., the excellent authority who had given Mr. Medhurst his figure of 1s. 2d. as the cost of 1000 cubic feet of gas, including interest on capital, and putting the gas into the holder. The figure of 1s. 2d. might be the average cost; but he (Mr. Carr) could assure Mr. Medhurst that there were works in this country where the cost, including all charges, was 30 per cent. less than the figure he had named. That being so, if really active competition came into the gas industry, as it had done in other trades, what was possible in gas production would of necessity become much more general. From what they had recently seen as to improvements effected for cheapening cost of production, it was evident that gas was just as much in its infancy, and as capable of development, as electricity; and he (Mr. Carr) could not see that electricity was any more likely to check the consumption of gas than gas had been able to reduce the consumption of candles and oil.

Mr. J. Stelfox (Belfast) did not think it would be right for him to attempt to answer directly the question put by Mr. Alderman Miles, as it did not refer to his department. He had in recent years asked for an increase of producing power in gas-making, and had consequently been put down as an opponent of the electric light under all circumstances. But he had only asked for what he thought was needful for their own industry; and he did not at all regret to see the electric light extended. As it was a separate department in Belfast, he did not care to give figures, which should come from the head of that department. He might say, however, without going into the figures, that in the only quarter's running of the electric light installation at Belfast (and it was not a full quarter), the gas bill amounted to one-half the total accounts for the electricity, and the increase in gas consumption for that quarter was fully twelve times the amount of the bills sent out for electric lighting. Mr. Medhurst had assumed that people would be disposed to take the electric light on account of its extra brilliancy; and no doubt the electricians could make a very beautiful display, when they had on a small table as much light-giving power as was generally distributed over a small parish. But when the light was taken off the tables, and put at intervals through the streets and shops, he (Mr. Stelfox) did not see where the superiority came in. A few evenings previously, he was in the Belfast Exhibition, which was supposed to be very brilliantly lighted with arc and incandescent lights; but there was not a second opinion from anyone he had spoken to who had been in the place, as to the fact that the small stand of the Incandescent Gas-Light Company was the most brilliant thing in the exhibition. It stood out even amidst the arc lights, and attracted attention to itself right across the building. Accompanied by Mr. Denny Lane, he went through the exhibition; and the parties themselves admitted that the picture gallery, which was entirely lighted by means of incandescent electric lights, was simply not lighted at all. The question had been naturally asked, Why did not the Incandescent Gas-Light Company put up a few lights there? Now, with regard to private installations. In the very centre of the small compulsory district of Belfast, he had just jotted down the names of five large firms who were using the electric light. Four of them employed gas-engines in its production; and one, an extensive steam installation. He thought he was correct in saying that the united energy expended in these five places was considerably more than was going out from the public installation. In one case, they had two 8-horse power nominal gas-engines; and in another, two 20-horse power nominal engines. There were many cases all through the town; but these were in the very midst of the compulsory lighting district. The adoption of electric lighting by corporations was no proof that real progress was being made. Letters were written to the newspapers, and people insisted that the electric light should be adopted, so that they should not be behind others. In this, people who knew nothing whatever about it, were unanimous; and so it got done. Some years ago, electricians were very keen to start companies; but now they were much keener to experiment with public money. One gentleman said he thought they would make money if they had not to repay loans. That sounded like saying that people would all be very well off if they had not to pay their debts. In that case, they would all be content permanently with their present salaries, or even less.

Mr. C. A. Craven (Dewsbury) said, in the town he came from, they were a very "happy family" so far as lighting was concerned—both gas lighting and electric lighting were under the local authority. He was very pleased to hear from Mr. Medhurst that there was a prospect of them having some assistance towards paying the interest and the sinking fund of the gas-works from the electricity works, if such assistance should ever be needed. At present, the "boot was on the other leg;" but how long it would continue so, he really could not say. He did know of a case where the electricity department got some assistance in paying their interest and sinking fund from the gas department, and even occupied a portion of the gas-works without paying any rent. When the project for introducing the electric light was first mooted, it was discussed by the Lighting Committee; and the matter was referred to him. He said by all means introduce it; he was not afraid on account of the gas-works. But how the electric lighting would succeed, he did not know. Then an eminent electrical engineer was consulted; and they were very good friends. But the electrical engineer recommended that the gas-works should be simply utilized for heating, cooking, and motive power purposes, and electricity for lighting. Some of the Committee asked him (Mr. Craven) what he thought about that. He told them if anything of the kind were adopted,

he had one special recommendation to make, and that was that each of them should purchase a strait waistcoat, get put into it, and then retire into private life. However, they were getting on very amicably. The gas-works were none the worse for having the electric light brought into the town; and if there were any anxiety, he thought it was rather on the other side. No doubt, electric light would progress; but if not, they would have to continue the little bonus towards assisting them. One thing he felt sure of—that if they could once get hold of a good consumer, they would get twice as much out of him as the gas-works did. At the same time, he was anxious to know where an electric light station had injured any existing gas-works. He did not know of any, although he had tried to find out if such a case existed.

Mr. Joseph W. Buckley (Falmouth) said he should like to mention one or two points which had come under his observation—particularly one or two private installations. He found that in no case had the private installation been taken advantage of by the electric light except where the worst possible system of gas lighting had been continued in use. Like Mr. Ellery, he thought private installations ought to be encouraged, because his experience was that, where gas-engines were used, more gas was used for driving the engine than had previously been used for illumination. This probably arose from the fact that the consumers mentioned had used the gas most sparingly when consumed for lighting. The surprisingly low price per unit mentioned by Mr. Medhurst was very far from coinciding with a tender he had noticed some months ago from an electrical engineer for public lighting a street in the West of England. The cost he estimated for lighting the streets a mile long was about as much as the authorities were paying for the lighting of the whole town, about eight miles of streets, by means of gas.

Mr. Denny Lane (Cork) said that he would try to avoid repeating statements which he had made before. They might remember that at Belfast two years ago, when in the presidential chair, his address was principally devoted to this question of the application of gas for producing electric light; and he showed clearly, as he thought (at any rate no one had ever contradicted any of his statements), that whether for the production of electric light, or perhaps still more for its distribution, gas had special advantages. He then showed how by gas they could distribute some 3000-horse power a distance of a mile at an extremely low rate; and he pointed out how much cheaper it would be to have several stations than have only one very large station, with expensive conductors and feeders. He could corroborate what Mr. Stelfox had said with regard to the lighting of the Belfast Exhibition. He had always been exceedingly fond of pictures; and there was a nice collection, he believed, in the exhibition. But he must confess that he was totally unable to see them by the electric light. There were a great number of incandescent lights; but really the paintings were only semi-illuminated. One of the most brilliant displays he ever saw of artificial light of any kind was that from the stand of the Incandescent Gas-Light Company in the same exhibition; and, of course, there were a good many lights on it. One gentleman asked whether there was any case in which the consumption of gas would be diminished by the introduction of the electric light. He remembered one case where after its introduction, but certainly not on account of it, the gas consumption had been diminished; and that was in the important city of Berlin. Soon after the electric light was introduced, the gas consumption diminished; but the authorities attributed it—not to the electric light, but to the great economy of gas in consequence of the substitution of incandescent gas-burners for old-fashioned ones. Berlin and Amsterdam were visited two years ago by some of the Directors of his Company; and in both places they found that establishments which had previously been lighted by the electric light were then supplied with incandescent gas-lamps on account of their superior economy. He had taken a short note of what the difference might be between the very best gas lighting and the electric light. If the electric light were reckoned at 6d. a unit, which was a very moderate price, and each candle taking $3\frac{1}{2}$ watts to supply it for 1d., they had 50 candles of supply. On the other hand, taking gas even at 3s. 4d., or 25 candles for 1d., and in the burner shown the previous day, there were 27 candles given from one cubic foot. Therefore, on the one side there was for 1d. 50 candles of electric lighting, and 540 candles by gas-light. Of course, he was taking the best condition of burning gas; but putting it down at half that, electricity cost about five times as much as gas-light. He did not know what the reason was, but undoubtedly the electric light had some effect on the imagination; because, as someone had remarked, there was a very great tendency to prophesy among electrical engineers. Among the most imaginative of them all, perhaps, was Mr. Preece. He told them the other day that the electric light was essentially a poor man's light. He (Mr. Lane) had not found yet that it had proved itself to be so. He might remark that the city of Waterford was supplied with the electric light some eight or nine years ago; the Corporation having made a five years' contract with the Electric Lighting Company. But as soon as the contract terminated, the electric light terminated too; and there had been no electric light in Waterford for several years. There were a good many small installations in Cork; and in every case, except in flour-mills, the power was supplied by gas-engines. He could not see any unsteadiness or any unpleasant effect from using gas-engines, if they were properly attended to. They had a great many gas-engines in Cork; and they had one very capable and intelligent mechanic who thoroughly understood their construction. He periodically visited all the engines, and discovered if there were any defects. In consequence of this, they worked very much better than ordinarily. In one case recently, he was sent for—where any delay would have been of great damage to the business—to inspect the gas-engine. When he came back, he was asked if there was anything wrong with the engine. He replied that it was only the gas supply that was wrong—there was not sufficient gas; the air supply was wrong; the water supply was wrong; and the exhaust was wrong. That was all that was wrong. They never had complaints from any place where the electric light was supplied. Someone said he had heard of no other place where the electric light was supplied through gas-engines except at Belfast; but he (Mr. Lane) might mention that at Dessau, in Germany, it had been supplied for many years by gas-engines, and had given great satisfaction. At Belfast, the experiment was very practical. There were four engines of 100-horse-power, and two of 50-horse power. The whole of these might be required at night; but during the day one of the smaller ones was kept charging an accumulator. When there was an accumulator running parallel with the engines, there was improved steadiness with the light. Steam was employed at the Crompton Company's works at Kensington, and several other places. Besides the advantage of allowing the engines to remain unemployed for some time, it certainly steadied the light. With regard to distribution, he had always been in favour of the low-tension continuous, as compared with the high-tension alternating system. It was much better to distribute the generating stations in such positions that the current from them should not have to go more than three-quarters of a mile. Within that distance, it was quite easy to supply all, by means of gas-engines which required but little attention. That was another point which had not been referred to—the small amount of attendance necessary for a gas-engine. In point of fact, if the time of a man who had to take charge of the steam-engine and boiler in a small installation was reckoned, it would come to more than the whole gas would cost to supply the station. With regard to the supply of power also, except for very small motors, it could be very much more easily supplied by gas-engines than by any electric motor he had ever seen. As to cooking by electricity, it was one of those things which he deferred forming any opinion about, until he saw a baron of beef properly cooked by it. He would remark, in conclusion, that the paper seemed to avoid the question of the incandescent gas-light, which was the most serious opponent electricity had ever met with. He had seen many lamps which gave a purer and whiter light than the electric light itself—more especially those he saw a few days before in Belfast; and he had very little doubt that if the new process shown by Professor Lewes was carried out, of mixing the gas and air more thoroughly, the days of the electric light would be numbered. He should be sorry for that, however, because he believed in competition. As an evidence that he had no objection to electric lighting, the Directors of the Company with which he was connected, on his advice, had on two occasions applied to the Corporation for their

assent to the Company applying for electric lighting powers; and they were going to apply again this year. The consent of the Corporation was not necessary; but they should not like to get into conflict with good consumers. This, at any rate, was evidence that he had no prejudice whatever against the electric light; he believed it to be the best friend gas had ever had.

Mr. Frank Wright said, as a visitor to that august assembly—casting the "sandals of trade" from off his feet—he desired, with the permission of the President, to make a few remarks upon the subject of Gas *versus* Electricity. In the first place, they well knew the adage that a prudent general never despised the strength of his adversary; and they should also remember the fable of the tortoise and the hare, in which the poor despised tortoise, by perseverance, overtook, and left far behind, that fleet animal, the hare. Many years since, attracted by the effulgent rays of an electric arc lamp, and desiring to know something more on the subject, he made a call upon the company exhibiting the light, with a view to employment; and he ultimately succeeded in becoming assistant in the physical laboratory of Mr. St. George Lane Fox—a gentleman he had previously known in connection with the system of automatically lighting and extinguishing the gas-lamps in Pall Mall about the year 1876. No sooner did he (Mr. Wright) meet this gentleman, than he was advised to insist upon all his friends selling out their gas stock. However, not being a believer that electricity would ever entirely displace gas, he did no such thing. Many unfortunate beings, however, were at the time led into parting with their shares; and others more fortunate took advantage, and secured them. It was a fact that at this time many of the gas companies had never paid a higher dividend than 10 per cent.; whereas since the healthy competition of electricity, they had paid as much as 14¾ per cent. There were different classes of light as in other things; and they now had the incandescent gas-light competing with the incandescent electric light. He, however, always believed in having the best of everything. Mr. Denny Lane had but a few weeks back entered into a discussion with him on the question; and that gentleman had clearly proved that the average charge for electricity in some of the principal cities and towns was not more than 4d. per unit, this being what he (Mr. Wright) paid for the current he used for lighting and power. A previous speaker had mentioned that an ounce of practice was sometimes worth a pound of theory; but he (Mr. Wright) thought that, when practice fully supported theory, a more satisfactory state of affairs existed. As affecting the practical side of the question, he might mention that the Army and Navy Stores were replacing some 8000 incandescent gas-lights by incandescent electric lamps, on the score of economy.* Mr. John West had on several occasions endeavoured to show that electricity was many times more expensive than gas. This, however, did not agree with his (Mr. Wright's) opinion; for having been called in on various occasions to closely investigate the question in several large mills in Lancashire and elsewhere, he had no hesitation in stating that the useful available light from incandescent electric lamps, with energy at 4d. per unit, in comparison with flat-flame burners with 16-candle gas costing 2s. 6d. per 1000 cubic feet, was some 25 per cent. cheaper. Had there been a blackboard in the hall, he would have demonstrated this. He concluded by saying that the gas suppliers had it in their own hands to make a good fight; but he for one did not believe it was to their advantage to supply a low quality of gas at a reduced price, and then to leave it to a company such as the Incandescent Gas-Light Company to absorb a large amount of the profits due to the light by the supply of mantles, &c., for enrichment (so to speak), which might with much more advantage to themselves be replaced by rich gas made from the oils and cannels at their disposal.

* With reference to this part of Mr. Wright's remarks, the Secretary of the Incandescent Gas-Light Company, Limited, has since stated that the Army and Navy Stores never at any time used 8000 incandescent gas-lights; that they have never reduced the number of these lights in use; and that their premises are not lighted by electricity, with the exception of the basement, where the electric light was installed after the Company had represented to the Secretary of the Stores that it would be more suitable in that position than the incandescent gas-lights. With regard to Mr. Wright's subsequent remark as to the comparative cost of gas and electric light, it has been pointed out that, with gas at 2s. 6d. per 1000 cubic feet and electric current at 6d. per unit, the Welsbach system produces a given light at from one-sixth to one-eighth the cost of electricity, while the ordinary flat-flame burner produces an equivalent light at about one-third to one-half the cost.—Ed. J. G. L.

Mr. W. W. Hutchinson (Barnsley) suggested that, if gas lighting were abolished, the question would arise, where they would get the enormous quantities of coke, tar, and liquor which formed such an important feature in the commerce of this country. It appeared to him that special works would have to be put up to supply the coke, tar, &c.; and in that case gas would be the bye-product, and would at once come into competition again with electricity.

Mr. Medhurst, in reply, said he was much obliged for the courteous hearing which had been given to his remarks. They must admit that for the time being they were on different sides. But, nevertheless, this need not prevent their working for the common good; and he was pleased to see that there had been an entire want of acrimonious feeling in the discussion. He had tried to keep anything of that sort out of his paper; and judging from the discussion which had followed, he almost thought that he had succeeded. Mr. Ellery asked him to explain the low cost of production at Taunton; and he drew attention to the fact that the Company had sold electricity at 6d. per unit, and had not been able to make it pay, even though their working expenses were not more than 3½d. per unit. He was not quite sure if Mr. Ellery meant to dispute the figures given in the paper. They were not his figures; they were printed weekly by the paper *Lightning*, and were compiled from the Board of Trade returns.

Mr. Ellery said he did not dispute the figures. He only wanted to know how it came about that the Company made a loss, if they produced electricity at 3½d. and sold it at 6d.

Mr. Medhurst said he was not aware that they did make a loss on their year's trading. He did not see how it was possible, seeing that they made electricity for 3½d. according to the Board of Trade returns. Every electric supply undertaking had to furnish to the Board of Trade a yearly record of their working expenses, and their revenue; and these analyses were simply based on the returns made to the Board of Trade. He thought there must be a mistake in saying there had been a loss at Taunton.

Mr. Ellery said it appeared by the balance-sheet.

Mr. Morton suggested that the question of capital did not come in, which might account for it.

Mr. Medhurst believed the works at Taunton still belonged to the Company when these returns were made; and the question of the redemption of capital in the case of a company did not come in. A company was not in the position of a corporation, having to return its capital in 20 or 25 years' time. They had to set aside a certain sum for depreciation or redemption; but that was entirely an optional matter in the case of a company. The difference between 3½d. a unit, which it cost them to produce, and the various prices they received, was profit, with the exception that they had to make allowance for depreciation, rent, and directors' fees. If there had been a great loss, he did not think the Corporation would have been as ready as they had been to buy up the concern, though the figures he gave in his table only represented works' costs.

Mr. Ellery remarked that the Corporation gave about half the amount of the Company's capital after they had been losing money for years.

Mr. Medhurst said he could not accept these facts at present. They had also been informed that morning that gas would become cheaper. No doubt it would become a great deal cheaper; but even if it did, that rather tended towards strengthening his argument. He believed the electric light in the future would decrease the consumption of gas. Some gentleman asked for data with regard to that statement. Well, at Birmingham the effect had already been felt. The increase in the consumption of gas had not taken place as it had done formerly.

Mr. Chester said last year the Birmingham Corporation had an increase of about 5 per cent.—an increase they had not had for a long time.

The President drew attention to the fact that Mr. Medhurst was replying to the discussion and must not now be cross-examined.

Mr. Medhurst said in 1894 there was a decrease in the gas supplied, compared with 1893. It was difficult for any man to say absolutely what the reasons were. But they knew the consumption of the electric light had increased very much in Birmingham; and he thought it was not unreasonable to suppose that the diminution in the consumption of gas between 1893 and 1894 might be attributable, in some measure, to that circumstance. Of course,

that was a matter of opinion. Mr. Ellery asked where town gas had been actually used for supplying electricity from central stations. It was being used; but he could not give any returns as to working expenses. The fact was he could not give any returns as to the effect, as the only town in the United Kingdom was Belfast, and the works had only been in operation for three months. Then it was suggested that gas-engines ought not to be used to produce electricity from central stations, but to produce it on the consumers' premises, or at several small central stations in the same town. That, he thought, was altogether erroneous. If there were five gas-engines in a central station, they might very easily be run by employing two men. But if there were five gas-engines in five different spots in a town, they could not possibly be run with less than five men. The cost in labour was very much less by placing the engines in a central station rather than by placing them in cellars or specially-built engine-houses. Again if, as Mr. Lane suggested, they were put, not in the consumers' premises, but in a series of central stations or decentralized stations for supplying the electric light, there was the same difficulty, and there was the additional difficulty of obtaining land in some six, seven, or eight places for the works, which was much more costly than providing one plot on which to erect one good-sized station. Altogether he thought the working expenses would be considerably greater if Mr. Denny Lane's plan were to be adopted. Coming back to Mr. Ellery's remarks, the reason why the electric lighting at Bath had not been entirely successful, was that the station there was one of the earliest erected in the country. It was put up by a Company who had something to prove. They did prove to the satisfaction of people resident in Bath that the electric light could be supplied steadily without making a loss, even in those early days; and the best proof of the satisfaction that the people of Bath felt with regard to it was that the Corporation had, on his (Mr. Medhurst's) advice, passed a resolution refusing their assent to the Company's application for a Provisional Order, and stating their intention to apply for a Provisional Order themselves. Whether they would buy up the Company's works, or start new works of their own, did not matter for the purposes of his argument. Mr. West remarked truly that no amount of prophesying would extinguish the gas industry. He had not attempted to create the impression that electricity was going to extinguish the gas industry; but he did believe that the demand for electricity would decrease the demand for gas in towns possessing steam-driven electricity supply works. But still he thought that, even when this happened, the demand for gas would be very considerable. They had in the gas industry what they had not in electricity—a very valuable acquisition in the bye-products. Probably there were cases in which a gas supply undertaking either in the hands of a corporation or a company could almost afford to give away the gas because of the large revenues they derived from their bye-products. But if anybody used the electric light where they formerly used gas; it did not require an intricate argument to show that, to that extent, the demand for gas was reduced. Those gentlemen who saw in his paper an attempt to show how the demand for the electric light might take place without decreasing the supply of gas, had really discovered his meaning. Mr. West wished to know why private companies had not taken up electric lighting; and he said the fact of corporations taking it up was to his mind a proof that capitalists and financiers were afraid of placing their money in such undertakings. It was all very well to say that companies preferred throwing off the burden; but suppose corporations would not accept the burden! They had accepted it; but not before private capital had shown what it could do in the way of making the electric light pay. The Newcastle Electric Light Company had paid dividends from the very first year. The first year, they paid 2½ per cent.; the second, 4 per cent; the third, 4½ per cent.; the fourth, 5 per cent.; and last year they paid a dividend of 6 per cent. Their business had increased; and the cost of production had decreased.

Mr. West asked if that was purely and simply out of the products of electricity, or for apparatus supplied.

Mr. Medhurst said it was purely out of the profits of supplying electricity. The Company did not supply fittings at all at Newcastle. Take again the London Companies. To the best of his recollection, there was only one London Company that was not paying a dividend—that was the London Electricity Supply Corporation, which was a scheme entirely by itself. Instead of using engines of 100, 200, or 300 horse power, they used engines of 1000-horse power, which did not prove successful. All the normal London Companies did pay dividends varying from 3 to 6½ per cent. Electricity supply had proved to be a paying concern before there was this great outburst of municipal fervour in the erection of electrical works. Mr. West said that gas could be obtained more directly from coal than could electricity. With that view, he (Mr. Medhurst) did not agree. They were also told, and quite rightly, that the gas companies would benefit as much as the electric light if they could work at full load. Of course, that was so. The point was that even now the load-factor of the gas companies was much higher in the great majority of cases than at the electric lighting works; and they hoped in time to very much reduce that. Mr. West also said that the difference between the cost of producing gas and electricity was getting larger instead of smaller. If he meant that the cost of producing gas was decreasing more rapidly, and the cost of producing electric light growing only slowly smaller, he could not absolutely deny the accuracy of his remark, because he did not know in what ratio the cost of producing gas was decreasing at the present time, but he did know that in every instance the cost of producing electricity was decreasing. It was said that there was nothing new in using gas-engines. He had never claimed any novelty for the idea. He said quite openly that there was one instance in which gas-engines were used not only for producing light, but in a central station—viz., at Belfast; and they also heard that it was being done on the Continent. He had not attempted in his paper to bring forward anything new; but he thought it possible to do something profitable without doing something new. If they would inquire a little farther into the matter, they would find that, although not new, it was certainly profitable to use gas-engines actuated by town gas to produce electricity, rather than steam-engines, in cases where the public authority already possessed the gas-works. Then they were told the loss in distribution was very much greater in the case of electric lighting than in the case of gas lighting. That was a mistake. The loss in distribution—if by "loss" was meant the loss in the mains—was certainly not on an average more than 5 per cent., or rather less. It was only the amount of copper that was put into the mains which governed the actual loss. It might be possible to sink enough capital in the mains to make the loss practically negligible; but it was not found convenient to do so. The increase in capital was too great; and so, in the majority of cases, the loss on distribution was about 5 per cent.—not more, and probably less. As to the dividends, he had partially answered that aspect of the question already. He had told them of the Newcastle Company; and he might add that there was a second Electric Lighting Company at Newcastle which had regularly paid about ½ per cent. less than the one mentioned. Nearly all the London Companies paid very good dividends, and many Provincial companies as well. At Portsmouth, the first year's working showed a profit, which, had the undertaking been in the hands of a company, would have paid rather over 5 per cent. It paid the whole of the interest on the capital sunk, and almost the whole of the sinking-fund for the first year. The Corporation had only to make up ½ per cent. out of the rates for the first year's working. Most gas undertakings in the country did not pay dividends of five, six, or seven, or even of 1 per cent. during the first years of their existence. Mr. Craven remarked that the electric supply works in his town were not charged any rent for the ground on which they stood, and, even under those conditions, they were unable to pay their way. He (Mr. Medhurst) was quite ready to take Mr. Craven's word for it; but he expected to see very great improvement in the near future if that were the case. The question had been raised as to the practicability of cooking and heating by electricity; and one or two gentlemen actually said that, when they saw it, they would believe it. That was very hard on electricity; because they might see it if only they liked. They could see it in London or even in Edinburgh; but if they would not take the trouble to go and look at it, it was a little hard to say they would not believe it unless they saw it. It was perfectly visible, and might be seen every day. It was, too, very economical, as he could show by figures. He knew the cost of cooking by gas; and he knew the cost of cooking by electricity. An electric hot-closet, large enough for a good-sized family,

only cost 2d. an hour. Taking the current at 5d. per unit, an electric grill which required ten minutes to heat up and another ten minutes to cook two chops—or 20 minutes in all—cost less than 1d. When the grill had once been heated, it could be kept in constant use cooking every ten minutes at a cost of only ½d. With a cooking current at 4d., the above operation would cost 20 per cent. less. Mr. Denny Lane said he found the electric light did not illuminate pictures well in the Belfast Exhibition. With all due deference to him, that was no objection, because it was evident the lights were not properly applied. The right way to light a picture was at the bottom with a shade to reflect the light upwards, and not from the top. At Berlin, as Mr. Lane had said, the consumption of electricity for some cause had decreased the consumption of gas. Then Mr. Lane remarked that, for an outlay of 1d., 540-candle power could be had for an hour out of gas; and he then compared that with incandescent electric lighting, which he said was about ten times as great. That might be so; but Mr. Lane had taken the most economical form of gas-burner, and the most uneconomical form of electric illumination. He should have compared the gas illumination —not with the incandescent light, but with the arc light; and then he would have found that, for 1d. per hour, he could get 800-candle power out of the arc light, as compared with 540 candles out of the gas light. He (Mr. Medhurst) was pleased to have Mr. Lane's testimony to the fact that gas-engines were really capable of running steadily; though he did not agree with him in his objection to using alternating currents with high tension, and preferring low-tension currents with accumulators. He was sorry to say that electric accumulators were far from economical. They cost a great deal in the first instance; and the depreciation was very heavy. There was a loss in every conversion of energy. The more one converted energy, the more would the ultimate cost become. He was glad to hear that a Provisional Order was to be applied for in Cork; and it was quite evident they might have one instance in Great Britain in which the same Company would be supplying both electric light and gas. Mr. Miles's remarks were, on the whole, encouraging; at any rate, he showed that even at Bolton, where the electric light had only been running for four months, they had more than paid their expenses. They had earned a dividend, and had almost paid the sinking-fund. That did not compare badly, he thought, with the first four months of any gas undertaking they might select. He concluded by again thanking the members for the kind reception they had given his paper.

Water-Gas Plant in Sweden.—The first installation of water-gas plant in Sweden has just been completed at the factory of M. de Laval, for incandescent electric lamps. The capacity is about 4250 cubic feet per hour.

The Direct Determination of the Weight and Volume of Gases.—A recent number of the *Chemiker Zeitung* contains a notice of an apparatus patented by Messrs. Krupp and Co. for the direct determination of the weight and volume of gases. The state of tension of a volume of gas enclosed in a vessel is transmitted to index mechanism, in the manner of an aneroid barometer, and to a scale which shows any change of volume or weight. The scale is graduated so that expansion of volume can be read off in 0·01 of the unit of volume at 0° C. and 760 mm. pressure.

The Oil-Gas Experiments at Bradford.—Referring to the paragraph on this subject in the last number of the JOURNAL (p. 100), the Chairman of the Gas Committee of the Bradford Corporation (Mr. W. C. Dixon) writes that it is incorrect, "as there was no misunderstanding between Dr. Dvorkovitz and Mr. Lewis T. Wright." He says "the Doctor was solely responsible for what took place in regard to stopping the test." We learn from a local paper that, according to the minutes of the Gas Committee adopted at last Tuesday's meeting of the Town Council, arrangements have been made for an entirely fresh test of the Dvorkovitz process to be carried out.

The Miners' Federation and the Eight Hour Bill.—The General Secretary of the Miners' Federation of Great Britain (Mr. T. Ashton) has issued a manifesto, in view of the General Election, reminding the members of the Federation of their pledge not to vote for any candidate who objects to support the Mines (Eight Hours) Bill. He reviews the progress of the Bill since its introduction in 1892, and expresses the opinion that it has been encouraging. He asks that the operations of the measure shall extend as far as those of the Mines Regulation Act. No district, he thinks, should be exempt; and there should be no local option. He is desirous that all colliers shall work the same length of time—viz., eight hours from bank to bank; and he thinks that if the members of the Federation enter the present contest with an earnest determination to win, they will succeed.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 149.)

THE main characteristics of the past week on the Stock Exchange were very like those of the preceding week. Business in general was very far from being at high pressure; and the attendance was not as full as it might have been, owing in some degree to many counter-attractions of field and river. But nothing could stop the upward march of prices; and, while all departments were good, the chief places were again held by the two extremes of the choicest gilt-edged and the speculative mining adventures. Consols once more broke the record by changing hands on Wednesday and Thursday at 108; but unless some unexpected bolt from the blue should fall, even that figure will probably be beaten ere long. A very slight reaction was perceptible towards the close of the week; but nothing is likely to come of it. The settlement, big as it was, presented no difficulties; and any amount of money could have been had without producing any impression on the market. Business in the Gas Market was decidedly more quiet—stock generally being scarce; and, with the important exception of the leading issue, firmness was the feature. The greatest advances in value were made by the debenture stocks—a move which is likely to continue so long as the present condition of the Money Market lasts. A noteworthy incident is the fact that on Friday the Gaslight and Coke 6 per cent. debenture stock changed hands at over cent. per cent. premium; thus beating a 3 per cent. for money price. South Metropolitans did this some six months ago; and now Commercial is hurrying up after them. Gaslight "A" was rather inactive and flat; and on Friday was done as low as 283. The secured issues, however, were brisk, and made other nice advances beyond that already noted. Very little was transacted in South Metropolitans; but the "B" pushed up another couple of points, and the debenture was done at higher figures *ex div.* than those quoted with the dividend in them. Commercials as usual were quiet, there being no stock to deal in; but some debenture changed hands at a fair advance. The few dealings marked in Suburbans and Provincials showed rising values; but the only actual change was a rise in Crystal Palace. All the Continentals commanded better prices; but, excepting a fractional variation in Imperial, their quotations were left standing. Of the rest, Monte Video Gas advanced ½. There was considerably more activity in Water, with a free rise in prices, especially of debenture stocks.

The daily operations were: The Gas Market was almost inanimate at the opening; and nothing moved. In Water, Lambeth and West Middlesex rose 2 each; and Lambeth debenture, 3. Business in Gas was better on Tuesday. South Metropolitan "B" rose 2; but Gaslight "A" fell 2. In Water, Lambeth and West Middlesex gained 1 each; and Lambeth 7½ per cent., 2. Wednesday's transactions were only moderate. Commercial debenture advanced 1½. Business became quieter again on Thursday; but prices were good. Gaslight "C," "D," and "E," improved 3; and Monte Video, ½. New River debenture rose 4½; and East London debenture and Lambeth debenture, 3 each. Friday was a little more active. Gaslight "A" fell 1; but ditto 6 per cent. debenture rose 7½. Business on Saturday was much as usual; but important advances in quotations occurred. Crystal Palace rose 3; Gaslight 4 per cent. debenture, 1; and South Metropolitan debenture, 3½.

ELECTRIC LIGHTING MEMORANDA.

A New Electric Lighting Company—The Financial Condition of the Electrical Trades—Electric Traction at the Tramways Institute—Electric Lighting at the Railway Congress.

AT last there is news of another electric lighting company being brought before the public; and the event is of sufficient rarity to call for notice on this account. When things are very scarce —like great auk's eggs—they have a certain notoriety for this reason alone, irrespective of their intrinsic value or interest. So it is now-a-days with new electric lighting companies. There was a time when these ventures were hatched out at the rate of two or three a week. But those days are gone, never to return. "There are no eggs in last year's nests," says the Spanish proverb. Therefore, when one hears of an announcement that the British public are again asked to put money into an electric lighting company, one wonders why the promoters are not content to do as electric lighting schemers generally have done for several years past—get their money out of the ratepayers. It appears, however, that the company in question—which by the title professes to be formed for the purpose of working a certain patent device stated to be admirably adapted for the lighting of towns and villages—aims at ultimately getting money out of a number of such places. We cannot honestly say we wish the company may get it. The whole scheme has been very soundly "slated" by the *Electrical Review;* and there is little prospect of any more being heard of it. But it is impossible not to see from this example how small a thing electric lighting speculation has become.

Talking about electric lighting speculation raises thoughts on the subject of the financial condition of the electrical trades generally, which are all in a bad way just now, at home and abroad. It is, indeed, reported of the electrical industries of America that, with few exceptions, they are in a desperate condition. The electric lighting and traction "booms" of the last decade are spent; and very few of the rotten companies formed with the object of introducing different systems into American cities are doing anything more than dragging out a miserable bankrupt existence. We on this side have often been requested to admire the marvellous quickness of the development of the electric lighting industry of America; but nothing was said about the ramshackle way in which the work was done. This is now producing the inevitable result; and as the bankrupt lighting companies cannot afford to renew their plant, electric lighting is going out of use again in many a shaky "city" where it flaunted for a season.

Electric traction was discussed in an academic style at the recent meeting of the Tramway Institute, with the net result of showing that no substantial progress can be signalized in the application of electricity to haulage of tramcars. Mr. Neale, of Birmingham, representing a company possessed of steam, horse, and electric cars, "and the finest cable-line yet laid down" declared his preference for the last-named system. The Company's accumulator cars have proved a very great loss; but Mr. Neale thought the system has a future before it—a very doubtful admission—provided that the weight of the batteries can be substantially reduced. With regard to the trolley-wire system (the only practical alternative to the accumulator car), experience shows that British municipalities have an invincible repugnance to the permanent disfigurement of their streets in this way, merely in order that tramcars may be driven thereby at a problematical saving upon the cost of horse haulage. Their attitude in this regard is a worthy one; and so long as our local authorities persist in it, there will be the less reason for owners of gas and water pipes in the subsoil to think further about electrolytic troubles.

If electric traction did not come off very well at the meeting of the Tramway Institute, electric lighting for trains fared even worse at the International Railway Congress recently held in London. One of the reports presented to this Congress was on the important subject of the lighting of trains; and it was the general opinion of the meeting that at present, for efficiency and economy, oil gas holds the field. The representatives of several railway companies described experiments with electric lighting. On the carriages of the Wagons-Lits Company accumulators have been tried; and also a dynamo in the guards' van, driven off the axle of the car. But the system has been given up on the score of expense. This seems a remarkable conclusion, inasmuch as the axle-driven dynamo might be supposed to get its motive power for nothing. After discussing incandescent gas-lamps and the prospects of acetylene—which the railway engineers seemed to be a little afraid of—the conclusion at last agreed upon was that the use of compressed gas of high illuminating power was the most satisfactory; but that in certain cases oil-lamps, and even candles, were found sufficient. Candles were put into the resolution by special desire of a Spanish railway representative; and it must be confessed that mention of them spoils the look of the conclusion. Curiously enough, there does not appear to have been a single speaker in the Congress to say a good word for the electric light, even when used in connection with a "penny-in-the-slot" apparatus. This was a very significant circumstance, seeing how much effort and money has been devoted to perfecting the electric lighting of railway trains. It has been understood that the system has worked satisfactorily upon a few English lines; but it certainly is not being extended.

A New Combination of Argon.—The *Comptes Rendus* contains an account, by M. Berthelot, of a new combination of argon. Following up his previous researches, the author has discovered, says *Nature*, that free nitrogen, prepared pure from nitrites, can be caused to enter into combination with the elements of carbon disulphide when subjected to the spark or silent discharge after saturation with disulphide vapour. The resulting compound contains some mercury sulphocyanide, and does not regenerate nitrogen under the action of heat or of concentrated sulphuric acid. When argon is employed in place of nitrogen, a similar reaction appears to take place. Under the continued action of the silent discharge, a sample of 6·55 cubic centimetres of argon, as pure as it could possibly be obtained, saturated with carbon disulphide vapour at 20° C., and confined in the reaction-tube by mercury, gave a continuous absorption which appeared to go on indefinitely. The product contained mercury, but gave no reaction for sulphocyanide. When heated, a quantity of gas was recovered equal to about one-half the volume absorbed; and this recovered gas was proved to be argon by condensation with benzene, and production of the remarkable fluorescence previously described. Though this work has been done on such small quantities of material that an exhaustive examination of the product was not possible, M. Berthelot believes that he has satisfactorily demonstrated the significant property of argon—that it can enter into combination, and be regenerated from its compound or compounds with its initial properties intact.

DIPS INTO THE PAST.—PROJECTS THAT FAILED.

The history of gas lighting, as of every other product of aggregated human activity and ingenuity, is a record of advances and reverses. The endeavours of inventors to improve the methods and widen the scope of the art, and the schemes of adventurers to extend its commercial application, have alike been marked by dire failures as well as by striking successes. There have not been wanting Cagliostros to scheme and dupe, as well as Arkwrights to plod and invent; and the present position of the industry is the outcome of the labours of the one in despite of, but not uninfluenced by, the designs of the other—the net result of the ebb and flow caused by their several activities. In discoursing of some of the more notable incidents that have chequered the past, we are not relating merely an idle tale. If it be helpful to the cause of progress in social and political affairs occasionally to review past events in the light of the present, or, conversely, to examine the problems of to-day by the experience of former times, the exercise must be productive of good in the conduct of a great and progressive industry.

At the outset, therefore, we would declare that our object is not merely the delectation of our readers. Our purpose will fail of its intended effect if the story we have to tell be not fruitful in suggestion, which, rightly applied, will also tend to their edification. For while the record of events that happened in bygone times must always be of interest to the earnest student, whether of mankind or of technics, it is only as the lessons they teach are helpful (either as guides or as warnings) to the cause of further progress, that they are of manifest importance to us. A great historian has said: "No past event has any intrinsic importance. The knowledge of it is valuable only as it leads us to form just calculations with respect to the future." It is because the knowledge of past failures may be of service as aids to future successes, or at least as finger-posts showing what to avoid in order to escape disaster—thus preventing the waste of much fruitless endeavour—that we have undertaken to discourse on projects that failed.

At the dawn of gas lighting, the two foremost pioneers of the new art were men of widely opposed characteristics and diverse genius. The annals of company-promotion might be searched in vain for a more daring enthusiast, more ambitious schemer, and, in many respects, more visionary dreamer, than Winsor. A harder-headed, more practical, or more ingenious worker than Murdoch has not often been seen. One trait only they had in common—firm faith in the ultimate commercial success and universal adoption of the new illuminant. In the case of Murdoch, it rested upon the surest foundation—sound practical experience, which he had obtained by patient experiment and plodding industry, and which he was content to increase by gradually, but surely, enlarging the sphere of its application. On the other hand, Winsor, on learning how to produce the novel result of "light from smoke," immediately forms, with the rash presumption born of ignorance, the most daring and unbounded scheme for its commercial exploitation. Destitute of the merest smattering of chemical knowledge, he has the temerity to ascribe the most wonderful qualities to gas and to the results of its combustion; while the process of its manufacture is made to appear a veritable mine of chemical products. Without having so much as lighted a good-sized building, he has the boldness to make forecasts and calculations referring to the utilization of gas on an enormous scale—calculations promising fabulous returns to every modest investor in the scheme. Indeed, he seems to have been so infatuated by the marvellous prospects which his active imagination saw through the smoke issuing from his "*patent light oven*," as actually to believe the extravagant fables he put forth. And, at this day, one knows not whether to be more amazed at the sublime rashness of the unlearned dreamer, who could form such extravagant conceptions, or the scepticism of some of the wisest contemporary men of science, who, like Wollaston and Sir Humphry Davy, could not admit the possibility of gas being practically applied as an illuminant on any large scale at all. To be sure, in thus complacently ignoring or overleaping the long interval of labour and invention that was inevitable before his crude ideas could be moulded into any sufficient practical shape, Winsor but resembled present-day apostles of the Mann-Tillett type, who preach a millennium of maximum wages for minimum work, without counting the steps by which it is to be attained.

It might have been thought that Winsor's harebrained project for producing results which are demonstrably absurd and irrational, was a sufficiently obvious monument of human folly to deter others from following in his footsteps. In point of fact, it was only the prelude to a long series of magniloquently announced schemes that have appeared, at irregular intervals, from his day down to the present. Among the most remarkable features in the annals of gas lighting are these projects, cropping up now and again, for revolutionizing the ordinary conditions of gas making—projects which the application of a little elementary science, or of practical experiment directed by a modicum of common sense, would have shown to be preposterous and futile. To take only one or two instances. There was the Photogenic Gas Company, launched in 1862, to carry out certain patented methods of naphthalizing common air, and distributing it instead of ordinary lighting gas. Practically the

same process had been patented years before; and, when it was tried in practice, it had proved an utter failure. This "photogenic light" was said to be "so pure, bright, and wholesome that the public ought to be willing to pay much more for it than for ordinary gas light, whereas it would be supplied at one-fourth the cost." It is needless to say that, except on paper, the general pubic never saw the "photogenic light." Yet so boldly were its pretensions advanced, that it was said no scheme had more alarmed the shareholders of gas companies. In the event, it was the shareholders in the new venture—which had been, at first, projected with a capital of £200,000, one-fourth of which was to be paid for the patents—who had real cause for alarm; the Company, at last, being wound up in 1869. There was also a Tan Gas and Charcoal Company launched, about the same time, "with every prospect of success." An assured profit of £11,700 was to be realized the first year, on a capital of £20,000. Instead, however, of paying a dividend of upwards of 50 per cent. on the capital, the whole of it was lost.

Schemes such as those we have mentioned could, however, only take in the unwary. More dangerous were those in which some really novel or truly scientific process was involved, which, yielding satisfactory results when carried out on an experimental scale or in a tentative way, required some experience under actual working conditions to reveal their weaknesses or shortcomings. Of this class, one of the most notable was that known as White's Hydrocarbon Gas Process, which created a great stir in the gas world during the fifties. Essentially, the process consisted in the introduction of water gas, along with excess of steam, into a heated retort in which coal or other carbonaceous material was being distilled. It was claimed that in this way the non-illuminating water gas was enriched with illuminating hydrocarbons through part of its hydrogen or carbonic oxide (or of both) entering into chemical combination with the carbon of the coal or other material being carbonized. At the same time, the hydrocarbons given off from the coal were protected, to some extent, from contact with the heated walls of the retort, and thereby from decomposition, through their dilution with the introduced gases and steam. Thus the invention was a praiseworthy attempt to embody a well-known property of gases, which has had an attraction for the foremost gas engineers from the time of Lowe down to the present day—the property, namely, which non-illuminating or poor illuminating gases of low density possess of taking up, and retaining in suspension or solution, illuminating hydrocarbons of higher density. It also recognized and endeavoured to reduce the hurtful effect on the luminiferous hydrocarbons of contact with red-hot surfaces in the retort.

White's process was duly investigated and reported upon by perhaps the ablest chemist (Frankland) and the foremost gas engineer (Clegg) of the day. Both these eminent authorities showed that a higher value in illuminating gas was obtained from a ton of coals by this method than by the ordinary mode of manufacture. Frankland regarded the principle established by the experiments as one of great importance. He believed that the advantage of the process consisted in "the washing out of the luminiferous hydrocarbons, generated in the coal retort, by the stream of water gas, which latter shortened the period of contact of the former with the heated sides and contents of the retort, and to that extent prevented their destruction." He clearly recognized, however, a principal weakness of the process, wherein, in fact, it chiefly failed of its promises—namely, that the action of the steam and water gas within the coal retort was not confined to the residual carbon therein; but that the hydrocarbons being evolved from the coal were attacked by them. Thus, water gas, containing a high percentage of hydrogen, was being produced at the expense of destroying more valuable compounds. By analysis, he found that the gas produced by White's process contained less marsh gas and more hydrogen and carbonic oxide than that produced by the ordinary method. At the time these experiments were carried out, the opinion was general that hydrogen was the most serviceable diluent for the rich hydrocarbons in coal gas. It was this mistaken notion as to the value of hydrogen which led the younger Clegg to form a high opinion of White's gas, while (unlike his father) clearly recognizing and making known his misgivings as to the new process of manufacture being made a practical success. Thus he wrote: "A perfect illuminating gas is that which consists of light-giving hydrocarbons with pure hydrogen as a diluent. The hydrocarbon process approaches the nearest to this *in theory*." In our time, we have learned, through the researches of Dr. Percy Frankland and Mr. Lewis T. Wright, that the most valuable constituent of coal gas, apart from its condensable hydrocarbons, is marsh gas.

So much confidence was established in White's process, that installations on a fairly extensive scale were carried out in several places; but when it came to be tried in large gas-works by ordinary workmen, and subject to every-day conditions, many drawbacks to its advantages and hindrances to its success were revealed. Chief among these were the irregular yield of water gas, and consequent impossibility to maintain a product of regular quality—the high percentage of carbonic acid contained in the gas necessitating the employment of special means of purification, unless a great sacrifice of illuminating power were made; and, last but not least, increased wear and tear of the retorts, which had to be of iron, as clay ones were too porous for the water gas. The iron was rapidly oxidized by the action of the steam upon it at a bright red heat. The retorts speedily cracked by exposure to sudden alternations of temperature; and the steam, oxidizing the iron, tended continually to widen the fissures. In the end, after two or three years' experience of the practical application of the process, the Hydrocarbon Gas Company collapsed, as so many similar ventures have done before and since. It is sad to relate that its ingenious promoter, who deserved a better fate, died some few years later, if not actually destitute, in very straitened circumstances.

Though White's process was thus, in practice, a lamentable failure, it may not be said to have existed in vain. Who can tell the hidden germs of instruction, the springs of inspiration, or the incitements to further endeavour that lie in so-called failures? Or who knows the steps by which any notable invention has been evolved, or any practical perfection in the arts attained? It is a far cry from Stephen White to William Young. Yet do we see in the process, faulty as it undoubtedly was, devised by the former, the first rude attempts to apply a principle in gas making of which it has been left to the latter to discover the true bearings, and carry to practical perfection. It is a most interesting fact that Frankland deduced, from his experiments on the reactions going on in White's retort, that the best source of water gas would be water and coal tar alone; and it has been left for another generation of gas makers to behold the theoretical deduction converted into accomplished fact in the latest product of Young's genius. Thus one delves, another lays the foundation, and others build thereon, until the master builder brings forth the head stone with rejoicings, and crowns the edifice.

(*To be continued.*)

GROVES AND THORP'S "CHEMICAL TECHNOLOGY."

Second Notice.

In our first notice of the second volume of Groves and Thorp's "Chemical Technology," which bears the title "Lighting," we confined ourselves to the editorial portions of this instructive work; and we now propose to deal with the productions of the sectional authors. The first place is given to Mr. W. Y. Dent's chapter on Fats and Oils, which extends to 45 pages of the book, and like all the rest of the matter is illustrated, although not so freely as some of the other articles. Mr. Dent tells his readers what fats, oils, and waxes are, how they are obtained, and the treatment which they receive to prepare them for illuminating purposes. Mr. John M'Arthur follows with a section devoted to Stearine—an industry originated by the chemical researches of Chevreul, and consequently severely scientific in all its processes and developments. Neither of these sections calls for detailed comment here. The third section, on Candle Manufacture, brings the student nearer to the actual production of light. It is an important contribution, bearing the well-known names L. and F. A. Field. These authorities on the subject commence at the beginning, telling the reader that "the invention of candles may be regarded as contemporaneous with the need of artificial, portable means of lighting." They define a candle as "a porous, combustible core, surrounded or merely saturated with a fusible, inflammable solid. Accepting this definition, the man who first selected a more than ordinarily resinous brand to serve as a torch to lighten up the darkness, was the primeval chandler." It would be easy to pick holes in this picturesque claim for the extreme antiquity of the chandler. Inasmuch as the meaning of the word is a maker of candles, it must follow that the candle, properly so called, is a manufactured article, and therefore as different from the brand snatched from the burning as a sword is from a torn-off branch. It might be more plausibly argued that the step from the burning resinous stick to the rudest candle, prepared with a definite purpose, must have marked an epoch in the history of civilization; for social man thereby equipped himself with the most potent of all agencies for dispelling, not only natural darkness, but also the gloom and isolation of barbarism.

The authors attempt to give the history of the development of the candle in chronological order; starting with the torch and the link, which found their ultimate possibility of utility and ornament in the flambeau. The word candle is derived by the authors from the Latin *candela*, from *candeo*, I shine—a growth from the Sanscrit root *kan*, which had endless possibilities hidden in it. It is stated, somewhat arbitrarily, that the employment of candles as a means of lighting did not become general before the commencement of the seventeenth century; but the familiar legend which attributes to King Alfred the use of candles as time-measurers, surely argues for a much more ancient familiarity with the use of the article for its more direct purpose. It is a curious illustration of the slowness of real improvement that plaited wicks were only introduced so recently as 1820. Meanwhile, we are told that over fifty patents for snuffing candles mechanically were taken out, some of them marvels of ingenuity. The authors devote particular attention to the subject of the wick, which they justly term "the soul of the candle; for on the proportion, preparation, and condition of this slender core, the candle depends for the proper discharge of its functions." Photometrists will not dispute the force of this remark. The plaiting of the wick was

the fundamental discovery which rendered it possible to burn candles regularly; but a great deal more than plaiting goes to the preparation of a really good wick. The raw material must be selected with extreme care; and after the wick is made, it requires to be "pickled" with a view to the material of which the candle is to be composed.

It is a question to which we have never succeeded in obtaining a conclusive answer, why the French equivalent of our word candle is not *chandelle*, as would be naturally supposed, but *bougie*. Now "bougie," in the Messrs. Field's vocabulary, means the flexible form of drawn candle made up in a coil, somewhat like a ball of string, and still sparingly employed by users of sealing-wax, and otherwise when the light is only required for a short time. This article has no relation to what is known in France by the same name, although the word is a French one. The discrepancy illustrates how pitfalls lurk in the way of the free-and-easy translator of one language into another who proceeds upon the principle of representing a foreign word by its apparently natural equivalent in his own language. Strangely enough, the manufacture and use of candles as standards of light is not mentioned by Messrs. Field; and this omission cannot be regarded otherwise than as a blot upon their work. There is not much "trade" in this description of candle; but in view of the attempts that have been made by the London Gas Referees to import scientific accuracy into their manufacture, some notice of this branch of the manufacture of candles was to have been expected in an authoritative text-book of the industry.

After candles, petroleum. Mr. Boverton Redwood's account of the Petroleum Industry is one of the most valuable sections of this work; being only excelled in interest, perhaps, by the same author's careful monograph on Lamps. Mr. Redwood goes back to Herodotus for his earliest descriptive reference to petroleum; and he only quits the subject with the statement that what has already become an immense industry which supplies the whole world with a necessary of life, is "still in its adolescence." He thinks that the present and immediate future might justly be recognized in history as "the age of petroleum." This view is at any rate a welcome change from the other classifications of the same period, with which the world is more familiar in popular writings.

The earliest recorded uses of petroleum were medicinal; and the first known natural gas springs were employed for sacerdotal purposes. The modern petroleum industry dates, for all practical purposes, to the drilling of the celebrated Drake well in Pennsylvania, in 1859. "From this date, coal-oil refiners began to substitute crude petroleum for bituminous coal; and the distillation of the latter material for oil soon ceased to be profitable." The chief event of recent years in the history of the petroleum industry of the United States has been the remarkable development of the Ohio oil-fields. This oil, Mr. Redwood remarks, "contains sulphur compounds which are extremely difficult of removal; and it is therefore not a satisfactory source of kerosene, but it appears to be well adapted for use as liquid fuel, and is very largely employed for that purpose." It is also answerable in a great measure for the recent expansion of the carburetted water gas industry. American natural gas is very briefly mentioned by Mr. Redwood. He records the fact of the first gas well having been drilled at Fredonia, in the State of New York, in 1821; and states that for many years past systematic drilling for gas has taken place, and immense quantities of it employed as fuel. "The natural gas companies have, however, found it impossible to obtain adequate supplies; and many manufacturers have had to revert to the use of other fuel." What has been the benefit to the United States of this wondrous gift of Nature?

The locations of petroleum are given by Mr. Redwood, who also discusses its origin, physical characteristics, and chemistry. He remarks that petroleum is usually considered to have been formed by the slow decomposition of vegetable or animal matter, either in the rocks in which it is found, or in underlying strata. He notices the Berthelot and Mendeléeff theories of its formation; and cites Professor Peckham's arguments in support of the general view of the matter. The information here given respecting the characters and components of different petroleums, is very complete; and the process of winning the oil is fully described and abundantly illustrated. Boring for oil was a modification of sinking for brine; but the vast amount of ingenuity that has been applied to the boring and subsequent treatment of oil-wells, makes very interesting reading, as soberly and quietly recounted by the author. How exhaustively Mr. Redwood discourses of the qualities and uses of petroleum and its derivatives, may be appreciated from the circumstance that, in treating of paraffin and its applications, he does not omit to mention the Joly photometer blocks, which he says he has himself used with very good results.

The utilization of mineral oil for gas making does not appear to have come within Mr. Redwood's province. Yet at the close of a chapter upon the "cracking" of heavy oils into liquid hydrocarbons of lower specific gravity, he digresses into an account of the Dvorkovitz process. It is difficult to trace the logic of this incursion into a neighbouring technic; because there is no more "cracking" in the Dvorkovitz process than there is in other methods of producing illuminating gas from oil. As to "cracking," the reader interested in the subject may learn all about it from Mr. Redwood, who describes the process as consisting essentially in heating oil vapours above their boiling-point under pressure. In 1889, Dewar and Redwood patented a process and apparatus, described here, to enable intermediate and heavy oils to be readily converted, to a considerable extent, into lighter oils suitable for use in ordinary mineral oil lamps; "and even mineral spirit of low boiling-point, capable of being employed for the carburetting of coal gas, may be produced." We believe the late Mr. Frank W. Clark did something in this line; but Mr. Redwood does not mention his name. It may be remarked here that the term "cracking," as ordinarily used by gas engineers and chemists to signify the changes wrought in oil vapour by exposure to radiant heat or in passing through a "fixing" chamber or retort, does not refer to the combination of high pressure with this external heating.

Mr. Redwood's work on mineral oil ends with a full and particular description of the shale-oil industry, in which gas engineers are specially interested, as all the manufacturing processes are capable of being described as reversals of their own carbonizing devices. Where the coal gas manufacturer desires gas, the shale distiller seeks a fluid; and one of the most valuable of the residuals of both operations is the same commodity, sulphate of ammonia. Mr. Redwood, comparing the shale oil with the petroleum industry, observes that "the object of the shale-oil refiner is, like that of the petroleum refiner, to obtain by the classification of the hydrocarbons present, the largest yield of the products for which he has the best sale." Singularly enough, the aim of the coal gas manufacturer is identical with this! In taking leave of his subject, the author observes that "vast as is the consumption of mineral oil in lamps, and of paraffin in the form of candles, the manufacture of products suitable for use as lubricants also constitutes a business of immense industrial importance; whilst the growing employment of petroleum as liquid fuel and as a source of gas for illuminating purposes, opens up a field of incalculable magnitude." All this is quite true, as also is the author's opinion that the petroleum industry has not yet attained its full growth. In another article we shall deal with the section on Lamps.

NOTES.

The Strength of Tie-Bars with Screwed Ends.

A question has been raised by Mr. J. H. Edwards, in a letter to the *Engineering Record*, which it would be of advantage to designers of structural ironwork to have answered in one sense or the other. It refers to the strength of tie-rods formed with plain screwed or with thickened ends. According to the 1886 edition of Trautwine's "Pocket-Book," there is no difference in the ultimate resistance of a long tie-rod to a slowly applied strain, whether its screwed ends are upset, or swelled, or not. Mr. Edwards states that he has communicated with Mr. J. C. Trautwine, junr., and asked him whether this is the interpretation that should be put upon the remark in the "Pocket-Book." In reply, Mr. Trautwine repeated the assertion, originally due to his father, that a *long* rod may be expected to break about mid-length under the same slowly-applied pull, whether the thread at the end is cut into the original diameter of the bar (thus reducing the diameter) or whether the screwed ends are first upset, so that the diameter inside the thread is not less than that of the original bar. Mr. Trautwine states that he has not learned that this remark is erroneous; and he has always explained to himself the apparent paradox by the theory that under a slowly-applied load a long bar, before breaking, will stretch sufficiently to reduce its diameter in the middle of its length below the thickness left by the cutting of the thread in the original bar. Additional information is desired on the subject from engineers who have made tests of such rods, and observed them under actual use. The circumstance of upset ends being a universal requirement in respect of tie-bars, although lending general support to the idea of their desirability, is not absolute proof of necessity.

The Visibility of Lights at a Distance.

It is on record that in 1890 the German Marine Observatory tested about 3000 running lights as used on board ship, and found two-thirds of them defective. Further tests of the visibility at a distance of lights of known candle power were made last year by a German Government Committee; and, curiously enough, the first public intimation of their results has appeared in a leaflet just issued to seamen by the United States Weather Bureau. The law of emission for a white light is that its visibility is proportional to the square root of its candle power; and the results of the German experiments closely follow this law—the departures from it being no greater than the estimated errors of position of the vessel carrying the light. The mean of a large number of observations gave, as the distance to which a white light of 1-candle power became visible, 1·4 miles for a dark clear night, and one mile for a rainy one. Experiments carried out in America after the International Maritime Congress in 1889 gave the following results for very clear weather: A light of 1-candle power was plainly visible at one nautical mile, and a light of 3-candle power at two miles. A 10-candle power light was visible with an ordinary binocular at four miles; one of 29 candles, faintly at five; and a light of 33 candles, visible without difficulty at the same distance. On

another exceptionally clear evening, a white light of 3·2-candle power could readily be distinguished at three miles; a light of 5·6-candle power, at four miles; and one of 17·2-candle power, at five miles. The Dutch Governmental experiments, conducted at Amsterdam, gave the following results: A white light of 1-candle power, visible at one nautical mile; 3·5-candle power, at two miles; and 16-candle power, at five miles. Experiments with green lights gave 0·80 mile as the range of visibility of 1-candle power. The illuminating power of a green light to be visible at one, two, three, and four miles was respectively 2, 15, 51, and 106 candles. The remarkably rapid diminution of the visibility of green light with distance, even in good weather for observations, and the still more rapid decrease in rainy weather of a character which but slightly affects the visibility of white light, show that it is of the utmost importance to select for the glass a tint of the colour which will interfere with the intensity of the light as little as possible. The tint recommended is a clear blue-green. Yellow-green and grass-green become indistinguishable from white at a short distance. For the red a considerably wider range of tint is admissible; but a coppery-red is found to be the best.

The Bacteriological Testing of Water.

A highly interesting and important paper on "Bacteria and other Organisms in Water," by John W. Hill, with the discussion, appears in the May number of the "Transactions" of the American Society of Civil Engineers. The main purpose of the paper is to elucidate the value and meaning of the bacteriological examination of drinking water, with special reference to the case of town supplies which have been, and must continue to be, subject to previous sewage contamination, The author was moved to take up this subject from a desire to know something about the micro-organisms in the Ohio river water supplied to the city of Cincinnati. He appears to have succeeded in this part of his inquiry, for he describes a large and varied collection of foreign constituents, living and otherwise, found in the samples of water examined. The next question that arose in this connection was as to the possibility of purifying such water by filtration. Mr. Hill recognizes the truth that it is not possible to reject water containing sewage pollution in all cases of a public supply; but he holds that it is practicable to sterilize all such waters before they are used for dietetic purposes. The work of Professor Percy F. Frankland upon the water supply of London is cited; and the conclusions of the Royal Commission are also duly referred to. Mr. Hill is of opinion that the results of bacteriological tests are to be regarded rather as indications than as proofs, because of the uncertainty still obtaining as to the quality of the various kinds of bacilli or bacteria found to be present. A striking portion of his paper deals with the example of a widely-advertised and much-consumed natural table water sold throughout the civilised world at a high price. The result of an examination of a bottle of this water showed, in three plate cultivations, the presence of from 1984 to 2112 bacteria per cubic centimetre; the standard for the London water supply being 100 bacteria per cubic centimetre; and the number in practice being often as low as 18 to 20 bacteria.

Freezing a Bed of Quicksand.—A novel engineering scheme in the construction of the foundation of the retaining wall of the new speedway at High Bridge, in New York City, is the freezing of a bed of quicksand which impeded the work. A row of 4-inch pipes have been sunk a few feet apart, to the depth of 40 feet. These pipes are capped at the bottom, and inside them are inserted smaller pipes, open at the bottom. Cold air is forced from a condenser through the smaller pipes into the larger, and thence returned to the condenser. The air is cooled by expansion to a temperature of about −45° C., thus freezing the surrounding mud and wet sand, and checking the flow into the excavation.

Uniform Methods of Testing Materials of Construction.—A conference on this subject is to be held at Zurich on the 9th, 10th, and 11th of September next. It has been inaugurated by the International Association for the Unification of Methods of Testing Materials, founded by the late Professor Bauschinger, of Munich. It is proposed to promote these ends by (1) personal intercourse between technical men of all countries; by (2) the interchange of views and experience by means of addresses and papers; by (3) reports of important points in experimental researches on the chemical and physical properties of materials of construction; and by (4) reports on the practical durability of materials under exceptional conditions and circumstances.

Iron and Steel Institute.—The autumn meeting of the Institute is to be held in Birmingham from the 20th to the 23rd prox. The programme will embrace visits to the leading industrial establishments in and around the city. The Mayor will hold a reception, at the Council House and Art Gallery, on the evening of the 20th. Among the papers expected to be read are the following: "The Thermo-Chemistry of the Bessemer Process," by Professor W. N. Hartley, F.R.S.; "The Hardening of Steel," by Mr. H. M. Howe; "The Mineral Resources of South Staffordshire," by Mr. H. W. Hughes; "On Tests of Cast Iron," by Messrs. W. J. Keep and T. D. West; "Estimating Oxide of Iron in Steel," by Mr. A. E. Tucker; and "The Use of Nickel in the Metallurgy of Iron," by Mr. H. A. Wiggin.

TECHNICAL RECORD.

THE CHEMICAL CONSTITUTION OF GAS ENRICHERS, AND ITS RELATION TO THEIR ENRICHING VALUE.

By Wilfrid Irwin, F.C.S.

[A Paper read before the Manchester Section of the Society of Chemical Industry, and Reproduced from the Society's "Journal."]

So very much has been written of late on the theory of uminous combustion, and the influence of the various components of a gas on its illuminating power, that it may seem presumptuous for a comparative stranger to enter a field where so many chemists of standing and ability are already engaged, and are daily making new additions to our knowledge on the subject; for, though it is now nearly a hundred years since the manufacture of gas for lighting purposes was first introduced on a commercial scale, it is only very recently that any scientific knowledge of the cause of luminosity has been forthcoming. The widespread ignorance of the composition of illuminating gas may be gleaned from the fact that in very few of even the later text-books is any mention made of its most important illuminant, benzene—a substance which is now being manufactured on an enormous scale. Its history may be found in Lunge's treatise on "Coal Tar and Ammonia" (1887), p. 114, and in Roscoe and Schorlemmer's treatise on "Organic Chemistry," Vol. III. (1886), p. 64.

In the year 1882, the price of 90 per cent. benzol having risen to 15s. per gallon, Mr. Josiah Hardman suggested to me the advisability of experimenting on this process. A few trials soon showed me the right course to pursue; and the results were truly startling. I found that as much as 3½ gallons of benzene could be produced from 10 000 cubic feet of Manchester gas; or, in other words, of all the benzene formed in the process of coal carbonization, only from 3 to 5 per cent. remains in the tar—the rest going forward into the gas, and supplying a great part of its illuminating power.

Plant was immediately erected, and within a very short time several hundred gallons were actually extracted from the Corporation gas; the residue being employed as fuel. Large carbonizing works were also soon in course of construction; and the commercial bearing of the case may be gauged from the fact that at that time 1 ton of coal, costing 6s., with labour (say) 4s., would produce 30s. worth of benzene, in addition to other bye-products.

There occurred to me about this time an idea to make an arrangement with gas companies for the extraction of benzene from their gas, and to replace the illuminating power lost thereby with light petroleum spirit; the former being about eight times the price of the latter. I soon found, however, that at least three times the amount of spirit was required to repair the loss of a certain quantity of benzene, and that there was also great difficulty in getting the required amount into the gas without condensation. These facts, combined with the rapidly-falling price of benzene, soon rendered the suggestion quite impracticable. Mr. G. E. Davis afterwards brought out a process in which he cooled the gas before absorption; and Mr. S. Mellor, one for obtaining the benzene by compression. So that Manchester and benzene are somewhat intimately associated.

In the years succeeding, from the small beginning above mentioned (largely owing to the increase in the number of coke-ovens of the Simon-Carvès type, especially in Germany), the supply of benzene has outstripped the demand. The price now [May 24] stands at 1s. a gallon; and unless some new requirement can be found for it, it appears likely to remain there. It was in connection with experiments on its efficiency as a gas enricher that I was led to take up the line of investigation I am about to describe.

Methods Employed for Conducting Experiments on Gas Enriching.

This, to begin with, is no easy matter, as the contact of ordinary coal gas with water was found to cause a rapid diminution in illuminating power, so that known mixtures in ordinary gas-holders could not be obtained. An experiment will illustrate this. Take a large bottle half-filled with water and the remainder with Manchester gas of 19 to 20 candle power. Agitate the two together, and then test the gas again. It will be found to have fallen from 19 candles to 1 candle with a union-jet burner, or to 2 candles with an Argand.

This fact could only be due to the solubility in water of the benzene and olefines; and as the former is described in the text-books as practically insoluble in water, I determined to settle the matter by experiment. The result was just what one would expect, and was as follows: 1000 volumes of water dissolve 1·45 volumes of benzene.

As a little digression, I resolved to compare it with toluene and xylene in this respect. You may be aware of the fact that the addition of CH_3 in the aromatic nucleus decreases the solubility. Thus aniline is more soluble than toluidine. Phenol is more soluble than cresol, and this again than xylenol; and it appeared interesting to discover if the base of all these bodies followed the same law. This was found to be the case. As I said before, 1000 parts of water dissolve 1·45 parts of benzene, 0·57 part of toluene, and 0·12 part of xylene. In comparison with the foregoing, heptane was found practically insoluble in water.

The method I adopted for the regular and gradual absorption by the gas of an enricher on a laboratory scale was the following: The gas, after being well dried with chloride of calcium, was passed over the enricher—say, pure benzene; and a bye-pass was arranged for the unenriched gas to meet and mix with the enriched gas before passing to the burner for testing. By this means, only substances with constant boiling-points could be tested; but it appeared the most satisfactory method I could think of for the work I wished to perform.

The first experiments I propose to describe were made with disillumined coal gas—that is, gas from which all illuminating power had been extracted by treatment with fuming sulphuric acid. Such gas, with a union-jet burner, tested about 0·03 candle; with an Argand burner, 0·75 candle. With an Argand burner having its air supply checked, it gives a flame of about 5 candles, but difficult to determine, owing to its peculiar colour and great length. The gas is practically a mixture of 2 of H to 1 of CH_4. As the union-jet burner is the commonest in practical use, all my experiments, except a few specially mentioned, have been made with it; a No. 4 Bray being the one chosen.

Note very carefully the flame we get with this disillumined gas. Next to the jet is a space quite devoid of luminosity; above it, a very slight luminous band; higher up still there is a perfectly dark band; and, lastly, at the very top of the flame is again a fringe of slight luminosity.

To determine the meaning of this, I made the following experiments: I first introduced into the disillumined gas a small quantity of benzene vapour, and noted the change in the flame. I found that the lower slightly luminous portion greatly increased in brilliancy; the result being a comparatively small but very bright flame. I next tried benzene with hydrogen and water gas respectively, and found that the combination in both cases gave a result similar to, but more intensified than, that when disillumined coal gas was employed.

I then tried the effect of hexane—an enricher which contains a large percentage of hydrogen, and which, on decomposition in the lower part of the flame, would yield a considerable amount of CH_4. The result of this admixture was that the lower part of the flame was not rendered anything like so brilliant as with benzene, but that the outer luminous fringe was considerably increased in size, so that a large, though not highly luminous, flame was the result. The union jet was now replaced by an Argand burner, which doubled the illuminating power of the hexane gas, while the gas enriched with benzene was not greatly altered—say, about 20 per cent.

Professor Lewes's researches seem to point to the fact that most substances which produce luminosity in gas do so by first of all decomposing into C_2H_2 and H; and, further, that the endothermic heat of decomposition of C_2H_2 causes a rapid rise in the temperature of the liberated carbon, resulting in the luminosity with which the flame is endowed. When hydrocarbons of the paraffin series are passed through a red-hot tube, a large amount of C_6H_6 and CH_4 is produced; the latter being further decomposed by more intense heat into C_2H_2 and H. A less intense heat is required for decomposition of benzene, which, however, also produces large quantities of C_2H_2.

The meaning of the stratification of slightly luminous flames now became clear. When the gas first leaves the jet, it passes through the "baking" part of the flame, where bodies such as C_6H_6 and C_2H_2 are decomposed and form the lower luminous band. In the case of gas treated with sulphuric acid, a trace of C_6H_6 has evidently escaped absorption. As we pass farther up the flame, the temperature naturally rises, until after passing the non-luminous layer, where complete combustion of the liberated carbon has taken place, we ultimately reach a point sufficiently high in temperature to decompose CH_4 with the production of C_2H_2, the decomposition of which again yields the luminous fringe at the top of the flame.

With an Argand burner, the heat of the whole flame is greatly increased. This has little effect on the benzene, as in a union jet there is still sufficient to cause its decomposition into C_2H_2. But with a body like hexane, which on decomposition would yield a large quantity of CH_4, the heat of the Argand is most beneficial, as it causes more CH_4 to decompose into C_2H_2 and H; and therefore very much less has to be spent in merely maintaining the heat of the flame by combustion. I have little doubt that this is the process which goes on in every gas-flame, with certain exceptions, to which I will refer later on.

We now come to the figures relating to the action of different quantities of benzene on disillumined gas; and as an example of the details required in each case, I will give the following: Volume of gas employed, 14 litres; volume of gas after the addition of benzene vapour, 14·28 litres; weight of benzene absorbed, 1·267 grammes; time occupied in burning, 7·5 minutes; candles burning at the rate of 119 grammes per hour; candle power calculated to 5 cubic feet per hour, 20·2 candles; benzene contained in a litre of gas burned, 0·088 gramme; benzene required per candle, 0·00434 gramme per litre.

The results of the disillumined gas *plus* benzene were—

0·0221	gramme per litre	gave	1·3	candles.
0·0385	,,	,,	4·1	,,
0·0544	,,	,,	7·6	,,
0·0630	,,	,,	9·6	,,
0·0863	,,	,,	21·0	,,
0·0881	,,	,,	20·2	,,
0·1230	,,	,,	30·0	,,

From the above it will be seen that 0·018 gramme per litre is required before any effect is produced on the illuminating power of the gas; but that after this point is reached, the illuminating power is increased at an average rate of 0·0034 gramme of benzene per candle, or about 4 candles per gallon per 10,000 cubic feet.

With the foregoing I carefully compared the action of heptane (prepared by fractionating petroleum spirit) on the disillumined gas. The following were the results:—

0·0528	gramme per litre	gave	2·15	candles.
0·1010	,,	,,	6·35	,,
0·1560	,,	,,	11·10	,,

From the above it will be seen that 0·028 gramme per litre was required before any illuminating action could be produced; but that, after reaching this point, the increase was at the rate of 0·0115 gramme per candle per litre, or about 1 candle per gallon per 10,000 cubic feet.

By comparing these results, I came to the conclusion that the carbon density alone had little to do with the enriching value of the hydrocarbon, but that it was the proportionate amount of carbon and hydrogen in the molecule that was the principal factor in determining its value. I therefore resolved to try the effect of toluol, which (if this theory, which I have since found that Knublauch was the first to put forward, be correct) should be below benzene in its illuminating value:—

Benzene.	Toluene.	Xylene.	Naphthalene.	Heptane.
C_6H_6 ..	C_7H_8 ..	C_8H_{10} ..	$C_{10}H_8$ ..	C_7H_{16}

With toluene I found 0·0033 gramme per litre was required per candle, against benzene 0·0034 gramme, and heptane 0·0115 gramme. This result did not seem encouraging; so I tried xylene, with which I found 0·0027 gramme per litre was required per candle.

This result quite upset the before-mentioned theory; and I began to conclude that the arrangement of atoms in the molecule might have a considerable influence on the enriching power of the hydrocarbons. I therefore tried the effect of naphthalene, and found that 0·062 gramme per litre gave 26·9 candles; 0·059 gramme, 23·5 candles; 0·046 gramme, 21 candles. The average, 0·058 gramme per litre, gave 23·8 candles. After allowing 0·010 gramme for the start, the amount of naphthalene required per candle per litre was only 0·0020 gramme; showing that its enriching power was more than half as great again as that of benzene, and nearly six times that of heptane.

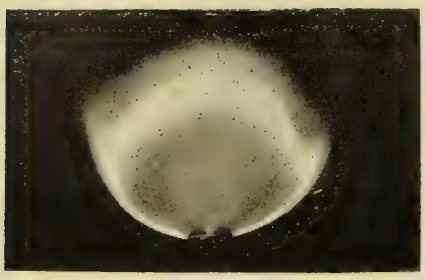
On comparing benzene with naphthalene, as regards structural arrangement, we find that, in the case of benzene, 92 per cent. consists of carbon combined with hydrogen; while in the case of naphthalene, 75 per cent. consists of carbon combined with hydrogen, and 18 per cent. of carbon uncombined with hydrogen. From this we may conclude that carbon, in combination only with other carbon atoms, and not linked with hydrogen, is of much greater utility as an enricher than carbon in combination with hydrogen. In other words, far more of the latter gets destroyed—*i.e.*, burnt—before the final decomposition of C_2H_2 takes place. As a matter of fact, it is very improbable that the two carbon atoms uncombined with hydrogen ever form C_2H_2 at all, but simply separate into free carbon.

From the above figures, we may calculate that carbon in combination with other carbon atoms only is nearly three times as efficacious as carbon in combination with hydrogen. In other words, only one-third of the carbon atoms in combination with hydrogen ever get utilized. So that, even in naphthalene, not more than 44 per cent. of the weight added to the gas is really utilized in emitting light; and since the addition of 0·002 gramme per litre raises the illuminating power of the gas by one candle, the amount of solid carbon engaged in emitting this quantity of light would be 0·00088 gramme; or, in other words, a gas burning for one hour, and giving a light equal to 20 candles, does not employ more than the extraordinarily small amount of 2·58 grammes ($\frac{1}{11}$ oz.) of solid carbon actually engaged in emitting light. Experiments on naphthalene and hydrogen, shortly to be described, confirm this result.

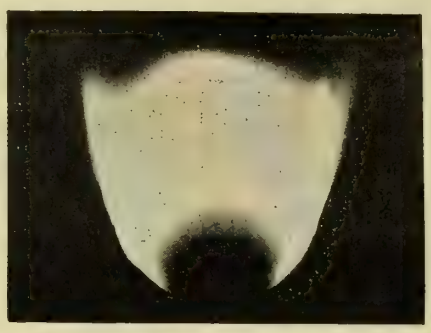
From the above considerations, and bearing in mind that, with a union jet, CH_4 and C_2H_6 are non-luminous, we arrive at the following four conclusions: That, in an enricher, a carbon atom combined with H_4 or H_3 is useless; that a carbon atom combined with H_2 possesses enriching power; that a carbon atom combined with H_1 possesses two or three times the enriching power of the foregoing; and that a carbon atom combined only with other carbon atoms again possesses two or three times the enriching power of a carbon atom combined with H_1. These facts easily account for the position toluene and xylene hold with regard to their enriching value.

My next experiment was on the influence of a body possessing a higher percentage than naphthalene of carbon atoms combined only with other carbon atoms. For this I used phenanthrene. Here again I obtained higher values than with naphthalene. But its very high boiling-point (350° C.) made it difficult to work with; and my results not being at all constant, I do not care to give them.

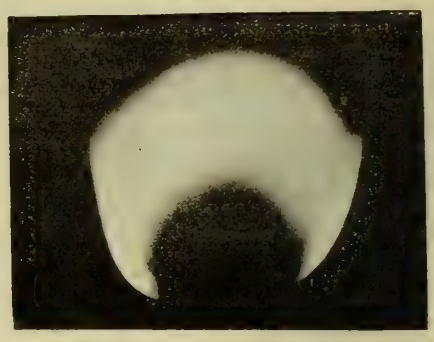
I then tried the effect of an oxygen atom in combination with benzene. For this I used phenol (C_6H_5OH)—the results being interesting: 0·020 gramme per litre gave 1·6 candles; 0·0841 gramme per litre, 11·6 candles, or 0·0064 gramme per candle after the start. This was nearly double the benzene figure; and it illustrates the deleterious effect of combined oxygen on the illuminating value of the enricher.



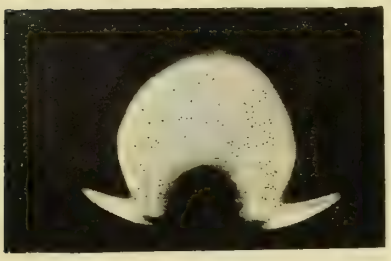
Disillumined Gas.
Owing to the quivering of the Flame, the Black Band over the Lower Luminous Layer is not very Distinct.



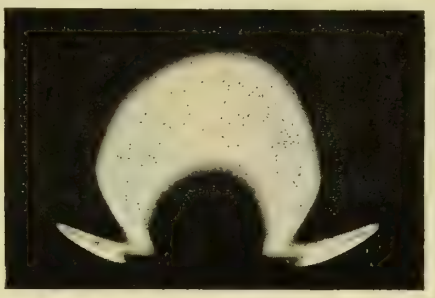
Disillumined Gas and Benzene, showing Contracted Size of the non-Luminous part of the Flame.



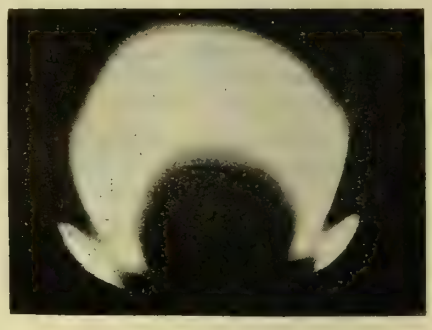
Disillumined Gas and Heptane.



Water Gas and Bezene.



Water Gas, Benzene, and a little Pentane.



Water Gas, Benzene, and more Pentane.

So much for the action of enrichers on disillumined coal gas. Let us now consider their action on hydrogen itself.

Benzene and Hydrogen.—0·068 gramme per litre gave 0·45 candle; 0·096 gramme per litre, 10·05 candles. Hence one candle, after the start, required 0·0028 gramme of benzene.

Hexane and Hydrogen.—0·121 gramme per litre gave only 0·2 candle, though this amount was increased to 1·5 candles with an Argand burner.

Naphthalene and Hydrogen.—0·0517 gramme per litre gave 4·3 candles; 0·0872 gramme per litre, 18 candles. Therefore 0·0355 gramme per litre gave 13·7 candles after the start, or 0·0026 gramme per candle per litre.

Mr. Lewis T. Wright, in a paper recently published,* lays great stress on the relation between the total effective carbon vapour (*i.e.*, carbon in combination with hydrogen) in any gas and its illuminating power. I would beg to bring before his notice the case of this mixed gas and that of disillumined coal gas. The latter, with a carbon density of 30 per cent., has an illuminating power of at most 5 candles with an Argand burner (air checked). Naphthalene *plus* hydrogen with a carbon density of 7·5 per cent. has an illuminating power of 18 candles. This fact, you will see, quite disposes of the theory advanced by some, that a good heating gas and a good lighting gas are practically synonymous terms.

In the foregoing figures, there is one point that needs some explanation. In the case of benzene 0·065 gramme, with hexane 0·12 gramme, and with naphthalene 0·042 gramme per litre is required to be sacrificed before any luminosity is forthcoming. Professor Lewes finds the same to be the case with acetylene. He explains it by the fact that the more dilute is the enricher, the higher the temperature required for decomposition; and he assumes that it is the heat of combustion of a certain amount of the enricher that is required, in addition to that supplied by the burning hydrogen, for the decomposition of a further supply of the enricher—say, C_2H_2.

Additional proof appears to me necessary, however, to settle this point; for only half the amount of benzene (which has the same percentage composition of carbon and hydrogen as C_2H_2) is required, and only one-third the amount of naphthalene, to produce the same result, and this in spite of the high endothermic property of acetylene.

Again, in a disillumined coal-gas flame, where the percentage of carbon is far higher than in any of the above mixtures, a certain amount of benzene is required to be added before any perceptible addition to the illuminating power is obtained.

The only attempt at an explanation that I can give is to suppose that it is merely a question of the ability of a certain amount of the enricher to resist oxidation in the lower part of the flame before it can reach that portion of it which is hot enough to cause complete decomposition, with separation of solid carbon. Of course, the latter action will be hastened by the heat of combustion of that portion of the hydrocarbons which is burnt in the lower part of the flame.

It may be noted that, in these considerations, the solid particle theory of combustion is completely upheld; but the theory that it is always the hydrogen in a hydrocarbon that first burns—thus liberating the carbon to form the glow—is unsound, and no longer tenable.

Water Gas and Benzene.

In the preparation of the gas, steam was passed through a tube filled with coke, and kept at a bright red heat. The gas produced contained no air, but 10 per cent. of carbon dioxide, which was removed by treatment with caustic soda. With this gas, 0·079 gramme of benzene per litre gave 0·51 candle; 0·154 gramme, 12·9 candles. Hence, 0·075 gramme of benzene was required before any luminosity could be produced; and after that point was reached, enrichment at the rate of 0·006 gramme per candle ensued. On comparison with previous experiments with disillumined coal gas, these figures tell against the use of benzene with a gas containing a high percentage of carbon monoxide in a general way; but its economic bearing, taking into consideration the rapid rate at which carburetted water gas can be manufactured, I cannot now enter into.

Note the shape of the flame of water gas and benzene. It is like an ordinary gas-flame without a top to it. This is no doubt due to the fact that little or no CH_4 is present to decompose into C_2H_2 and C at the hottest and highest part of the flame. If, however, we add to this flame an enricher like pentane, which by itself, in any reasonable quantity, does not add any illuminating power to the flame, but which, on decomposition in the lower part of the flame, would yield a large amount of CH_4, the flame nearly resumes its normal shape.

Benzene with Manchester Gas.

For the action of benzene as an enriching agent on ordinary coal gas, the figures given by authorities on the subject are most widely divergent. The following is a list: Bunte says 1 gallon in 10,000 cubic feet of gas gives 3·6 candles enrichment; Frankland, 2·9 candles; Hunt, 0·9 candle; Knublauch, 3·7 candles; Stenhouse, 1·3 candles; L. T. Wright, 0·8 candle.

The following experiment will suffice to show the effect of benzene on Manchester gas:—

	Union Jet.		Argand Burner, Arranged to Give the Most Light.
Manchester gas before enrichment	12·6 candles	..	21·0 candles (approx.)
Benzol added, or rather contained in the enriched gas, per 10,000 cubic feet	0·075 gramme per litre.	..	0·079 gramme per litre.
Illuminating power after enrichment	28·6 candles	..	23·5 candles.
Gain in luminosity by enrichment .	16·0 "	..	2·5 "
Gain in illuminating power per gallon per 10,000 cubic feet. Average of three tests	2·7 "	..	0·5 "

Notice the extraordinary effect the burner has upon the results. But, further, these results do not appear to tally, even in the case of the union-jet burner, with those wherein disillumined gas was experimented upon; and I can only account for the difference by assuming that a sort of overlapping takes place in the illuminants contained in an ordinary coal-gas flame—in other words, that you cannot get the full value of the light-giving power of both the olefines and the benzene when burnt in any proportion together. If this be so, a cubic foot of gas enriched to 20 candles with olefines mixed with an equal amount of gas enriched to 20 candles with benzene, would not

* See Journal, Vol. LXV., p. 310.

necessarily give 2 cubic feet of 20 candles; but the mixture would probably have a lower illuminating power.

The above supposition, if it be correct, must be of the greatest importance to the gas manufacturer; and I hope before long to be able to settle it by experiment. But it is the only explanation I can offer in regard to my own results, and to account for the discrepancies recorded by other observers; the influence of the class of burner used, great as it is, being insufficient. Data recorded relating to enriching values are absolutely useless unless both the composition of the gas to be enriched and the burner employed are stated at the same time.

Manchester Gas with Hexane.

	Union Jet.
Illuminating power before enrichment	13·2 candles.
Hexane contained in the enriched gas per 10,000 cubic feet	0·092 gramme per litre.
Illuminating power after enrichment .	17·3 candles.
Gain in illuminating power by enrichment	4·1 ,,

Equal to 0·62 candle per gallon per 10,000 cubic feet.

The foregoing experiments open up a very wide question. They show that, when the common union-jet burner is employed —and I suppose 80 per cent. of the burners used in this country are of that type—gas enriched to a high candle power, when tested in the ordinary manner, is of very little avail, when that enrichment is due to the presence of olefines or other hydrocarbons with a high percentage of hydrogen. Argand burners are not popular, and slit burners are said to be smoky. So the union-jet burner still holds the field.

The lights of Paris, with its 14-candle gas, are often compared with, and said to be equal in illuminating power to, those of the North, with gas of 20 to 30 candles. Why is this so? Some say because the atmosphere of Paris is clearer than that of our northern towns, and that therefore the lights shine more clearly; while others try to find a difference between illuminating power and illuminating effect—a distinction I am unable to understand. My own opinion in the matter, and one formed from the experiments here described, is that Paris gas, as Berthelot states, owes its 14-candle illuminating power almost entirely to benzene; so that the consumers really get what they are supposed to do—probably quite as much as we in Manchester get from our 20-candle gas, which is made from cannel (and therefore owes its illuminating power largely to olefines as well as benzene), and which the majority of us consume in burners ill adapted to its use. Gas enriched to 17 or 18 candles with benzene would be far better appreciated than 20-candle gas owing its illuminating power largely to olefines—that is, by the average consumer. The same considerations also hold good for petroleum enrichment as for olefines.

As regards price, benzene at 1s. a gallon is by far the most economical enricher with a union-jet burner; and its production from coke-ovens is continually on the increase. Should a great increase in its employment cause a rise in price, the gas-works might themselves manufacture it in summer for use in winter, when the market for coke and other bye-products would allow of this being done. But, anyhow, while the price remains at the present figure, it certainly ought to be used for the enrichment of gas.

General Conclusions.

(1) That of all enrichers, benzene, for the average consumer of gas, gives the greatest value for the money.

(2) Toluene and xylene are better enrichers; but their non-volatility precludes their employment.

(3) Naphthalene is the cheapest and greatest enricher; but it cannot be supplied with gas from the gas-works because of its non-volatility. It could, however, be used for the street-lamps with a carburetting apparatus, which would give 50 per cent. more light for a mere fraction. Were separate mains employed and water gas used in connection with naphthalene, the cost of street lighting would be reduced to a minimum.

In the course of the discussion upon the paper,

Mr. T. Banbury Ball (Rochdale) said, from the practical gas manufacturer's point of view, he differed *in toto* from Mr. Irwin in the method adopted for determining the value of benzol as an enricher. It was undoubtedly quite possible to use benzol in the way described; but there would be great difficulty in securing uniform results. Mr. Irwin's object was to show the value of adding benzol and other hydrocarbons as enrichers to ordinary coal gas; and the gas manager desired to know what, for example, benzol would do when added to 15, 16, or 17 candle gas. It was of little interest to him what its effect might be upon gas deprived of its illuminants, such as Mr. Irwin had used. The fact that an increase of 16 candles had been found when the enriched and unenriched gases were burnt in a union-jet burner (and a small one too), though only three candles' increase was found when the samples of the same gas were tested in an Argand burner, tended to show that the former was an entirely unsuitable burner for the gas tested before enrichment, and not that the whole improvement was due to benzol. The method adopted by Mr. Irwin, of passing the gas over the surface of the benzol, would probably be found to result in the liquid gradually becoming denser, and the enriching effect diminishing. This was found to be the case when the benzol was volatilized by steam heat; and one would expect it to be much more so when the gas simply carried away the benzol mechanically. Referring to the figures just quoted by Mr. Irwin, as to the values arrived at by Dr. Bunte and others, it was difficult to compare them without knowing the conditions under which the experiments were conducted; and while he should be delighted if the values quoted could be obtained in ordinary working, he was bound to say that as yet they had only been able to approximately reach the figure given by Mr. Stenhouse in his paper read at the previous meeting.*

Mr. W. Thomson asked whether Mr. Irwin had made any experiments by burning the different mixtures of gases under pressure or by means of hot air, as in the Wenham burner. He also wished to know if Mr. Irwin could explain the reason why two little wings of light formed at each side of the flame when burning naphthalene as an enricher.

Dr. Lewkowitsch wished to know how Mr. Irwin had estimated the solubility of benzene, as the paraffins experimented on were doubtless of American origin. He suggested that Russian petroleums should be tried; the naphthalenes in this petroleum forming an intermediate group between the open-chain paraffins and closed-chain benzenes. As to the theory of the flame, would it not be advisable to burn the gases in Smithells' flame-dividing apparatus, and examine the gases?

Mr. H. Grimshaw expressed his disappointment that nothing had been said about acetylene, which, according to recent reports, was coming to the front for enriching coal gas. In his opinion naphthalene used as an enricher of coal gas was still the cheapest, especially at the present price of about £9 per ton; and he thought the most practical outcome of the discussion would be to ascertain whether acetylene or naphthalene would be the cheaper. In his own mind, he considered that acetylene was not destined to be a rival of the other materials used for the enrichment of coal gas.

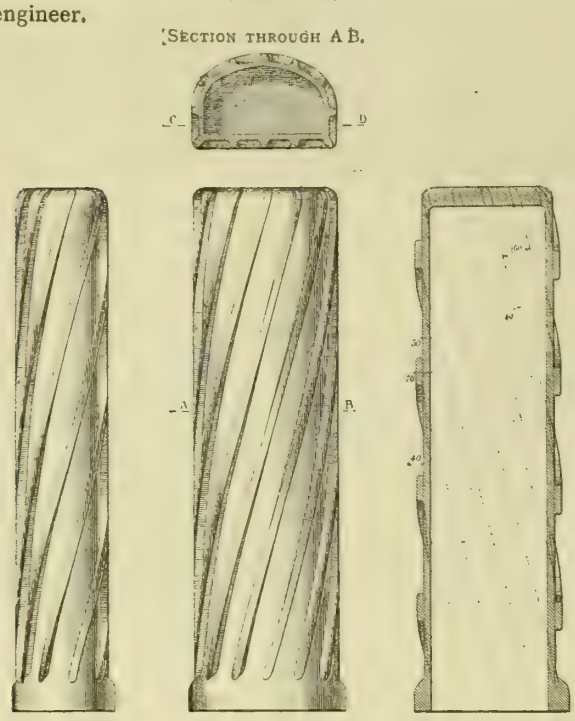
Mr. T. Stenhouse thought the paper would have been of much greater interest had Mr. Irwin explained how the experiments had been carried out, the kind of burners and the photometer employed, and whether he had used ordinary coal gas of 15 or 16 candle power or disillumined gas. How was the gas enriched by the naphthalene? Were the enrichers used weighed or measured? The paper contained very little information on these points, though the results appeared to have been calculated out very finely.

Mr. Irwin, in reply to Mr. Ball, said he distinctly stated that his experiments were made with the burner most commonly employed—viz., the union jet. He was fully aware that the Argand burner, which was chiefly used for testing in gas-works, had not given high results with benzene. But he regarded the question from a consumer's rather than from a gas manager's point of view; and, so regarded, he considered benzene the most economical enricher. With respect to the carburetting apparatus, he never suggested that the laboratory method he had mentioned could be used on a large scale. Were he carburetting in a works, he would use either such an apparatus as that suggested by Bunte or possibly a simple tower packed like a scrubber, up which the gas might pass and meet and absorb a stream of benzene descending. In reply to Mr. Thomson, the reason regenerative burners gave more light was in all probability that the additional heat supplied caused a greater quantity of marsh gas to be changed into acetylene with less waste in merely maintaining the heat of the flame. In reply to Dr. Lewkowitsch, he had estimated the solubility of benzene in water merely by agitating the benzol and water together; taking the precaution not to allow more air than possible to be admitted into the mixture. Just before the point of concentration, the mixture formed a froth, which disappeared again the moment excess of benzene was added. The data given represented volumes of liquid benzene, and not vapour of benzene. With regard to naphthalenes, he had not made any experiments with them; but he should expect they would follow, in their carburetting power, the theory he had advanced. In the paraffin series, generally speaking, the higher they were in the series the greater was their enriching value. With reference to Mr. Grimshaw's remarks, he had at first intended to institute comparisons with acetylene; but as the paper was getting lengthy, and acetylene was being put out of the field altogether by its introducer, Professor Lewes, he decided to leave it alone. In reply to Mr. Stenhouse, the kind of photometer employed was one of the Bunsen pattern he had constructed for use in his laboratory. It was not on so elaborate a scale as a gas-works photometer; but any error due to the instrument itself would not be sufficient to affect the theory he advanced as to the constitution of enrichers, and its relation to their enriching power. In the case where such bodies as naphthalene were employed, the burner had to be kept in contact with the stopper of the vessel containing the enricher at a constant temperature of (say) 100° C. Trials had to be made at first to find at what temperature the best result could be obtained with the substance to be experimented upon, and afterwards the test made. He had arranged an apparatus by which he could pass a constant stream of gas—say, half a cubic foot—over the enricher. It would be interesting to test a benzene hydrogen gas with a regenerator, in which case he doubted whether the gain in enrichment would be anything like so great as with ordinary gas. It would be his desire, at some future time, to repeat these experiments with more elaborate apparatus, and (with the aid of experience already gained) complete the work.

* This paper will be found on next page.

GUEGUEN'S PATENT RETORT.

The attention of gas managers is invited to a novelty in retorts the nature of which will be understood by a glance at the accompanying illustrations. They represent the helicoidal ribbed retorts patented by M. Guéguen, a well-known French gas engineer.



The advantages claimed for the system are the reduction of the thickness of retort walls which it permits, without detriment to the strength of the retort, and the consequent saving of heat. Experiment has demonstrated that it is greatly due to the resistance to the passage of heat from without to the charge of coal in an ordinary retort, that the carbonizing process lasts so long, and that such a high temperature is required in the setting. By reducing the thickness of a fire-clay retort from 2¾ inches to 1½ inches, there is an increase made of 32 per cent. in its heat-transmitting capacity; and M. Guéguen claims to have found, with trial retorts of his special design introduced in a setting with others of the ordinary construction, an increased carbonizing capacity of 20 per cent. With helicoidal retorts 3 centimetres (1·185 inches) thick, an increased carbonizing power of 25 per cent. has been obtained. It is also claimed that retorts with compensating helicoidal ribs run less risk of breakage during transport; and they are better baked than the ordinary thick retorts. The virtue of the new retorts, of course, resides wholly in the reduction of their substance—the helicoidal ribs are merely to compensate for the loss of strength due to this feature. Taking into account the value of the improved carbonizing effect of these retorts as compared with those of the ordinary pattern, it is claimed for them that they represent an economical advantage of £16 per retort per annum over the common make.

Trial retorts upon the new system have now been at work for twelve months; and these show no cause to suspect them of inferior durability to other kinds.

EXPERIMENTS WITH LIQUID GAS ENRICHERS.

In the JOURNAL for the 7th of May last (p. 943), we noticed briefly a paper on the above subject, read by Mr. T. STENHOUSE, F.I.C., F.C.S., before the Manchester Section of the Society of Chemical Industry. The text of the paper has since appeared in the Society's *Journal*, from which we reproduce it.

During the last few years, many gas managers, instead of using cannel coal, have raised the quality of the gas obtained from ordinary coal to the required standard by using liquid enrichers. These have been vaporized by steam in various kinds of carburettors. Generally the gas is improved 2 or 3 candles in this way. There is, however, a great difference in the few published statements respecting the value of the various hydrocarbons commonly in use—especially of carburine and benzol; and probably there is as great a difference between the privately circulated results believed to have been obtained at various gas-works where enrichers of this class are employed. Dr. Bunte, for instance, makes the rather wide statement that between 7 and 9 grains of benzol vapour will improve 1 cubic foot of gas between 4 and 5 candles. This is equal to an improvement of 1 candle in upwards of 30,000 cubic feet of gas by 1 gallon of benzol.

In a letter to the JOURNAL OF GAS LIGHTING (Feb. 19, 1895), Mr. Hunt, of Birmingham, stated that 1 gallon of benzol enriches 9500 feet 1 candle, and that 1 gallon o carburine will improve 2800 cubic feet to the same extent. In an interview with Mr. W. Young, of Peebles, this gentleman credited a gallon of benzol with an enrichment value of only 4500 candles, and carburine with being only one-fourth as effective. These statements are so greatly at variance, that a gas manager, wishing to select some enricher of this kind for his gas, must be not a little perplexed, and scarcely able to calculate what the cost will be. Of course, it is quite possible that gases of the same illuminating power may so differ in composition that no particular enricher will have exactly the same improvement effect upon them. This, however, cannot account for the differences just noticed.

With a view of ascertaining the relative values of a few enrichers for coal gas, I have recently made some careful experiments with several liquids, but principally with carburine of ·680 sp. gr., and commercially pure benzol. The gas used was of about 16-candle power, and was improved from 1 to 2 candles. The photometer employed was the ordinary 60-inch open bar photometer at the Rochdale Gas-Works. A Methven 2-candle screen replaced the candles, so as to avoid any trouble with the latter during the tests. The gas, after leaving the meter, was bye-passed through two flasks with short lengths of glass tubing. The first flask it entered was a small one holding a quarter of a litre; the other had a capacity of 2 litres. The inlet-tube reached nearly to the bottom of the small flask, while the outlet-tube only just passed through the cork. The tube arrangement was reversed in the larger flask—the gas entering at the top, and leaving at the bottom. The lower part of the small flask was heated on a water-bath; and the liquid enricher was allowed to fall in drop by drop. In this way the gas was enriched each time a drop entered and became volatilized; but as the gas immediately passed into, and became diffused through, the larger flask, there were only very slight variations in the illuminating power of the improved gas when the enricher was added uniformly for about 15 minutes. With a few trials, it was soon ascertained at what rate the liquid, whatever it was, must be added to give 1 or 2 candles enrichment, and allow accurate readings to be taken at the photometer. The liquid enricher was measured from a burette with a glass tap, and passed into the flask at the required rate. After the gas had been improved to a suitable extent, and was burning at the proper rate, the liquid in the burette was carefully read off, and a test, lasting (say) half an hour, was made.

With an arrangement of this kind, it is not at all difficult to watch the photometer disc, and regulate the supply of the enricher, so that the illuminating power of the gas shall remain fairly steady at one value—say, at 18 or 19 candles, as may be required. Certainly the difference between the readings is not greater than what is experienced when using candles in the ordinary way while testing unenriched gas. With the addition of one drop of benzol from the burette every 20 seconds, one can get an improvement of about 2 candles when the gas is burning at 5 cubic feet per hour. Between two and three times as much carburine is required to give the same improvement.

Added in this way, practically all the liquid is vaporized under the influence of heat and the stream of gas playing over the bottom of the small flask. Even with enrichers containing small quantities of dense hydrocarbons, there is a mere stain left in the flask after an hour's test. Under these circumstances, one may safely rely on obtaining the full duty from the liquid under examination, as it is practically all turned into vapour, and carried directly into the flame, of which the illuminating power is being determined. As the flame is never more than equal to 18 or 19 candles in these tests, the gas is never saturated with the added vapour, and consequently will have no tendency to deposit anything either in the larger flask or in the short length of tubing leading to the Argand burner. It may here be remarked that at Rochdale, where carburine has been employed as an enricher during the last two or three years, Mr. T. Banbury Ball, the Engineer and Manager of the Gas-Works, has not found that any of the liquid has condensed in any of the syphon-boxes attached to the mains, notwithstanding the severe frost of last winter.

Working in the way just described, the following results have been obtained with the respective liquids:—

	Gas Enriched 1 Candle by 1 Gallon of the Liquid.
Benzol (chemically pure)	13,300 c. ft.
Benzol (90°)	12,500 ,,
Carburine (·680 sp. gr.)	5,700 ,,
Common petroleum spirit (·700 sp. gr.)	4,300 ,,

Of these liquids, the two important ones are commercially pure benzol and carburine or light petroleum spirit. Their composition is well understood. As the specific gravity shows, a gallon of the former contains about 2 lbs. more real matter than the latter. Besides this, the molecular structure of the benzol molecule is such that, of all the liquid hydrocarbons known, it is the one which may be expected to break up most readily into that wonderful acetylene of which we have heard so much lately, and which, according to some authorities, puts everything else in the shade as a light producer.

Benzol is a liquid which is being produced more plentifully every year from the gas and tar obtained from coke-ovens. It was recently estimated that 50 million gallons of benzol could be obtained from the 30 million tons of coal annually coked in Great Britain, if the coking were done in closed ovens. There is, therefore, every probability that this most useful liquid will

be available in greater quantities in the near future. It is already a rival of carburine; and it may soon supersede it altogether for enriching ordinary gas of 15 or 16 candle power. So long as benzol can be purchased at 1s. per gallon, it is, in my opinion, decidedly preferable to carburine, even at the lowest price at which the latter has yet been sold. Volume for volume, it is about 2¼ times as efficient as a gas enricher; and there is less loss and danger from evaporation during transit. The temperature at which benzol volatilizes is also a convenient one, as ordinary steam heat is all that is required. The amount of benzol vapour which common coal gas can permanently retain —viz., over 50 grains per cubic foot at 0° C.—is greater by far than anything required to enrich low-quality gas to any reasonable extent. If used in a rational way, there is therefore no need to fear that the added benzol will be condensed and deposited in the gas-mains.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Discussion on Mr. M'Crae's Gas Institute Paper.

SIR,—In your last issue you publish Mr. M'Crae's paper, read at The Gas Institute meeting, and the discussion thereon. The remarks I made on that occasion were so entirely misunderstood by all the speakers who took occasion to refer to them afterwards, that I think my hoarseness must have rendered my meaning very obscure. Speaking was very painful to me; and, as time was pressing, I refrained from asking the President's indulgence while I made an explanation—preferring to wait until the report appeared, when I might claim your indulgence instead, to enable me to put myself straight, as far as may be necessary, although, after seeing my observations in print, I am puzzled to know how they could have been so misunderstood.

The curt manner in which you put my observations aside, in the leading article on this subject in your last issue, as not even to be taken seriously, only shows, to my mind, the obtuseness of people constantly occupied in writing for a purely technical journal on matters affecting the larger questions of humanity. You work in that old aphorism about "two blades of grass." I might reply with another about filling two mouths with food. But that is not serious discussion, however suitable it may be for leading articles. There is no question of making two blades of grass grow here. It is simply a question of the best way of making the same blade grow in the same place year after year. My contention is that it is better to do it ourselves, and have the benefit distributed among ourselves, so long as we can do it as well and as cheaply as anyone else, rather than call in the assistance of someone in Russia or America, and let him share a portion of the benefit.

I wish it to be distinctly understood that underlying my remarks was this sentence of Mr. King's: "Quite independently of the economical production." Anything that will lessen the cost of production in any way does not fall under the pale of my observations; and therefore Mr. Denny Lane, with his ponderous sledge-hammer, does not find even the proverbial tack to drive home. I am as much in favour of real labour-saving appliances, and economy of production in every form, as anyone who spoke at the meeting; and in my practice I never allowed any consideration for the men to stand in the way of those things. Mr. Duxbury caused a laugh by drawing attention to something I said in a letter some time ago; but if he had understood what I was talking about, he would have seen no inconsistency in that. It was always my policy to get full value for all moneys expended, whether in the shape of wages or otherwise; but I never went to my Committee and asked them to put in machinery of any kind to dispense with labour because I was unable to manage my men. Mr. Stelfox made the most reasonable and effective reply to what I had said. He frankly admitted that the men had acted unreasonably towards himself ("put to the torture" is a strong expression, but it is his own); and therefore he felt inclined to give them one back. Well there is a good deal of human nature about that; but it is not more reasonable than the stand previously assumed by the men.

It may be said that every man is a philanthropist so long as it costs him nothing. It is evidently so with Mr. Alderman Miles, of Bolton. He has been a believer in conciliation up to quite a recent date; he has even advocated it in public and at our meetings. But some time ago the Corporation had a dispute with their men, and the men were, of course, unreasonable—could not, or would not, see eye to eye with Mr. Alderman Miles, and so he conciliated them with the Conspiracy Act. The men were told on one occasion that, if they did not accept the conciliation meted out to them, they—the Bolton Corporation—would have to *resort to stoking machinery* (the italics are my own). Fancy the resort! I have heard it stated, and I believe the statement, that there is at least one of the London Suburban Gas Companies using stoking machinery alongside of hand labour, and that they have found the hand labour to be as cheap, if not a cheaper way of making gas or carbonizing coal. So that, after all, Mr. Alderman Miles was well advised in using the word "resort." If men are obtainable in the neighbourhood of those works, I contend that it is an injustice to the district from which those works derive their revenue to have substituted machinery for hand stoking, if they are not making any additional profit by it. I wonder what a working-man director would say if the manager proposed to substitute machinery for labour, not because it would save money, but because it would save him the trouble of looking after so many men. I think a working-man director, if he understood the business, would be a very wholesome influence in many places. Perhaps it would be worth while considering what the status of the gas manager will be when eight men are employed to do the work of 340. In gas-works that now employ 40 men, there will only be one; and that will be the manager himself, who, being an energetic person, will do all the work required. However, as that is the manager's affair purely, I will leave it for the present.

This is a very large question, and one can hardly expect to get it thoroughly understood and threshed out in one discussion. Indeed, it is questionable if another century will see it. But, even in this early stage of the discussion, I protest against it being taken as an axiom that it is better in every respect to employ 20 men instead of 200, apart from economical considerations. I say the reverse is the case. That the man who can feed or provide a good living for 200 men is ten times the benefactor of the man who only provides for 20. To speak of throwing 180 men out of employment, for no other consideration than that it shall save you a little trouble, is inhuman. Perhaps it may have arisen from mere thoughtlessness. But the effect of thoughtlessness may easily be inhuman; and it was my purpose to place it on record that all the members of The Gas Institute did not subscribe to this doctrine.

One thing is certain, that labour is gradually awaking and finding its feet, and is following the natural bent of all humanity in trying to raise its own status. That it is indiscreet and unreasonable at times is only another way of saying that it is ignorant, or not yet fully awake. Hence its liability to trust its affairs to outsiders, who often do it more harm than good. But it will go on, and force its claims upon you; and I contend that the gas manager or the employer, whatever he may be, will display the greatest wisdom who keeps in sympathy and in touch with his men, who tries to understand their case and see their point of view, rather than the one who takes refuge behind the shelter of an unprofitable machine.

Altrincham, July 11, 1895. W. CARR.

The Manufacture of Sulphate of Ammonia.

SIR,—In your issue of June 25, you have a paper by Mr. C. Stafford Ellery, of Bath, upon "Some Improvements in Methods of Manufacturing Sulphate of Ammonia;" among these improvements being that figured in your pages as "Ellery's Self-Emptying Saturator." We do not know how long Mr. Ellery has had his self-emptying saturator at work; but we should like to point out that we designed a saturator on the self-emptying principle, and actually took out provisional protection for it, as long ago as 1890. Our first design was almost exactly like Mr. Ellery's saturator—even to the treacle valve. But as we had misgivings as to the quantity of liquor which would leave the saturator along with the salt, we made considerable changes, with a view to obviating this possible difficulty.

Manchester, July 8, 1895. DAVIS BROS.

Sloping Retorts at Brentford.

SIR,—In reply to Mr. Graham's letter on the above subject, in the JOURNAL for the 2nd inst., the first installation of inclined retorts was not worked at Rochdale. No improvements have been made since the first installation at Brentford. In my paper, I do not make a claim for any size of retort—it would be absurd to do so; neither do I recommend or use taper retorts. As a matter of fact, our retort mouthpieces are contracted an inch, making them 23½ inches; and we get a rapid discharge of coke. We have no lug on the discharging iron mouthpiece; and this was neither mentioned nor claimed in my paper. No. 2 house is an exact copy of No. 1, excepting that the retorts are larger in the former; and all improvements in No. 2 house have been used in No. 1 for years. I believe our re-installation of sloping retorts (72 sets), which will be at work in the coming autumn, is the largest in England. Mr. Ball does not claim the three shoots, as we modified the first Southall pattern, after experiment, for convenient and rapid charging.

Brentford, July 12, 1895. J. HUSBAND.

Professor Lewes's Report on Gas-Fires.

SIR,—It is with great diffidence that I take the liberty to endeavour to add to the work of so brilliant a scientist, and so worthy an author, as Professor Vivian B. Lewes. But, alas! when one sees in his paper, on "The Combustion of Coal Gas for Fuel Purposes" the small fault so explicitly stated that has long barred the commendation of an article which possesses many good points, it rouses one to the use of the pen. I refer to the "Condensing" gas-stove; and I am exceedingly sorry to see no test of it in so comprehensive a dissertation on the somewhat important subject of heating by coal gas.

This class of stoves has for a long time been catalogued; and though they do not give all the much-to-be-desired radiant heat, they give a portion, and certainly a useful heating duty (per cubic foot of gas consumed), unequalled by any other stove known to me in the trade. In conjunction with the late Mr. F. Weller, I had the pleasure of making some rough tests on one classed in a well-known firm's list as "6 P.S." The stove was placed in an apartment with an eastern aspect, 16 feet by 12 feet and 10 feet high; and it gave, with a consumption of 8 cubic feet of gas per hour, an amount of heat which surprised us both.

It needs no demonstration to prove that the products of combustion of so small a quantity of gas are hardly worth consideration; though doubtless a test of the humidity of the air in the apartment would have here been useful.

A consumer who tried one for heating his office had an account of about 35s. per quarter; and I question had this said consumer been left to one of such stoves as Professor Lewes mentions, with gas at 4s. 6d. per 1000 cubic feet, whether his bill would not have amounted to £7 or £8 per quarter, with the unfortunate result in his case of the abolition of heating by coal gas.

The main things to be insisted on from the stove maker are: (1) The governor underneath the Argand burner should be such that, when subjected to the maximum amount of pressure, it will not allow a greater amount of gas to pass than the surface of the stove will properly condense all the vapours given off from its combustion. (2) The receptacle for the condensed liquid should be of such a size that it will take easily all the liquid formed in twelve hours. (3) The stove should be properly japanned, or the pores of the material of which it

is made filled up by some suitable medium. (4) The inside of all the parts should be easy of access when taken to pieces.

No doubt, many managers are allowing stove makers to place with them a stock for disposal during the ensuing winter; and should they feel inclined to give this class a trial, I believe they will have little room for regret.

Clapton, July 11, 1895. J. STEEL JOHNSON.

The Working of the London Gas Companies.

SIR,—In your issue of June 25, a correspondent wants to know, "How is it that the South Metropolitan Gas Company require only 1·31 per cent. of cannel to enable them to supply 16·4-candle gas, while the Crystal Palace District Gas Company, to supply 16·2-candle gas, use 3·08 per cent. of cannel—both Companies being under the able management of Mr. George Livesey."

As you point out, it is an error to suppose that Mr. George Livesey is the Manager of either of these Companies; but it is also the fact that practically during his working life Mr. George Livesey was the Manager of the South Metropolitan Gas Company, and that *management* is the cause of the difference in the percentage of cannel to which your correspondent refers. And I have no doubt that very shortly the cannel used by the Crystal Palace District Company will bear a close comparison with that of the South Metropolitan Company, though Mr. George Livesey is not Manager, but only Chairman.

I make this statement advisedly, and for the following reasons: During the last twenty years, I have watched the career of Mr. George Livesey carefully, and always found that, when that astute gentleman is either Manager or Chairman, the price of gas invariably goes down, and with it the percentage of cannel.

I believe I am right in stating that, for many years, Mr. Livesey made gas much above 16 candles without using any cannel (or other enricher) at all; and I expect to see this result again.

Just as there is a Champion Cricketer, so there is a Champion Gas Manager; and those who don't walk about with their eyes shut know it.

342, *Strand, W.C., July* 8, 1895. V. TAYLOR, F.C.S.

P.S.—I may add that I have no connection with any gas company.

The New Water-Works for Cookstown (Ireland).—The Local Authority of Cookstown have applied to the Local Government Board for Ireland for a further loan of £1500 for meeting the balance of expenditure on their new water-works. According to the evidence laid before the Chief Engineering Inspector of the Board (Mr. C. P. Cotton), the works have cost £5391; land and wayleave, £2403; law and engineering charges, £1257; and sundries, £86—making a total of £9137. The original loan was for £7760.

New Offices for the Cardiff Gas Company.—The foundation stone of the new offices and show-rooms of the Cardiff Gas Company (a short description of which was given in the JOURNAL for May 7 last) was laid last Wednesday, by Mr. C. H. Williams, the Chairman of the Company. In addition to the Directors, there were present Mr. E. J. Phillips, the Chairman of the Newport Gas Company; Mr. G. Clarry, the Secretary of the Cardiff Company; and Mr. H. Morley, the Engineer and Manager, to whose designs the buildings are being constructed. The interesting ceremony commenced by the Contractor (Mr. James Allan) presenting to Mr. Williams a handsome silver trowel and ivory mallet, with which he discharged his pleasant task. The stone was inscribed as follows: "This memorial stone was laid by Charles H. Williams, Esq., J.P., Chairman, on the 10th of July, 1895. H. Morley, Engineer and Manager; James Allan, Contractor." The trowel was also suitably inscribed on one side, and on the other was an engraving of the new offices. Through the generosity of the Chairman, the workmen engaged upon the building subsequently partook of a substantial repast.

The Charging of the Extra Expenses Occasioned by Last Winter's Frost.—It may be remembered that at the meeting of the Grand Junction Water Company on the 12th ult., a question was raised as to the charging of the extra expenses occasioned by the severe frost of the past winter. A sum of £6015 appeared in the accounts. But it turned out that this was not the entire amount spent by £6000; and the shareholders' Auditor (Mr. R. A. M'Lean) had some correspondence with the Directors on the matter. He learnt that it was their intention to spread the whole expenditure over two half years, though it had all occurred in the six months covered by the accounts; and he was told that the matter of the balance would be referred to at the meeting. Mr. M'Lean protested against this course, and accordingly appended to the accounts a note in regard to the item. This action gave rise to some criticism at the meeting, seeing that the Government Auditor and Mr. M'Lean's own colleague differed from him. An auditor's duty, in a case of this kind, has been the subject of some correspondence in the Money Article of *The Times*—a writer under the signature of "Chartered Accountant" expressing sympathy with Mr. M'Lean in his position. The latter gentleman has replied by giving a statement of the case, and concluding with the following points of general interest which, he says, arise thereon: "(1) That all loss sustained during a given period should be shown in the accounts of that period, no matter when afterwards repaired. (2) That the omission to show the whole loss cannot be justified by any private arrangement between directors and auditors to make future profits bear a part of it. Such a practice, if once sanctioned, is capable of unlimited abuse. In this case the whole loss could easily have been shown, one-half of it charged, and the intention to spread the other half stated. (3) That no promise from a board to refer, at a future meeting of shareholders, to losses sustained, but not shown, in these accounts, can justify an auditor in certifying those accounts to be correct. (4) That while auditors are bound, come what may, to secure truth and accuracy in accounts, a corresponding obligation rests on shareholders to support them in the performance of that sometimes delicate and trying duty. The extent to which that support may be withheld, through apathy, indifference, or design, is the measure of the encouragement which shareholders give to the publication of erroneous accounts."

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE IN IRELAND—CHANCERY DIVISION.

Friday, June 28.

(*Before the* MASTER OF THE ROLLS.)

Alliance and Dublin Consumers' Gas Company v. Corporation of Dublin.

The hearing of this action, which was brought by the Alliance and Dublin Consumers' Gas Company against the Corporation of Dublin to have the award of December, 1889, in relation to the meters attached to the public lamps, carried into execution and specifically performed by the Corporation (see *ante*, p. 42), was resumed to-day. The Company also applied for a mandatory injunction to compel the defendants to remove all defective meters from the public lamps, and to provide in lieu thereof proper meters within the meaning of the award, for the purpose of ascertaining the consumption and rate of consumption of gas supplied by the Company to the defendants, and for an inquiry as to the damages sustained by the Company by reason of the defendants' breaches of the award. The Corporation in their defence alleged that the meters were proper ones within the meaning of an award in an arbitration between themselves and the Company.

Evidence having been given on behalf of the Corporation, witnesses were called by the plaintiffs to rebut it; and the further hearing of the case was adjourned.

Saturday, July 6.

To-day judgment was given.

The MASTER of the ROLLS said the action was brought by the Gas Company against the Corporation; and the plaintiffs prayed to have an award dated Dec. 16, 1889, in reference to certain meters, carried into execution and specifically performed. They also applied for a mandatory injunction to compel the defendants to remove defective meters, and to provide in lieu thereof proper meters within the meaning of the award, and for an inquiry as to damages. He might say, as regarded the damages, that he had heard nothing in reference to them, nor anything that would suggest to him that there ought to be such an inquiry in any event. It appeared that plaintiffs had been supplying the city of Dublin with gas; and, in the course of the proceedings, a submission to arbitration was entered into, and an award was made which provided that the Company should sell, and the Corporation should purchase, the public lamps at a price to be settled by two arbitrators. Then it specified that the Corporation should "provide proper meters for all metered lamps." The average meter system was to continue to be used; the metered lamps to be one in every twenty. The short case on behalf of the Company was that the Corporation had provided defective meters, which were not in compliance with the award. The Corporation, in their statement of defence, said the meters provided were, within the meaning of the award, proper meters. On behalf of the defendants, it had been argued that another part of the award—in reference to a photometer—had not been complied with by the plaintiffs. But this had not been brought before him for decision; and it did not afford an answer to the claim of the plaintiffs. The award said: "The Corporation shall provide proper meters." In his opinion, some meaning must be attached to the word "proper" in the collocation in which it appeared. In the course of the discussion on the case, he intimated a very clear and concluded opinion that the stamping and sealing of meters under the Gas Acts was not conclusive as to the proprietary of the meters within the clause of the award; for the stamping and sealing required by the Act of Parliament was a legislative, statutory minimum of requirements, without which meters could not be issued for the purpose of regulating the relations of providers and consumers of gas. But this statutory requirement, without which no meter could be supplied for public use, seemed to have, in the contemplation of the parties to the award, something underlying the whole of it, but not at all determining the particular class of meters to be used for this specific purpose. The whole of the evidence showed that there were different kinds and qualities of meters—all of them satisfying the statutory requirements. It was not contended that the meters were proper meters within the award, if they were not rendered proper by the sealing of the Board of Trade authority. Nor, indeed, could it; because otherwise the very cheapest and most inefficient meter would fall within the terms of the award. But that there was something much further and more important was demonstrated by the clause which specified that the average meter system should continue to be in use. This system was that the consumption of gas was not to be the subject of complete measurement by meter, but that in lieu thereof, one lamp out of every twenty was to be provided with a meter. If it was a perfectly accurate meter, it made no difference whether it was applied to one or to twenty lamps; but if there were any inaccuracy in it, then the importance of the inaccuracy was measured, not by the consumption of one, but by the consumption of twenty lamps; in other words, any error must be multiplied by twenty. Now this was, in his opinion, the exigency of the award. The meters must not only be meters stamped and certified; they must be proper meters under all the circumstances. It appeared that the city of Dublin had been subject to the average meter system before, and the meters used were placed in the body of the lamp-posts; and it was said by the defendants that the same award which provided for proper meters provided also for the taking over by the Corporation of the existing lamp-posts, many of them being previously fitted with meters, and that it must be considered to have been within the contemplation of the Arbitrators that the new meters which were to be provided should take the place of the old ones, and should be of such a size as to fit within the lamp-posts. There were at present 188 meters; but the number of lamp-posts the Corporation took over which were fitted for the reception of meters was 1345. Therefore, as to about 1150, it could not have been within the contemplation of the parties that they should have been used for meters at all. The correspondence in the case showed plainly that the Company,

when they found that it was the intention of the Corporation to use small meters, were perfectly and absolutely astonished at such an intention; because this circumstance was proved by all the witnesses, that in no other city or place in the three kingdoms in which the average meter system had been adopted was there any instance of meters such as were employed in the present case being selected for the purpose—viz., small meters, limited in capacity by the position in which they were to be used, being located in the lamp-posts. It was a question of fact whether the meters that had been provided were, under all the circumstances, proper meters or not; and the onus of showing that they were not rested on the Company, who had produced a considerable body of scientific and practical evidence. He could not but regret that the Corporation did not act upon proper advice as to the kind of meters they should purchase. The Corporation were trustees for the public, and no doubt it was their duty to exercise a strict and proper economy over their expenditure; and he felt bound to say there was nothing in this case that was in any way discreditable to the Corporation, to their officers, or to the Gas Committee. He did not question their *bona fides*. But this was not the point. Their desire for economy might have led them astray in this instance. Whether it had or had not, this was a case in which a little liberality might have been very prudently and economically exercised. He passed from this to the evidence with regard to the absolute unfitness of the meters used. Having reviewed the evidence at considerable length, his Lordship remarked that upon it he had come to the conclusion that the vast preponderance of it was in favour of showing the inadequacy of the meters. Other matters had been introduced into the case, to which he wished briefly to refer. He had already dealt with the stamping and sealing; and on the question as to whether or not the meters were intended to be fitted into lamp-posts, he was of opinion that the Arbitrators had not this in contemplation when they made their award. With regard to the interview between the deputation from the Company and the Gas Committee of the Corporation, in view of the evidence adduced, he must hold that there was nothing definitely arranged at that meeting. How, then, did it come about that the Corporation ordered meters which were not proper ones? In his opinion, it was due entirely to over-economy. The more strained the relations between the Company and the Corporation were, the more important was it, in his opinion, that the Corporation should have exercised extreme caution in carrying out the award. The difference of cost would have been trifling. The cost of 188 meters supplied, at £1 5s. each, was about £230; and the cost of the underground meters, which would undoubtedly have been efficient and proper, would, at £5 10s. each, be about £1000. In February, 1891, long after the award was made, the Corporation were informed that the underground meters at £5 10s. were by far the best. The firm selected to supply the meters never dreamt of suggesting that they should supply the small overground meters. Their interpretation of the requirements of the Corporation was that they should supply the large meters in an iron box to be placed underground. They said "they were the best for the purpose, and could be relied upon," and that "they were by far the best." As regards the small meters, they said subsequently that "they might do"—that was to say, they might *not* do—but that "the others were by far the best." As he had said, he thought the more strained the relations were with the Gas Company, the more imprudent it was for the Corporation, in the face of this advice, not to have gone and shown the correspondence to the Company, and said to them: "What do you say about it?" If they had done this in the first instance, it was more than probable—indeed, it was quite certain—that the point at issue would have been raised before they were committed to the order and before the matter was closed. He did not pause to condemn, because it was not his business to do so; but he did refer to the circumstance that, in the correspondence and letters which appeared before him, the statement was conveyed to the Company by the Gas Committee of the Corporation that they had had an assurance that the meters provided were the very best that could possibly be procured for the purpose. This they stated in black and white. No doubt it was a mistake, but it was an important mistake, and one that ought not, under the circumstances, to have occurred. He was of opinion that the meters employed did not correspond with the award; that there was no legal answer to the action; and that there must be an injunction to the Corporation to replace them by others that should be proper meters under all the circumstances of the case.

Mr. W. Kenny, Q.C. (for the Company): Of course, that is a decree with costs.

The Master of the Rolls: The decree must go with costs.

Mr. Kenny asked that, having regard to the scientific witnesses that had been produced, the costs should be taxed on the higher scale.

Mr. C. O'Connor, Q.C. (for the Corporation), argued that taxation on the lower scale would meet all the witnesses' expenses.

The Master of the Rolls said he was not sure that it would; and he thought the case came within the order for costs on the higher scale. The plaintiffs were entitled to a decree in the terms of their petition, with costs. His Lordship added that it was to be regretted that the Arbitrators did not, in their award, exactly define the meter that should be used.

The Stroud Water Company's Debenture-Holders.

Last Saturday week, as already reported in the Journal, Mr. Justice Stirling made an order, in the action of a debenture-holder of the above-named Company, directing an account of what was due to the plaintiff and the other debenture-holders, and giving the Liquidator liberty to apply to the Court in regard to the payment of moneys coming into his hands. His Lordship was asked to enlarge the order by extending power to the receiver to pay the expenses of maintaining the Company's works; but he declined to do so, on the ground that he would not interfere with the direction of the Company. The application was repeated last Thursday before Mr. Justice Kekewich, who was hearing Mr. Justice Stirling's petitions. Counsel said the matter had become urgent; and if provision were not at once made to meet trade debts, the Company must cease operations. Though the request was supported by Counsel representing the Company, his Lordship refused to interfere; considering he had no jurisdiction practically to set aside his learned brother's directions.

Liability for the Restoration of Roads.

At the Chepstow Petty Sessions, on the 2nd inst., the Chepstow Water Company were summoned, at the instance of the Monmouthshire County Council, for breaking up a main road at St. Kingsmark, and not afterwards leaving it in a proper state of repair. The Company, through their Secretary (Mr. C. Evans), denied their liability, on the ground that the road had been opened by a contractor named Jones, who was erecting the St. Maur College. The County Surveyor (Mr. W. Tanner) stated that about 200 yards of the road in question had not been properly reinstated after the laying of the water-mains. The Bench asked Mr. Evans if he could refer them to any case which would put the responsibility upon Mr. Jones. Mr. Evans said he informed the District Surveyor that Mr. Jones had opened the road on his own account; and he began the work before the Company knew of it. The only part of the road the Company had opened was where a hydrant had been put in. Mr. Tanner said this portion, though included in the summons, had settled down properly. The Sessions Clerk remarked that if the Company were foolish enough to allow a contractor to interfere with their pipes, they must bear the consequences. Mr. Evans intimated that if the Bench decided against the Company, they would repair the road to the satisfaction of the County Surveyor. The Chairman (Mr. H. L. P. Lowe) said the Bench were unanimously of opinion that it was the duty of the Company to do the work, and that they were responsible. On Mr. Evans undertaking to put the road in repair within 14 days, only a nominal penalty of 1s., with 10s. 6d. costs, was inflicted.

Unlawfully Re-Connecting a Gas-Meter.

At the Bow Street Police Court last Thursday, Mr. T. Dudley, an Architect and Surveyor, of Lancaster Place, Strand, appeared before Sir J. Bridge, in answer to a summons charging him with a breach of the bye-laws of The Gaslight and Coke Company. Mr. H. Avory explained that the offence complained of was in contravention of section 64 of the Company's Act, which provided that before any person connected or disconnected a gas-meter with the Company's mains, he should give 24 hours' notice of his intention, or forfeit a sum not exceeding £5. The defendant had had his gas cut off no fewer than eight times in default of payment; and on one previous occasion he connected it again without giving notice. The Company, however, overlooked the offence. On the 6th of May last, the defendant's gas was again cut off; but on the 22nd of June it was discovered that the meter had been reconnected. This was a serious offence; and in similar cases people had been convicted of stealing the Company's gas. Evidence was called to show that when the gas at the defendant's place was last cut off, the meter showed a consumption of 11,100 cubic feet. When a meter inspector visited the premises on June 22, he found that a cap placed over the cut end of the service-pipe had been removed, and the pipe reconnected with the meter, which then registered 13,600 cubic feet. Mr. Johnson, on behalf of the defendant, said the Sheriff's officers were in possession of the premises. Everyone knew what they were like; and he suggested that they had connected the gas-pipes to enable them to smoke and keep warm. (Laughter.) Defendant was well known, and utterly incapable of committing the offence attributed to him. Sir John Bridge said it was evident the defendant must have known that the gas-pipes had been again connected, no matter by whom the work had been done. It was a serious offence; and he should fine the defendant £5, or, in default, 14 days' imprisonment.

Using Water for other than Domestic Purposes.

At the Bristol Police Court on the 5th inst., Frederick John Hawkes, of The Firs, Somerville Road, St. Andrew's, was summoned by the Bristol Water Company for, upon two occasions, using the water supplied by them for other than domestic purposes. Mr. C. J. C. Prichard, who appeared for the prosecutors, said defendant's house was supplied with water for domestic purposes, but not for watering the garden. On June 15 he was seen watering his garden with a hose, and also that of a next-door neighbour. Evidence was given in support of the case on June 15, and also with reference to a second occasion on June 27; the Company's officer stating that he did not warn defendant. His Honour Judge Austin said there was no reason why the defendant should not have been warned. It was quite possible that he was ignorant of the fact that he was committing any offence; and it was rather sharp practice to let him go on in his offence, and then "pull him up" for a second offence. The fine imposed would be 10s. and costs in the first case, and 1s. without costs in the second.

Brent Water Supply.—An inquiry was recently held by Colonel J. O. Hasted, on behalf of the Local Government Board, relative to an application by the Totnes Rural District Council for permission to borrow £850 for the improvement of the water supply of Brent. The question has been under consideration for some years. On a former occasion, the Rural Sanitary Authority sought powers to borrow £300 to bring in a stream of water; but the opposition was so great that the Local Government Board refused its sanction. It was now proposed to construct a reservoir of 5000 gallons capacity, and lay 4-inch mains from it to the village, a distance of 2280 yards. Mr. C. G. S. Acock, the Surveyor to the District Council, explained the scheme, and said the cost would be £813; and the result would be to just double the present summer supply. Opposition was offered on behalf of a majority of the Parish Council and a large number of ratepayers. The objections were that the supply, even if it doubled that now existing, would be insufficient; while the higher part of the district would be still, as now, without water.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

Dr. Williamson's Quarterly Report.

The following is an extract from the report of Dr. A. W. Williamson, the Chief Gas Examiner for London, on the quality of the gas supplied to the Metropolis during the quarter ended the 30th of June, 1895:—

I. *With respect to Illuminating Power.*—The maximum, minimum, and average results, in standard sperm candles, at each of the testing-places, were as follows:—

Testing-Station.	Maximum.	Minimum.	Average.
The Gaslight and Coke Company—			
21, Millbank Street, S.W.	17·3	16·1	16·4
123, Ladbroke Grove, W.	16·8	16·2	16·4
11, Devon's Road, Bow.		(Closed.)	
1, Carlyle Square, Chelsea	16·7	16·0	16·2
170, Camden Street, N.W.	17·0	16·1	16·5
14A, Graham Road, Dalston	17·3	16·3	16·7
47, Kingsland Road, E.	17·8	16·2	16·8
Spring Gardens, Charing Cross.	17·3	15·6	16·3
Grove Gardens, St. John's Wood		(Closed.)	
116, Lambeth Road, S.E.	16·8	16·0	16·1
121, Hornsey Road, N.	17·0	16·0	16·3
66, George Street, Hampstead Road	17·5	16·0	16·7
106, Fenchurch Street, E.C.	17·1	16·1	16·5
10, Kinghorn Street, Cloth Fair	17·0	15·8	16·4
1, Dorset Buildings, Salisbury Square	17·3	16·1	16·6
Commercial Company—			
6, Wellclose Square, E.	17·1	15·6	16·2
24, Parnell Road, E.	16·8	16·0	16·2
South Metropolitan Company—			
104, Hill Street, Peckham.	17·6	16·0	16·6
37, Bedford Road, Clapham	17·3	16·0	16·3
1, Stoney Lane, Tooley Street	17·6	16·1	16·7
180, Lewisham Road, S.E.	16·9	16·1	16·4
99, Blackfriars Road, S.E.	17·5	16·0	16·5
211, Burrage Road, S.E.	17·2	16·0	16·5

II. *As regards Purity.*—Sulphuretted hydrogen has not been present in the gas at any of the testing-stations. The proportions of sulphur in other forms than this were as follows:—

Grains of Sulphur per 100 *Cubic Feet of Gas.*

Testing-Station.	Maximum.	Minimum.	Average.
The Gaslight and Coke Company—			
21, Millbank Street, S.W.	8·5	4·9	7·0
123, Ladbroke Grove, W.	10·8	7·9	9·3
11, Devon's Road, Bow.		(Closed.)	
1, Carlyle Square, Chelsea	12·4	8·7	10·4
170, Camden Street, N.W.	13·5	9·0	11·9
14A, Graham Road, Dalston	15·5	10·0	12·2
47, Kingsland Road, E.	13·9	5·5	10·9
Spring Gardens, Charing Cross	11·3	4·1	6·9
Grove Gardens, St. John's Wood		(Closed.)	
116, Lambeth Road, S.E.	14·8	6·1	9·3
121, Hornsey Road, N.	12·2	8·5	10·2
66, George Street, Hampstead Road	16·7	8·8	12·0
106, Fenchurch Street, E.C.	17·9	8·0	11·7
10, Kinghorn Street, E.C.	13·0	8·7	10·4
1, Dorset Buildings, E.C.	12·3	7·3	10·3
Commercial Company—			
6, Wellclose Square, E.	10·3	4·1	6·2
24, Parnell Road, E.	8·5	4·4	6·0
South Metropolitan Company—			
104, Hill Street, Peckham	16·2	5·4	9·1
37, Bedford Road, Clapham	29·5	6·6	11·7
1, Stoney Lane, Tooley Street	15·7	6·3	9·2
180, Lewisham Road, S.E.	17·1	7·0	11·6
99, Blackfriars Road, S.E.	32·6	8·4	11·2
211, Burrage Road, S.E.	12·4	6·3	8·2

SOWERBY BRIDGE GAS UNDERTAKING.

Meter-Rents—The Extension of the Works.

At a recent meeting of the Gas Committee of the Sowerby Bridge District Council, it was decided to reduce the rents of two-light meters from 3s. to 2s. per annum; of three-light meters, from 4s. to 2s. 8d.; of five-light meters, from 5s. to 3s. 4d.; of ten-light meters, from 8s. to 5s. 4d.; and of twenty-light meters, from 12s. to 8s. It was further agreed that in future no more than 5 per cent. on the net cost be charged for the supply of new meters, the necessary connections, and fixing. On the same occasion, a letter was read from the Local Government Board in reference to the application of the Council for approval of the modified scheme for gas-works extension, requesting that the original sanction should be returned for cancellation, except as to the sum of £6409, the estimated expenditure on the modified scheme, and that a copy of the resolution of the Council directing the present application, together with an amended estimate embodying all the works which it is now proposed to carry out, be furnished to the Board. The Board also wished to know the age of No. 3 gasholder, and whether No. 2 holder was provided out of borrowed money. If so, when the loan was raised; and what amount, if any, was now outstanding. The Clerk was instructed to state that No. 3 holder was erected in 1879; and that No. 2 holder was provided out of revenue. Tenders for the erection of a third lift on No. 3 holder were afterwards considered; and it was decided to accept that of Messrs. Clayton, Son, and Co. On these minutes coming before the Council at their last meeting, Mr. J. Greenwood, alluding to the question of meter-rents, asked what the Committee were going to do with those consumers who had recently bought meters. He contended that anyone who intended buying a meter was at a very serious disadvantage to those who had already bought them. Anyone having bought a meter and wanting it repaired had to do it himself; and if the meter was taken back, a return was made upon it. During the past three years, the meters had had 12½ per cent. put on them; while those who had borrowed meters had nothing to pay. He urged that the meter buyer paid more than the meter borrower; and he considered it an injustice to the buyer, on whom 12½ per cent. was put, to lower the meter-rents, considering the small amount of gas which was consumed. The Chairman of the Gas Committee was not present to answer the question; but the Chairman of the Council said the Committee would leave as they were those persons who had purchased meters. The Committee did not think they had been unfairly dealt with in the past; and as the members were aware, those people who possessed meters were so few that there could be no injustice. The 12½ per cent. was what had been charged up to the present time. This had been running on for close upon 30 years; and hirers of meters had paid for them several times over. The percentage was now reduced to 8½. He moved the confirmation of the minutes, which was agreed to.

ELECTRIC LIGHTING NOTES.

The Eccles Town Council have been granted a twelvemonth's extension of the time in which, under the powers of their Provisional Order, they are to construct electric lighting works; and they have empowered their Electric Lighting Committee to incur the necessary expenditure for carrying out a scheme of lighting. The Electrical Engineer who has been consulted (Mr. Clirehugh) has projected works for public and private purposes which will involve a capital outlay of £18,971. His report is of a very sanguine character. He says that, if the Corporation adopt his proposal, there will be no charge on the rates, as, while the annual running expenses, including maintenance and machinery, interest on capital and payment to sinking fund, so as to pay off the loan in less than thirty years, would be £2066, the receipts would be £2590, or a surplus of £524. If the Council were to undertake the lighting of the street-lamps only, although the figures for capital outlay and annual cost would come up to not far short of the above figures, there would be a margin of saving (so Mr. Clirehugh says) as compared with the annual sum at present paid for the lighting of the street-lamps; the capital outlay being £15,000 in round figures, the annual cost £1560, as against an annual sum for gas lighting and other matters of £1690—leaving a margin in favour of electric lighting of £130, out of which, however, there would be a sum payable for rates and taxes.

The Tunbridge Wells Town Council are applying to the Local Government Board for sanction to borrow £12,000 for carrying out additional electric light works.

The Special Lighting Committee of the Liverpool Corporation have passed a resolution, recommending the Council to approve of an application to the Board of Trade for a Provisional Order, to enable them to supply electricity for public and private purposes "within the area of the city as the same may exist at the time of the granting of the Order."

The accounts of the first complete year's working of the Blackpool electricity undertaking have been presented to the Town Council. They exhibit a profit of £1604; the expenditure having been £3877, and the receipts £5481. The present output of current is all utilized; and the works are about to be extended. The Committee propose to acquire land between the electricity and gas works, and ultimately work the electric tramways from the same generating station.

At the meeting of the St. Pancras Vestry last Wednesday, Dr. J. Bell moved the adoption of a report of the Finance Committee recommending that £75,000 be borrowed from the National Bank, at 3 per cent. per annum, mainly for electricity purposes—repayment to be spread over a period of 42 years. It was explained that the total saving effected by obtaining the money from the bank instead of the London County Council would be £5626—the latter requiring 3¼ per cent. In regard to raising the loan by bonds issued by the Vestry itself, the Committee expressed the opinion that no advantage would result, and an initial cost of £500 would be incurred, as against £102 needed to effect the loan from the bank. Mr. E. Barnes moved, as an amendment, that the matter be referred back to the Committee. He maintained that, on the Vestry's own bonds, the money could be procured at 2½ per cent. Mr. Hodgson, in seconding the amendment, stated that the Corporation of York had recently secured a large sum on their own bonds at 2¾ per cent.; and he saw no reason why the St. Pancras Vestry should not be able to satisfy their financial needs at an equally cheap rate. Dr. Walter Smith advocated the consolidation of the whole of their debts and the issue of St. Pancras stock. Dr. Bell doubted whether the Vestry was a "corporate body" entitled to issue stock like a municipal corporation. The Chairman (Mr. J. Thornley, J.P.) stated that no Vestry in London had yet been able to borrow at 3 per cent. He incidentally mentioned that an additional loan to the extent of £100,000 would soon be needed for another electric installation. The original motion was carried by a large majority.

Prepayment Meters at Burslem.—The number of slot meters in use at Burslem is 600; and, according to a statement by Mr. Hulme at the last meeting of the Council, the price charged for gas through these meters is equally low with that supplied to the ordinary class of consumers.

Norwich Water Company.—The half-yearly accounts of this Company show that there is a sufficient balance in hand to pay a dividend at the rate of 6 per cent. per annum (deducting income-tax), and to carry forward £928. The late winter severely tried the resources of the Company; and at one period they sent into the City above 50 per cent. more water than the normal quantity. The Directors announce the death of their colleague, Mr. R. Fitch, who was until recently the Deputy-Chairman. The vacancy has been filled by the appointment of Mr. W. H. Black.

WATER-WORKS IMPROVEMENTS AT LEEDS.

The members of the Leeds Corporation yesterday week visited the city water-works in the Washburn Valley. Having reached Pateley Bridge by train, they drove to the head of the Washburn Valley, where they had an opportunity of inspecting the sites for the suggested two new storage reservoirs. The existing reservoirs have a capacity of 3907 million gallons; and the daily consumption in the city is about 24 millions. If, therefore, all the reservoirs were full, there would be sufficient water stored to supply the needs of the inhabitants for 163 days. But this is not considered sufficient, especially in view of the rapidly increasing consumption. A question, however, that is regarded still more seriously by the Corporation is the increasing expenditure incurred in furnishing an adequate supply of water to the higher districts of the city. Ten years ago a 100-horse power engine sufficed to do all the pumping required to get the water to the higher levels; but in the meantime these higher levels have been largely built upon. Thus, owing to the increased demand for water in these comparatively elevated districts, the cost of pumping has risen very considerably; and the Corporation are now confronted with the question whether they will be content to go on from time to time increasing their pumping power, or whether they will erect new storage reservoirs in the Washburn Valley at such an altitude that water could be supplied to the whole of Leeds (as it is at present to the lower portions) by simple gravitation. As to the matter of cost, the City Engineer (Mr. T. Hewson) is of opinion that, in a very short time, the annual cost of pumping will amount to more than would the interest on the capital necessary for the construction of the new reservoirs. The site for these reservoirs is at an altitude of about 800 feet, or over 200 feet above the present highest level of the Moortown and Bramley reservoirs; and there is a collecting ground of fully 4000 acres. After an hour's stay at the head of the Washburn Valley, the party were driven four or five miles farther down the valley to the Fewston and Swinsty reservoirs. Later on they proceeded to Harrogate, where dinner was served at the White Hart Hotel. In responding to the toast of his health, the Chairman of the Water Committee (Alderman Cooke) said the time had now fully arrived when active steps must be taken to secure a site for the future requirements of increased water supply, and to entirely abolish the costly process of pumping to the high-level districts. During the past year, there had been 5687 applications for new supplies of water. The total quantity of water supplied by meter for trade purposes in the city during the year was 1271 million gallons—an increase of 60 millions. The total consumption during the year had been 5,048,656,457 gallons—an average of 13,750,000 gallons per day. The renovation of the Eccup trench was proceeding very satisfactorily; the third and final section having been commenced. Plans were being prepared for new pumping-engines at Headingley; and the Committee were negotiating for the purchase of a site for a new service reservoir for Beeston.

THE SHEFFIELD CORPORATION AND THE LITTLE DON WATER SCHEME.

At the Monthly Meeting of the Sheffield City Council last Wednesday, the minutes of the Water Committee contained the following resolution: "That, as the Little Don portion of the Bill of the Dewsbury and Heckmondwike Water-Works Board has been rejected by the House of Lords, and the Bill of the Barnsley Corporation has not been passed by Parliament in this session, the Town Clerk be instructed to communicate to the Corporations of Rotherham and Doncaster that the Corporation of Sheffield are prepared to deposit and promote in the session of 1896 a Bill in accordance with the terms of the agreement of June 12, 1895,* between the three Corporations, for dealing with the whole watershed of the Little Don, for the supply of water in the manner, and for the purposes, set out in that agreement."

Alderman GAINSFORD, in moving the adoption of the minutes, said his motion involved the promotion of a Bill on the part of the Corporation, dealing with a probable expenditure of several hundred thousand pounds; and therefore he thought it was not right that he should simply in silence move a resolution of so much importance. The agreement of June 12 between the three Corporations of Sheffield, Rotherham, and Doncaster, settled the various conditions that should come into force if the Bills of the Dewsbury and Heckmondwike Board and the Barnsley Corporation were not passed by Parliament. The one had been, so far as the new works were concerned, rejected absolutely; and the other had not at any rate been passed by Parliament. The condition of things contemplated by the agreement had thus substantially come to pass; and it was proposed that the Council should now proceed to act according to the terms of the agreement that was sealed when they last met. If they did not do so, they would be taking a course that would be contrary both to the agreement and the interests of Sheffield. They needed for themselves the water of the Little Don Valley. They had been saying throughout, and would continue to say as long as there was any question raised about the matter, that Sheffield needed the water of the Little Don for herself. But, as he had freely stated, and as he thought the Council would agree, the requirements of Rotherham and Doncaster were very great, and had been proved to be great. The authorities of these places had applied to the Sheffield Corporation; but they could not supply Rotherham and Doncaster with any water whatever unless they had the control of, and parliamentary sanction for, the watershed of the Little Don. Therefore, as an absolute preliminary to their giving these towns the supply of water which they required, and the share of the water resources of the Don Valley which Sheffield had always admitted they had a natural right to, the Corporation must have parliamentary control over the whole of the watershed of the Little Don. It was simply to end the discussion that had taken place from time to time with regard to the ultimate destination of the waters of the Little Don Valley for a period of about thirty years, that they proposed to promote the Bill in Parliament. He thought there could be no question but that the proper destination of the water resources of the Little Don Valley was that which was set out in the agreement between the Corporations of Rotherham, Doncaster, and Sheffield. There was a way of using the waters without any waste for the benefit of the population in the valley. That, he said, was their proper destination, and that was the point which they proposed to submit to Parliament on behalf of the Corporation in the forthcoming session. The scheme which the Sheffield Corporation would probably be advised to deposit would be for two or more reservoirs, for utilizing the whole of the watershed. It was estimated that by the year 1931, Sheffield would not be satisfied with a quantity of water of less than 28 gallons per head per day, looking to the amount consumed in other towns, which was admitted in the Committee-room to be a reasonable figure. Between 1917 and 1918, there would be exhaustion of the existing and authorized works for Sheffield alone, which meant that the present power of supply was only a little over 13,000,000 gallons a day. Therefore at that period (when the quantity required would be 13,100,000 gallons a day) the works of the Corporation would be exhausted. If they decided that they were to give a supply to Rotherham and Doncaster out of existing resources to the extent that had been agreed upon—2,400,000 gallons per day—the whole of the Sheffield works would be exhausted, not in 1917, but in 1908. He was sure no one would contemplate that they should put themselves in such a position that their water supply would be exhausted at such an early date as that; and it was for this reason he remarked that, unless they obtained the powers proposed to be sought by the Bill, they could not afford to give Rotherham and Doncaster any supply of water whatever. He mentioned at the previous meeting of the Council the circumstance that the Barnsley Corporation proposed to take a portion of the water from the Little Don watershed, although they left a quantity of water unutilized. This took place at Ingbirchworth, on the Scout Dyke, which joined the Don at Penistone; and the Barnsley reservoir was not large enough to impound the waters that arose from the gathering-ground above this point. There was a quantity of water amounting to 700,000 gallons a day beyond what was or could be in the present condition of affairs drawn by Barnsley from the reservoir. The whole of the supply mentioned was not being utilized for any good purpose of water supply whatever. One of the points of the Corporation (and by no means the only one) in opposing the Barnsley authorities, was that before they had any shadow or ground whatever which would lead them to ask for water from anywhere else, they should make use of this 700,000 gallons per day of perfectly pure and good water arising from their own gathering-ground. It was suggested, in the course of the proceedings in London, that Sheffield was a very big and rich place—that it had better not talk about the small things, but leave them to the small corporations; and that it had better go farther afield, and make magnificent works like those of Manchester, Liverpool, Glasgow, and Birmingham. But to go farther afield would cost from 33 to 50 per cent. more per 1000 gallons than to take the water of the Little Don. Looking at the fact that the rates of Sheffield were already the highest of any town in the country, he was at a loss to understand what possible force there could be in the suggestion that Sheffield should deliberately give up water which was its natural heritage, and go farther afield, at a cost of some 50 per cent. more. That was a very good and sufficient answer, and one that they would not be afraid to submit in the proper place if occasion required.

The resolution was put, and carried without comment.

* See JOURNAL for June 18, p. 1329.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

At this period of political ferment, little attention is being paid to such prosaic subjects as are related to gas or water supplies; and consequently my "Notes" this week must be brief. Between gas supply and a parliamentary election, there is not so much affinity as there is when the election is a municipal one. Candidates therefore do not address themselves either specially to gas-workers or upon subjects connected with the gas industry. There was a notable, and a rather curious exception this week at Dundee, where two of the five candidates honoured the gas-workers with a special visit. Mr. John M'Crae was the natural chairman; and being in that position, he was able to take up the attitude of not indicating what his principles were. That was quite right; but I have not mentioned the curiosity of the business, which was that the first speaker, though soliciting parliamentary suffrages, devoted the whole of his time to a history of the gas undertakings, and their amalgamation when the community acquired them—a subject on which the workers might be expected to require no enlightenment, and upon which no amount of enlightenment would help them to discharge their duty at the polls. The incident is not worth following further in these pages; but it indicates very aptly how the roundest of men sometimes get into the squarest of holes, and points to the necessity there is, in public life, for the community not to accept everything that is uttered, but to exercise a critical judgment.

At the monthly meeting of the Perth Gas Commission this week, Mr. T. Whimster, the Engineer, reported that during the month of June the output of gas amounted to 3,398,200 cubic feet—an increase upon the output in June of last year of 292,200 cubic feet, which, in the dull season, shows how satisfactorily the gas consumption of Perth is rising. The yield, from coal and tar, was at the rate of 10,304 cubic feet per ton of coal carbonized. Using the Peebles oil process, the gas was enriched up to 27·40 candles.

The Dumfries Gas Commission have a balance at the credit of revenue for the past year of £515 8s.; and they have reduced the price of gas from 3s. 6d. to 3s. 4d. per 1000 cubic feet. A motion was made to the effect that the price of gas should remain at 3s. 6d., and that the 2d. should be applied to improving the quality; but only one man held the opinion that there was any necessity for improvement, and the

motion was not seconded. In 1878, when the Corporation acquired the gas undertaking, the price of gas was 5s. 10d. per 1000 cubic feet.

The Kirkcudbright Gas Commission, who have a mortgage debt over their works of £4300, had an income last year of £961, and an ordinary expenditure of £684; leaving £277 to meet interest. As, however, the amount required to do this was £297, there was a deficit of £19 15s.

It was reported to the Peterhead Town Council on Monday, that the output of gas during the last financial year amounted to 17,833,100 cubic feet—an increase of nearly 750,000 cubic feet over the output in the preceding year. The revenue from gas was £4159, as compared with £4339, which was accounted for by a reduction of 4d. per 1000 cubic feet of gas. The total revenue was £4575; and the ordinary expenditure, £2965. After paying interest on mortgages, &c., there was a surplus amounting to £618. Last year it was £596. A year ago, the estimate was for a surplus of £210, so that the expectation has been more than realized. For the current year, they have estimated a surplus of £392. The Commissioners again reduced the price of gas by 3d. per 1000 cubic feet, making it now 5s. 3d., which is equal to a reduction of 7d. in two years. This tells of excellent management; and it is gratifying to observe that the Town Council are conscious of the good services their Manager (Mr. J. Kincaid) is rendering them, as is shown in their advancing his salary by £20 a year.

During the five months in which they have owned the gas undertaking, the Falkirk Gas Commissioners have earned a profit of £198 on the working of the undertaking. That sum is to be carried forward. Nothing else could be done with it. It will doubtless be all required when the first annual balance is struck, for the formation of reserve or depreciation accounts, if for nothing else.

The Cupar Gas Company last year earned a profit of £965; and have paid dividends at the rate of 4 per cent. on the preference, and 7½ per cent. on the ordinary shares. A sum of £176 has been set aside for depreciation, and £100 has been added to the reserve fund; leaving £150 to be carried forward. The price of gas has been reduced from 4s. 7d. to 4s. 2d. per 1000 cubic feet. The shareholders, at their annual meeting on Thursday, resolved to have the Company registered as a limited liability one. It is evident that the Company, under the re-arrangements of two years ago, in which Mr. Adam Macpherson, of Kirkcaldy, took a leading part, have entered on a new lease of life.

The Denny Police Commissioners have an increasing business; the output of gas last month having been 8400 cubic feet more than in the corresponding month of last year. The Police Commissioners instructed the Gas Committee to consider as to what remuneration the Gas Manager and his assistants should receive for the extra work they did last winter on account of the frost. This is a sensible proceeding, which might be copied elsewhere.

The Bathgate Gas Company have closed a successful year; and have reduced the price of gas from 4s. 7d. to 4s. 5d. per 1000 cubic feet. Mr. R. Robertson, the Manager, who was President of the North British Association of Gas Managers when they met in Edinburgh in 1891, has been ill since the year began; but I am happy to say—and I am sure your readers will be glad to learn—that he is getting stronger daily, and is now, though still weak, able to attend to his duties.

The Irvine Gaslight Company had an income last year of £3100, and a sum available for dividend of £1129. The capital of the Company amounts to £8718, upon which a dividend at the rate of 10 per cent. has been paid. The price of gas has been continued at 3s. 9d. per 1000 cubic feet. A sum of £2359 has, in the last two years, been paid out of reserve fund for a new gasholder and tank; and the balance at the reserve fund is now £575.

Sulphate of ammonia is in less demand, which is quite natural, considering the season of the year. Few transactions are taking place; and the prices realized are slightly down—being £9 11s. 3d. per ton for spot delivery.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 13.

Sulphate of Ammonia.—Throughout the week, the market has been quiet; and the tendency of prices has been in favour of buyers. Production is, of course, just now very limited. But demand, too, has been only moderate; and dealers' low quotations to consumers have had a damaging influence upon the market, so that, at the close, the quotation f.o.b. at the ports is £9 10s. to £9 12s. 6d. per ton. At about spot prices, there no doubt would be large buyers for forward delivery; but the figures are too low for even "bear" sellers to risk in the forward position; and makers will not look at them.

Nitrate of Soda remains quiet, at 8s. 3d. per cwt. for fine quality; and forward delivery is unchanged.

LONDON, *July* 13.

Tar Products.—With the exception of pitch, which keeps in fair demand, this market is as dull as it could well be. Benzols are flat and unsaleable; and while solvent naphtha is being delivered freely on contract, it is not easy to sell at full values for forward. The same remark applies to carbolic acid, which was readily sold a short time ago; but to-day the position is distinctly languid. Anthracene maintains the Product Committee's prices; but no business of importance is reported. Important tar contracts are said to have been let at prices ranging between 17s. 6d. and 21s. 9d., according to position and quality of tar. Other prices are: Pitch, 35s. to 37s. 6d.; Benzols, 90's, 1s.; 50's, 11½d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d.; salts, 18s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 5½d. Anthracene, nominal, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia does not recover as it was hoped it would during the summer months. There is a distinct "bear" operation in this market; and dealers seem able to do as they like in the way of prices. But having regard to the nitrogen value of nitrate, sulphate certainly should be held. Transactions during the week have taken place at £9 10s. to £9 15s., less 3½ per cent. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The only important gas-coal contract in this district now remaining to be settled is that of the Salford Corporation; and I was informed on 'Change that inquiries made by the representative of one colliery that had sent in tenders, elicited the fact that the contracts were not likely to be settled for several weeks to come. One or two similar contracts have been concluded during the last week or so; but prices have shown no appreciable variation from those I have already quoted—ranging from 6s. 6d. at the pit mouth for good qualities of screened four-feet, to 7s. for partially screened or through-and-through gas coal. Perhaps one of the most extraordinary features in connection with gas-coal contracts is that they should be made a matter of political controversy; but this has been the case with regard to the tender sent in by one large concern — the Chambers collieries—for the contract at Oldham. Of course, just now political excitement runs very high; and allegations have been freely made that the Chambers colliery tender has not been accepted because of political opposition in the Council. Placards have been posted about the town giving the names of the Conservative members who are in favour of accepting the tender, and the Liberal members who are against it, with the result (I am informed in a semi-official way) that the Chambers tender has been accepted, subject to subsequent confirmation by the Council. With regard to the round coal trade generally, business all through continues excessively quiet; and to avoid further accumulations of the already heavy stocks which are held at most of the collieries, the pits in a great many cases have not been running more than two or three days per week—four days representing about the full average anywhere. Where business of any weight is to be got hold of, prices are weak and irregular; representatives of collieries in most cases being ready with concessions upon the nominal list rates. At the pit mouth, best Wigan Arley coals are only fetching more than 10s. per ton in special cases for small lots; with second qualities and Pemberton four-feet averaging about 8s. 6d. to 9s.; and common coals ranging from 6s. to 6s. 6d. for steam and forge qualities, up to 7s. and 7s. 6d. for common house-fire descriptions. The excessive supplies of round coal now upon the market are naturally making themselves felt in the shipping trade, where rates are being cut lower than ever; and Yorkshire coal is coming into this district at prices which even Lancashire coalowners are not in a position to touch. Ordinary steam coal delivered at the ports on the Mersey can be bought readily at 7s. 3d. to 7s. 6d. per ton; and the very best qualities scarcely average more than 7s. 9d. Engine fuel moves off fairly well; but although the present output of slack is in most cases insufficient to meet the requirements of customers, there are large quantities held in stock which come upon the market at low figures, and prevent any upward move whatever. Good ordinary slack is readily obtainable at about 3s. 6d., and better qualities at about 4s. 6d. per ton at the pit mouth.

Northern Coal Trade.—There is an increased demand for coal, both of best steam qualities and of gas coal, during the last few days; but that for the latter is still a long way below the average consumption. Best Northumbrian steam coals are in good request for export; and the price is well maintained at 8s. 9d. to 8s. 10½d. per ton. Pits producing other kinds of steam coals are, however, only moderately at work. Steam small coals are quiet at from 3s. 3d. to 3s. 6d. per ton. For manufacturing coals there is only a moderate demand, with no alteration in price. Gas coals are in a little better request. Deliveries have now begun on a large number of contracts, the price of which ranges from equal to 6s. to 6s. 4d. per ton f.o.b. Sales of odd cargoes for shipment are at prices that vary more—from 6s. 3d. to 7s. per ton being quoted, according to the position of the collieries and the quality of the coal. Many of the coalowners, however, already complain of the prices they are receiving—prices which are scarcely likely to yield much profit; and though some concession in wages may be asked, any issue of such a request will be only doubtfully arrived at. Coke is on the whole steadier; the best Durham qualities being quoted at 13s. to 14s. per ton f.o.b. Exports are about up to the average, mainly to Spain and to the Baltic. There is no alteration in the price of gas coke this week; but the production is now naturally very small, though slightly increasing.

Scotch Coal Trade.—There is an absence of demand for all classes of coal which is giving some anxiety to owners, as this is a season—being immediately before the miners' holidays—when the demand always shows an improvement. For the next fortnight little work will be done in the pits; and in this way accumulations will be slightly reduced, but not much, as consumers of coal will also be largely on holiday. After the holidays, there must either be an improved demand or a lowering of prices, which would bring about trouble with the men; most probably it will be the former. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments now compare with the attenuated figures during the miners' strike last year. For last week, the quantity shipped was 171,114 tons—an increase upon the quantity in the preceding week of 6312 tons, and of 143,857 tons upon the corresponding week of last year. For the year to date, the total quantity has been 3,458,589 tons—a decrease upon the quantity in the same period of last year of 161,951 tons.

New Joint-Stock Companies.—The Harrow Electric Light and Power Company has been registered with a capital of £25,000, in £5 shares, to take a transfer of all or any of the powers, duties, and liabilities by the Harrow Electric Lighting Order, 1894, granted to, and imposed upon, the undertakers therein mentioned, and to carry on business as suppliers of electricity at Harrow, Middlesex, or elsewhere. The Anglo-French Process Company, Limited, has been registered with a capital of £5000, to erect and maintain plant and apparatus for the manufacture of gas, and to carry on the business of a gas company. A Company has been formed in Brussels, with a capital of £40,000, for carrying out incandescent gas lighting on the Verstraeten system.

The Warwick Corporation and the Gas-Works.—The Warwick Gas Company having been approached upon the question of disposing of their property to the Corporation, the Directors have intimated to the latter that they are averse to the proposal, but they would be willing to consider any offer that might be made.

An Anomaly in Gas Supply at Newmilns, Ayrshire.—In the small weaving town of Newmilns, a few miles from Kilmarnock, there are, strange to relate, two Gas Companies; and yet the population of the area supplied is probably less than 4000. A few days ago the Directors of the two Companies held a joint meeting to consider the price of gas, with the result that they agreed to increase it ½d. per 100 cubic feet, which will bring it up to 4s. 7d. per 1000 feet. Some definite line of action between the two Companies has also been resolved upon in regard to the discounts to be allowed to large consumers. Surely the anomaly of having two gas undertakings in so small a community is to be traced back to the Flintoff agitation of about forty years ago.

The Gas Industry at Saltcoats.—The quantity of gas made at Saltcoats, Ayrshire, last year was 12,756,300 cubic feet, as compared with 12,122,500 cubic feet in the preceding twelve months. It is said that the bulk of gas now produced per annum is exactly twice as large as it was in 1886-7. There is no change to report in the price of the gas, which remains at 3s. 9d. per 1000 cubic feet; the charge for street-lamps being two-thirds of that amount. The ordinary revenue of the Company in the past year was £2416; the expenditure, £1608. The quantity of coal used was 1328 tons; its average price being 10s. 10·11d. per ton. At the recent annual meeting of the Company, a dividend of 7½ per cent. was declared, as compared with 6⅔ per cent. for 1893-4.

Yeovil Gas Company, Limited.—In the report of the Directors of this Company to be presented to the shareholders at the annual general meeting on the 29th inst., it is stated that the profit on the year's working, with the balance brought forward, amounts to £2779. Out of this an interim dividend of 5 per cent. was paid in February last, and the Directors recommend a further dividend of 5 per cent., free of income-tax. The Directors have reduced the price of gas by 2d. per 1000 cubic feet; bringing it down to 3s. 4d.; and a corresponding reduction has been made in the charge for street lighting. The works, under Mr. Edward Howell's management, have been maintained in good working order. The quantity of gas sold by meter (28,723,000 cubic feet) realized £5026; for public lighting (3,800,000 cubic feet), £738; and residuals produced £1280—the total revenue being £8629. A sum of £2664 was spent for coal and cannel (3325 tons); £816 for wages and salary; £682 for repairs and renewals of plant; and £227 for retorts and fire goods.

Eastern Counties Coal Boring and Development Association, Limited.—The first ordinary general meeting of this Association was held at Ipswich last Tuesday week—Mr. R. C. Rapier in the chair. The Directors reported that shares to the value of £4824 had been subscribed, and a site suitable for operations selected on the Suffolk side of the River Stour. A contract had been concluded with Vivian's Boring and Exploration Company, Limited; and work was commenced by them on Nov. 26 last. The chalk was reached at a depth of 72 feet from the surface; and the total depth bored to the 8th ult. was 938 feet. For 448 feet of this depth the work was of a very difficult character, owing to the great number of flints encountered. The borehole had passed 373 feet into the grey chalk. The Directors considered the rate of progress had, so far, been very satisfactory; and it was hoped that a few months more of steady work would carry the first hole to a sufficient depth. In moving the adoption of the report, the Chairman stated that Mr. Whittaker, F.G.S., one of the Consulting Geologists to the Association, had recently visited the boring, and had given very careful consideration to the results. In rendering assistance, Mr. Whittaker had the assent of the Geological Survey of England and Wales; and the officials were taking the liveliest interest in the Company's proceedings, and were perfectly willing to render all the help in their power. The only thing remaining was to persevere with the work; and so soon as the Directors had any satisfactory news to communicate to the shareholders, they would have very great pleasure in informing them thereon. The report was adopted.

European Gas Company, Limited.—The annual general meeting of this Company was held yesterday at the London Offices. The report which was submitted by the Directors mentioned that various unfavourable circumstances had prejudicially affected the business during the year, with the result that the aggregate rental at the seven stations showed a reduction of 1½ per cent. Among the causes of this decrease was the early closing of shops in provincial towns during the severe weather in the month of February; and the Company had now, with one exception, to contend with the electric light at all the stations. The Directors had, in many cases, been able to meet this competition by incandescent gas-burners, and by making special concessions in price to large consumers. The number of consumers on the Company's books was stated to be constantly increasing; and the Directors were trying to extend the use of gas among small householders by introducing prepayment meters at three of their stations. At Nantes, the cost of coal had been enhanced by the increased dues levied by the Municipality. This increase, the report said, was a matter of considerable importance to the Company, as it represented an additional charge to the Nantes works of nearly £2000 per annum. Finding they could not come to an amicable arrangement with the Municipality, the Directors had reluctantly felt it incumbent upon them, in justice to the shareholders, to institute proceedings to have the question tested in a Court of Law. With reference to financial matters, the Directors had found it possible to reduce the amount hitherto set aside each year for the depreciation and redemption of capital, which would leave a larger amount of profit for distribution. In spite of the disadvantages under which the Company had laboured during the year, the usual dividend was recommended—viz., 20s. per share on the fully-paid shares, and 15s. per share on those on which £7 10s. had been paid (less the interim dividend of 8s. and 6s. per share respectively), and also the payment of a special bonus of 1 per cent. The report was adopted, on the motion of the Chairman (Mr. J. Blacket Gill), seconded by Mr. N. E. B. Garey. The Directors' statement, with a fuller report of the proceedings, will be published next week.

The Gas-Works Purchase Question at Ossett.—The Ossett Town Council yesterday week resolved to promote, in the next session of Parliament, a Bill enabling them to acquire the works of the Gas Company, and to establish an electric lighting plant.

The Ystrad Gas and Water Company have intimated to the Rhondda District Council that they are willing to sell their water undertaking at a fair value. The Directors aver that the statement recently made that they were unable and unwilling to supply a reasonable quantity of water is erroneous.

The Gas-Works Extensions at Bergen-op-Zoom.—In the JOURNAL for the 18th ult. (p. 1321) reference was made to the extensions which are to be carried out at the gas-works at Bergen-op-Zoom, in accordance with the plans and under the supervision of the Engineer (Herr Asselbergs). They comprise a two-lift gasholder of a capacity of 4000 cubic metres (about 150,000 cubic feet), which is to be completed before next winter. Eleven tenders have been sent in for this work from English and Continental firms. The highest was for 34,250 fl.; the lowest, for 26,000 fl. The latter offer was made by Herr F. A. Neuman, of Aken and Eschweiler; and it has been accepted. It includes all accessories and incidental expenses.

The New Water-Works for Mansfield.—Commenced some months ago, the new water-works of the Mansfield Corporation at Rainsworth have been pushed on with all possible speed; and, as we announced lately, a temporary supply has already been provided from the new source by means of a scheme suggested by the Engineer (Mr. G. Hodson) and the Chairman of the Water Committee (Alderman Barringer). The supply from this source amounts to about 300,000 gallons in 24 hours; while, in addition, there is a supply from the old works, which, however, can only be worked a few hours a day. When the permanent machinery is laid down, the yield from the new well will reach upwards of 900,000 gallons per day. The reservoir will have a storage capacity of 800,000 gallons; and the whole work is expected to be completed in about nine months. A few days since, the Town Council proceeded to the site of the works at Rainsworth in brakes, and witnessed the laying of the first stone by the Mayor (Alderman Alcock); and the event was celebrated in the evening by a dinner at the Town Hall.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 134.)

Issue.	Share	Whe ex-Dividend	Dividend or Div., & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22 - 23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15—16	..	4 13 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	6¾—7¼	..	4 9 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	250—255	..	4 10 2
180,000	,,	,,	8½	Do. New	100	200—205	..	4 2 11
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220—225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	122—125	..	4 0 0
320,000	20	28 Mar.	11¼	British	20	53—54	..	4 3 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7½—8	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	99—102	..	5 17 8
150,000	20	11 July	8¼	Cagliari, Limited	20	26—27*	..	6 2 3
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	292—297	..	4 10 10
165,000	,,	,,	10½	Do. New o.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	+1½	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	255—260	..	5 0 0
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	+3	4 0 9
486,090	10	31 Jan.	11	European, Limited	10	24½—25½	..	4 6 3
354,060	10	,,	11	Do. Partly pa d	7½	17—18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	282—287	−3	4 3 7
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	+3	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190—195	..	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	130—133	+1	3 0 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	198—202	+7½	2 19 4
3,800,000	Stck.	10 May	12	Imperial Continental	100	248—252	+½	4 15 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5½—6	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	16—17	+½	5 17 8
150,000	5	24 May	8	Oriental, Limited	5	7—7½	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾—5¼	..	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	9—10	..	7 0 0
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	302—307	+2	3 18 2
290,000	,,	,,	13	Do. C do.	100	307—312	..	4 3 4
775,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172-176*	+4	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	235—240	..	3 6 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	155—160	+3	2 16 3
700,000	50	26 June	7	Grand Junction	50	113—117	..	2 19 10
708,000	Stck.	14 Feb.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	258—263	+3	2 17 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	207—212	+2	3 10 9
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	+6	2 13 4
500,000	100	14 Feb.	12¾	New River, New Shares	100	375—385	..	3 6 2
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	145—150	+4½	2 13 4
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157—163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	135—140	..	2 17 2
1,155,066	Stck.	12 June	10	West Middlesex	100	288—293	+3	3 8 3
						Ex div.		

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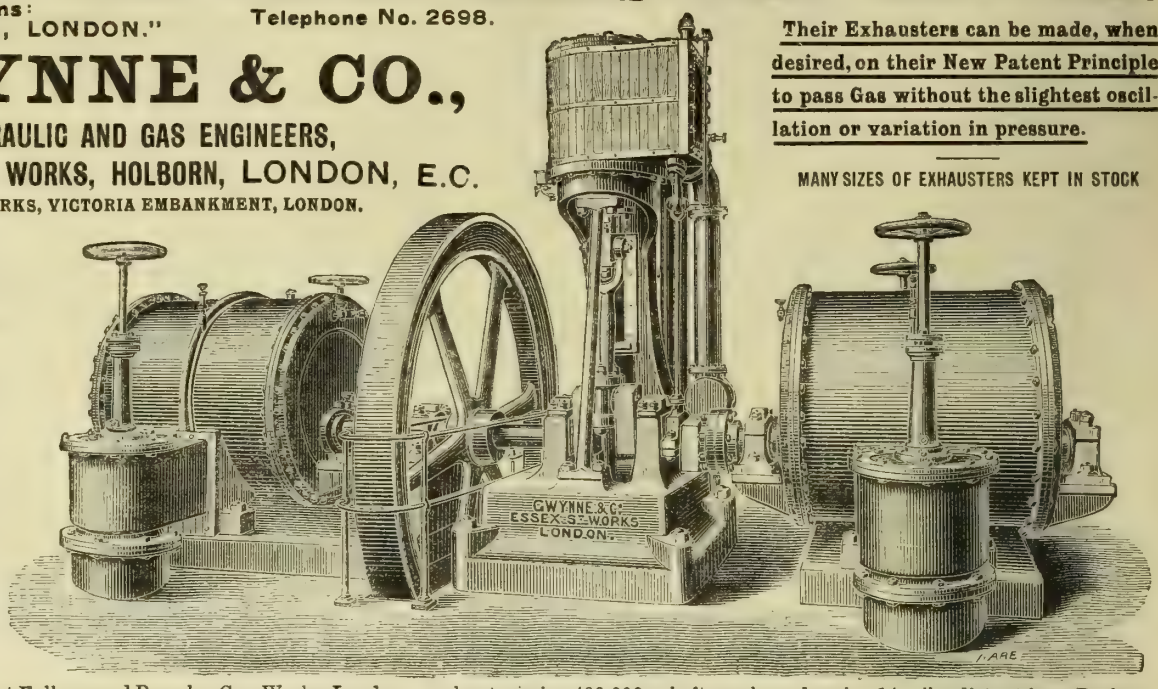

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EDITORIAL NOTES.

The General Election and Labour Politics.

THE General Election now in progress has advanced far enough to show what will be the character of the new House of Commons, and consequently what will be the general policy of the new Administration. It is not for us to say anything about questions of party politics; but it is impossible to pass over without recognition and some little comment the most salient feature of the polls that were held during the past week throughout the majority of the English boroughs, including London. This was the almost clean sweep made by the constituencies of the old representatives and new candidates who had identified themselves with Progressivism, Socialism, Trade Unionism, and all the other noisy and hare-brained sections of what was vainly imagined to be the "Popular" cause. Nobody could have known, until the test was applied, that the wishes and sentiments of British democracy were so completely misrepresented by the mushroom crop of politicians who during the last few years have styled themselves the leaders of the "People." The dominant party in the London County Council had a warning of their growing unpopularity in March; but what was then no more than a check and a withdrawal of their supposed "mandate" has now become a total rout. Progressivism throughout the country has had a reverse that may possibly chasten its mouthpieces in the Senate, the Municipal Council Chamber, and the Press; while the friends of real progress may justly take heart at the assurance they have received that the people of this country are nowise inclined to quit the ordered path of "Freedom "slowly broadening down from precedent to precedent," and embark upon a career of reckless experimental legislation inspired by the spirit of foreign-made Socialism. The men who organized the attack upon the London Water Companies, and would have gone on to sap the strength of the Gas Companies, are gone. Those who took the interested clamour of professional Trade Union chiefs—and the rawest of the order at that—for the truth of working-class sentiment, have been dismissed from the political eminences which they had gained or aspired to occupy by sheer force of audacity. Bearing in mind the actual preponderance in British borough constituencies of the workman voter, the ridiculous show made at the polls by independent Labour candidates and others who fondly thought they represented his views and aspirations, is nothing short of a revelation.

Digressing from this theme for a moment to remark with a satisfaction that will be shared by our readers that the special interests of the gas industry will be well represented in the new Parliament, if occasion should arise, by such sterling friends as Sir Julian Goldsmid, Mr. W. Woodall, Mr. John Aird, Mr. D. F. Goddard, and others, what is the correct inference to be drawn, not only as regards the prospects of the gas industry itself, but of every industry in which Englishmen earn their bread, from the discredit and defeat that has so opportunely overwhelmed the short-sighted instigators to industrial revolution and economic disaster? Simply, as Mr. George Livesey points out in the timely letter which appears in another part of the JOURNAL, that the natural and proper leaders of the forces of industry should take advantage of the inauguration of a period of comparative political and industrial peace, to make Capital and Labour friends for good and all, so that the discomfited agitator's place may know him no more when he recovers from his discomfiture. Surely, there is no fundamental difference between Mr. Livesey, Mr. W. Carr, Mr. M'Crae, and Mr. Stelfox—who, by the way, further explains his views to-day—and the other "good men and true" who have from time to time discussed the Labour Question in our columns, as to the righteousness of the policy of "live and let live," and the necessity for expanding the data of industrial economics to suit all worthy modern industrial developments.

The Report of the Standards of Light Committee.

THE issue of the report of the Standards of Light Committee as a parliamentary paper places this important contribution to the available store of information upon the subject at the command of every member of the gas engineering profession. The text of the report was made public in the form of an appendix to the communication

of the Secretary to the Committee—Professor Vivian B. Lewes—to the last meeting of the Incorporated Institution of Gas Engineers, and was noticed in these columns at the time. The parliamentary paper gives this text, supplemented by some valuable statements, and reports of the evidence taken by the Committee. The first witness invited to assist the Committee in their deliberations was Mr. G. T. Miller, whose evidence was required as to the changes that have taken place in the manufacture of sperm candles since 1876. A good deal had been said on different occasions upon this point, in support of the incontrovertible thesis that there are "candles and "candles." Some averred that candles are better light-givers now than they used to be; others that the reverse was the case. Mr. Miller's first words on the matter were that while the aims of the chandler had remained unchanged, his methods and appliances had been altered. The information given by the witness respecting the manufacture of sperm candles forms interesting reading, apart from its technical value, which is, of course, great. Then Mr. Vernon Harcourt gave the Committee some information on the subject of the manufacture of candle wicks. Mr. Vernon Harcourt's one-candle pentane standard came before the Committee at an early stage of the inquiry; and all the evidence obtainable at the time of the appointment of the Committee, as to the relative value of this standard and the light emitted by an average standard candle, is now given in summarized form. The one-candle unit led up to the ten-candle standard proposed by Mr. Dibdin; and this, as is known, commended itself to the Committee as the best available working photometric standard. The last portion of the paper consists of a report of the evidence and recommendations offered to the Committee by a deputation from the Incorporated Institution of Gas Engineers and the Incorporated Gas Institute. These proceedings were of considerable interest, and were characterized by the strong effort made by Mr. Hunt to secure acceptance of his views as to the best method of testing gas. Something as nearly like a controversy as the circumstances permitted took place over this question, and also in regard to one or two other suggestions made by different members of the deputation. The alteration of the method of testing gas actually recommended by the Committee in the thirteenth and final paragraph of their report is a compromise. Every gas manager and photometrist should hasten to procure a copy of the paper, and ponder its contents. Legislation will be necessary to carry the recommendations of the Committee into effect; and there is yet time to discuss them further, if this is deemed desirable in the interests of the gas industry or of the public.

M. de Lachomette's Address to the French Gas Managers.

In another part of the present issue of the Journal will be found an abstract report of the proceedings at the recent congress of the Société Technique du Gaz en France, translated from the account published by the official organ of the Society. M. de Lachomette presided, and delivered an address to which reference has already been made in these columns. In addition to that brief comment, we desire now to draw our readers' attention again to the sterling quality of M. de Lachomette's technical observations on the changes that occur in gas coal during storage, as well as of those upon other points of interest to the gas engineer. Intense practicality is throughout the note of the address, which from end to end does not contain a morsel of "padding." M. de Lachomette treats of the formation of naphthalene, among other matters; and he gives his adhesion to the hypothesis that this troublesome substance is formed exclusively during the process of carbonization, and is never formed afterwards. This opinion is probably just; but unfortunately the address does not contain convincing information as to the best way of arresting the naphthalene in parts of the plant where it can do no mischief. It is interesting to note that M. de Lachomette favours the use of a thermo-syphon as a means of keeping gasholder tanks free from ice during severe weather. This device has the recommendation of not requiring steam, which may be a consideration for small works; but, on the other hand, it cannot deal otherwise than indirectly with the water in the gasholder cups. The subject of distribution, of which the question of unaccounted-for gas is a branch, is treated of by M. de Lachomette in a manner that indicates the "solidarity" of the French and British technical position in this regard. A new departure in gas-works adminstration signalized in the address is the appointment of a lady as inspector of gas-stoves at Bayonne. It is declared—and the statement may well be believed—that this experiment has been attended with satisfactory results. The address refers to the old difficulty of the freezing of consumers' wet meters; discussing several suggested remedies for the evil, among which, however, the adoption of dry meters is not to be found. Will anybody say why it is that there is no market for the dry meter in France?

M. de Lachomette's concluding remarks are instinct with homely, solid wisdom. "Act always in accordance "with the teaching of experience," he says; "but do not "pay too dearly for it. Learn from the experiences of "others; and do not forget to study." So we may paraphrase his counsel; but there is one little bit of advice which deserves to be repeated here verbatim: "Notwith-"standing all our knowledge, there are some very simple "facts which lie close to us in our path, yet of which we are "ignorant, simply because we have not learnt to see them." It is the old, yet ever new and necessary lesson of the value of the "seeing eye," which needs to be constantly borne in mind in this age of much instruction and imperfect education. The wise man in every calling is not he who has been taught, but he who has perceived. The careless, indolent man kicks a pebble out of his path a hundred times; and then another man comes along and sees it is a diamond. Last of all, the man of the schools examines the discovery, and certifies its value. Such is the way of the industrial world.

The Affairs of the European Gas Company.

The report of the Directors and the speech of the Chairman of the European Gas Company, Limited, presented and delivered at the annual general meeting of proprietors on the 15th inst., and reported elsewhere, give a clear view of the condition of the gas industry in those Continental regions where the Company do business, There has been some slight falling off in the aggregate revenue derived from the seven stations of the undertaking, due partly to climatic influences, and partly to the competition of electric lighting. Curiously enough, during part of the winter the weather was too mild to suit the Company; and for the remainder of the season it was too severe. At first it was impossible to get rid of coke except at a reduction in price; and then the frost became so intense that, though coke sold at prices which made the managers regret they had tried to reduce stocks, gas became a drug, owing to the dulness of trade. People could not get about while the Arctic weather lasted; and so the shops shut early, and everybody went to bed betimes, to the loss of the Gas Company. The Directors make no effort to conceal the damage that electric lighting has done their business in some centres. The incandescent gas-burner notwithstanding, some factories and large *cafés* will have electric light; and it takes a good many small consumers—whose number is, however, increasing—to make up for a big defection of the former order of consumers. The Chairman (Mr. J. Blacket Gill) told the shareholders at the meeting that, in going his round of the stations, he was struck by the great inroads electricity had made among the consumers. "The *cafés* were their most important "customers"—and the *café* frequenters would have electric lighting, at whatever cost to the proprietor.

It is satisfactory to observe that Mr. Gill did not allow this statement to escape him without attaching to it an explanation which goes to the very root of the difference between the circumstances of a Continental Gas Company and one at home. The fact is that on the Continent the position of gas lighting in the popular economy has not been very different, if at all, from that now being sought by electricity. It has been regarded as a luxury; and the idea of charging a popular price for it has been rendered impracticable in many places by the action of the local authorities in making the gas company pay heavily for the privilege of existence. Indirect is preferred to direct taxation on the Continent; and gas has seemed to the national and municipal authorities an ideal subject for taxation to the last extremity, because the consumers were, almost without exception, well-to-do householders, and the companies, as a rule, flourishing. It is notorious how in Paris itself the Municipality force the Gas Company to charge an exorbitant price for gas, in order that their

share of the excessive profits may be large; while at the same time the local politicians curry favour with the populace by denouncing their partners in extortion. So in such places as Havre and Nantes it is still the large *cafés* and principal shops and factories that support the Gas Company; for, after all these years, gas is still a luxury in the estimation of the poor and thrifty private resident. These large consumers are the first to throw a company over if they can gain the merest trifle by so doing; and yet they are the most exacting of customers while they remain on the company's books. In England, the *café* does not bulk so largely in the estimation of the gas manager as is the case in France; but the factory is everywhere almost as great a source of trouble as its custom is worth. No doubt a good general connection is vastly preferable to a few large public-house and factory accounts.

The Railway Congress—A Bright Example.

The Railway Congress that has just been held in London, and also spread itself pretty extensively over all parts of the United Kingdom, appears to have been a great success. It presented several features of interest to those who are familiar with gatherings of a similar character, from which some lessons are to be drawn for use later on. The most striking of these peculiarities of the Congress was the frank way in which it was conceded that the main object of the gathering was the bringing together of a number of men of the same calling. The element of formality in this process was reduced to the minimum. Lists of papers were prepared, it is true, by sectional Committees; but none of these communications was intended to be read in public meeting. The members were supplied beforehand with prints of the papers; and the whole of the time of the sectional meetings was devoted to discussion only. There were no presidential addresses; but instead there were any number of excursions far and wide, including what may be called a grand parade before Her Majesty the Queen. And now all the visitors are bearing testimony to the thorough enjoyableness and instructive nature of the whole affair. This bears out what we have always observed in respect of gas managers' meetings. Technical papers, when they are good, are very useful; and success in obtaining an unfailing supply of these productions is a proof of the utility of a society, and of the devotion and popularity of the Secretary. But discussions are equally, or even more, desirable; and opportunities for the full and free converse of kindred souls are best of all. It is to be hoped that the bright example of the Railway Congress will be improved upon by some dry-as-dust technical societies we wot of, but refrain from naming, whose managers seem to regard dulness as a guarantee of respectability.

The Cheapness of Money.

The enormous appreciation of first-class investments that has aroused so much attention of late wherever merchants and financiers "most do congregate," can only be fully explained by reference to a vast number of considerations and influences that have co-operated to produce this remarkable result. The steady advance in the value of gas stocks which we have had to record week after week must have struck everybody even remotely interested in the industry as a really wonderful sign of the times. Some have thought that the South Metropolitan Bill, by giving greater publicity to the financial strength of the largest gas undertakings, helped to attract purchasers to the limited gas stock market; and this may partially account for the high price of this order of investments. But no accident of this kind would have availed to force up the value of gas property if there had not been a plethora of money for which it was impossible to find safe and profitable employment. Some noteworthy observations on this head were recently made by the Chairman of a large Discount Company, on the occasion of the half-yearly general meeting of proprietors. It was then stated that the Company had again gone through the whole of the half year with what had been called the dreary monotony of a 2 per cent. Bank of England rate. This low rate, however, was not the worst so far as the Company's business was concerned; for they had to discount the large portion of the bills which they took in at the market rate, which, for three months' banking bills, had been 17s. per cent. per annum only. "For discounting a "bill for £100 having three months to run, they received, "therefore, the small sum of 4s. 3d., out of which they had "to pay salaries, rent, and something for the money to "discount it with." After this it seems ridiculous for would-be reformers of the Henry George pattern to prate about the burden on industry of the financial middleman. Still, it seems that the Board of the particular Discount Company now in question were able to pay a dividend after the rate of 9 per cent. per annum on their capital of £650,000. So that lending money at the rate of 17s. per cent. per annum cannot be such bad business after all. It would require a good deal of mastery of the mysteries of modern finance to fill up the gap between these two rates of interest on capital, making due allowance for all working expenses besides.

WATER AND SANITARY AFFAIRS.

There is now, or has lately been, prevailing in the district of the East London Company, a "water famine" at the rate of 30 gallons daily per head of the population. Even an allowance of 30 gallons per head is better than nothing, though it has to include all purposes. If some people were to have their way, the supply would soon be reduced to vanishing-point, unless the rains of heaven came to the rescue. To let the supply run through open taps and the garden-hose, during every hour of the day and night, while an unprecedented drought takes effect on the source that has to be drawn upon, is a sure way of rendering the stock bankrupt. With the volume of water daily shrinking in the reservoirs, the guardians of the supply were bound to be careful. Hence it came to pass that on the 12th inst. the East London Company found it necessary to issue a notice stating that, owing to "the unprecedented "and continuous drought," the hours of service would have to be curtailed; and the people were advised to store a supply while the water was on. "And yet," said the *Daily Chronicle*, "the Royal Commission on the water supply "assured us that the water supplied by the present Com-"panies was sufficient for all our needs." So also our contemporary might remember that an eminent Progressive in the County Council argued in the House of Commons that the East London Water Bill might be safely shelved, for the Company had distinctly declared that there was "plenty of water." The Bill was thrown over for a year, thanks to Mr. Burns and the Irish vote; and we see the result. There is plenty of water, as in Jacob's well; but there must needs be something to draw with. Pumps are wanted, and pipes, and reservoirs—things which all cost money. But the County Council had resolved that no further capital should be raised by any of the London Water Companies, pending the transfer of the undertakings to the "one representative public body." Rather less than a fortnight ago, the inspired *London* commended to public approval those members of the County Council—including some few candidates for parliamentary honours—who had voted in March, 1893, against the Bill by which the East London Company sought power to increase their capital and extend their works. On that occasion, Mr. Mellor, the Chairman of Committees, warned the House that the "very gravest responsibility would be incurred" if they refused to send the Bill to a Committee. Yet the Bill was rejected; and when it was brought forward again last year, it was carried on the second reading by a bare majority of one. Had the Bill been lost in 1894 as it was in 1893, the prospect now would be eminently serious. Getting their Bill through Parliament in August last, the Directors lost no time in commencing the requisite works. Of the real need, there can now be no doubt. The very day following that on which *London* held up for approval the conduct of those members of the late Parliament who opposed the Bill, the East London Company issued the notice warning the public that care must be taken to economize the supply.

It is now shown, by a statement issued by the Company's Secretary (Mr. I. A. Crookenden), and by a letter which Mr. Bryan, their Chief Engineer, has addressed to the *Standard*, that if the Company's Bill had been passed in 1893 instead of 1894, the storage capacity of the works would have been enlarged ere this by 200 million gallons, and there would have been an additional supply of 3 million gallons a day. All complaint of a restricted supply would thus have been prevented, and East London might have

gone on perpetuating the waste which undoubtedly exists in that quarter. The constant supply in that district is subject to an abuse which unduly taxes the sources whence the water is drawn. A far too extensive abandonment of cisterns obviously places the supply beyond that control which prudence would dictate. But the great consideration to be kept in view is the fact that in this case Parliament was induced to prevent the Company from making that provision which was absolutely needful for the safety and comfort of the public. *London* says "it was not con-"sidered desirable that the Companies should have power "to incur more capital expenditure, as this meant that "the ratepayers would have all the more compensation "to pay for the undertakings." But it also meant that the public would have to suffer for the want of that supply which the Companies were anxious to give. Futile attempts have been made to penalize the East London Company by proceedings in the Police Courts. No such proceedings would enable the Directors to supply an additional gallon of water, nor would avail against the fact that works cannot be constructed if Parliament refuses the money to pay for them. Let us consider what would have been the result if the Company's Bill had been rejected on the second occasion. If the loss of a year proves thus perilous, what would have been the consequence had two years been lost? Beyond all this, the County Council would have stopped extension altogether, reckless of the mischief thus rendered inevitable. It cannot be said that the result of the recent elections in the Metropolitan boroughs has shown the gratitude of the electors for the policy of the Progressives. The *Daily Chronicle* is itself amazed at the result, and wonders what has happened to the London working man. The candidates held up for approval by the Progressive organ have fared badly; and those whom it has reprobated have largely succeeded. The failure of Mr. Benn to obtain re-election in St. George's-in-the-East, and the rejection of Mr. Costelloe in East St. Pancras, are incidents which show that the policy of "harrying" the Water Companies, as the *Standard* terms it, is not sufficiently popular to secure a seat in Parliament. The fate of Mr. Cornwall in Fulham, Mr. Steadman in Hammersmith, and Mr. Beaufoy in Kennington, points to the same conclusion. Amid all the political changes which now surround us, we are promised by the County Council organ that the Transfer Bills "will be undoubtedly revived "in the new Parliament," and will "have a chance of "becoming law," for the sublime reason that "they are "supported by a majority of the Council, including a num-"ber of Moderates." It is thus very hard to forego the notion that Parliament, as far as regards London questions, is to take its cue from Spring Gardens. Where is Mr. Shaw Lefevre?

Every organ in the press, however rabid in its politics or special in its methods of pleading, should make some semblance of a judicial attitude. But when a newspaper elects to deal with questions affecting a water company, even the show of impartiality is put aside, and its sense of justice straightway assumes the character of Euclid's point, which had no parts and no magnitude. The sixpenny papers, when hard up for something or somebody to attack, turn with avidity to the water question of the moment. The penny papers do likewise; and, needless to say, the halfpenny journals follow suit. Even so, and in like manner, the *Echo* has just delivered itself in regard to the present difficulties of supply in the district of the East London Water Company. People might well infer, from the remarks of our contemporary, that water companies are never so happy as when the consumer suffers; that there is a special joy among Directors when seasons of frost or of drought set in; and that the highest payment for the smallest quantity of water is the one object which all the water companies keep steadily in view. The *Echo*, therefore, manufactures a grievance out of the prudent notice recently issued by the East London Company to their consumers—that, in consequence of the drought, the water supply must be limited for a certain number of hours per day. "The East-enders quietly submitted." Probably the East-enders are more sensible than their self-appointed champion. They could scarcely be so poorly endowed as the *Echo* is with the spirit of fair play or common sense. Not content with merely taking up the drought question, our contemporary harks back to the topic of the great frost; declaring that "the same fate is "befalling these poor consumers in the depth of summer "as in the depth of winter." Then comes an altogether inconsequent attack on the class-legislators who are supposed to have taken care that, whosoever suffers from "the "act of God," it shall not be the Company's shareholders. Upon one point, however, the *Echo* is perfectly right. Probably the Directors and officers of the Water Companies are quite as sympathizing as the Press with the position of the East-enders on the question referred to by our contemporary—viz., the absence of cisterns; and here we also may cordially join in their expressions of regret. But to whom is the absence of cisterns to be attributed? Assuredly not to the Water Companies; and yet, if a system of storage were universal, there would be no occasion for the *Echo's* outcry, and no necessity for the inconvenience which some of the East London Company's customers are now experiencing. But to blame the Companies for husbanding their resources, and putting their customers on guard against further trouble if the drought continues, is simply an absurd reversal of the attitude which an impartial journal should assume in regard to such a subject. We do not say that the *Echo's* latest contribution to the water question is more worthless than many articles that have previously been published on the subject; but, on the other hand, it certainly cannot honestly be asserted as in any respect more intelligent or valuable.

At a season of the year when extravagance in the use of water is especially reprehensible, people should hardly complain if suppliers of this valuable element seek to check its unauthorized consumption. For our part, we can discover no hardship in the case reported in the JOURNAL last week, of the gentleman at Bristol, who, though he paid only for a supply for domestic purposes, was twice seen watering his garden with a hose, and performing the same "generous" office for his next-door neighbour. The Company proceeded against this gentleman in accordance with law, and, it may be added, in pursuance of those principles of fairness towards consumers in general by which suppliers of water should always be influenced. But the defendant—Mr. Hawkes—found himself before an indulgent tribunal. Judge Austin thought there was no reason why Mr. Hawkes should not have been warned. But, on the other hand, it is difficult to see why he should have been. He offended not once but twice, possibly oftener; and pouring water that did not belong to him into somebody else's garden as well as his own, is scarcely to be regarded as a mitigating circumstance. This sort of generosity at other people's expense is not to be commended. Moreover, in the case referred to, there was strong evidence of deliberation in the acts complained of. Why was Mr. Hawkes in possession of a garden-hose unless he meant to use it in his garden? Judge Austin thought it was possible that the defendant was ignorant of the fact that he was committing an offence. Possible, of course, but scarcely probable; and, at all events, Mr. Hawkes made no attempt to prove his ignorance, or even to allege it by the mouth of his advocate. On the whole—and it is very singular—Judge Austin seemed to regard the Bristol Water Company as a greater offender than the defendant. The learned gentleman thought it was "rather "sharp practice to let the defendant go on in his offence, "and then 'pull him up' for his second offence." But, surely, if there were sharp practice at all, it was on the part of Mr. Hawkes. As to warning him or anybody else, we take leave to say that the idea is absurd. The Act of Parliament does not require an offender to be warned. He is presumed to know what he is about, and probably does know. To hold that a man must first be warned and then proceeded against is to suggest an impracticable course of procedure. Water companies cannot detail a special staff of detectives to perform this sort of work. If a consumer is not prosecuted for his first offence, he should think himself lucky, instead of complaining that he was thereby induced to offend again. Many a consumer who has a garden-hose leaves it upon his lawn with the water running to waste. No one can tell the extent to which this sort of water peculation goes on; and when a case is discovered, it certainly behoves a company to prosecute, not merely by way of discipline for the offender, but also as a warning—the most effectual sort of warning—to others. Constrained by the Act of Parliament, Judge Austin imposed a penalty (a very small one); but it would be a pity if people were encouraged by his *obiter dicta* to adopt a system that is at once selfish and illegal.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 197.)

THE course of things on the Stock Exchange was rather a surprise. That business should be quiet, one was prepared for; the excitement of the elections having exercised considerable distraction, apart from other influences which drew attention elsewhere. But the markets suffered to a great extent. Beginning slack, they grew irregular and finished really flat. Prices in all the chief departments ran down, from Consols to the end of the list; the Foreign Market especially being a heavy loser. For this, the Bulgarian spark near the powder-barrel of the Eastern Question is mainly responsible. The Money Market continues in the same depressed condition. But, while prices were falling in the large departments, the strength and buoyancy of Gas stocks were actually increased; and prices seemed to rise for each parcel of stock as it came in. Gaslight "A" did not show any disposition to move at first, and jogged along, at prices varying little above or below 284, until the dividend announcement was made, and then it jumped up to 289½. The dividend for the half year is to be at the rate of 12¾ per cent., as against the previous 12 per cent.; and the balance carried forward will be greater by about £1550. As the increased dividend will require about £42,350, an improvement of about £44,000 in the revenue balance is apparent. Little was done in Gaslight secured issues; but the few bargains marked were at good figures. South Metropolitans were hardly touched, and made no sign. In Commercials, the old stock got a chance of moving, and was done on Thursday at 304—a noteworthy incident, as it had never previously topped the third century. Very little business was done among the Suburbans and Provincials; and although excellent bids were made for many of them, yet holders were apparently quite content to keep their stocks. Large advances were scored in the Continental group. Union sprang up to 265, and stands quoted with a ten-point margin. Cagliari also made a very large bound upwards; while Imperial and European effected substantial advances. Malta improved fractionally; and Bombay and San Paulo, in the remoter world, did the like. A good bit of business was done in the Water Companies, especially their debenture stocks; and some of the ordinary stocks had a good rise. New River was put up, 10 to 385-95; but as buyers in the Mart on Wednesday were willing to give 405, the quotation is not at all excessive. East London fell 2, owing to troubles with their supply.

The daily operations were: Gas opened unchanged on Monday; but prices showed a tendency to rise, though an advance of ½ in San Paulo was the only move. In Water, Lambeth old rose 1½; and ditto new, 1. Business in Gas remained very limited all through Tuesday. Imperial Continental advanced 2; and Cagliari, 1. In Water, Southwark "D" rose 5. Transactions in Gas on Wednesday were on about the same scale. Cagliari gained another 1½. Business was considerably brisker on Thursday; and prices were excellent. Commercial old improved 7; Continental Union, 2½; and Malta, ¼. New River rose 5. Activity in Gas was maintained on Friday; and Continental Union gained another 5. East London Water fell 2. Saturday was quiet, but important. Both Brentfords advanced 5; Gaslight "A," 3; British and European, ½ each; and Bombay, ¼. New River also rose 5.

ELECTRIC LIGHTING MEMORANDA.

Curious Accident to Electrical Power Plant—What it Takes to Work an Electrical Tramway—Proposed Electric Lighting of the Thames Embankment.

A CURIOUS accident to the electrical power plant of a Toronto street railway company was recently reported in a Canadian paper. It appears that a man left in charge of a new Siemens-Halske dynamo which had not been taken over from the contractors amused himself, in the absence of the Electrician-in-Chief, by scraping the machine with a knife. The consequence was that before the implement in question could be named by the startled attendant, it was drawn in, and the armature short-circuited. The machine then "went;" and the man was badly burnt. The accident threw so great a strain on another generator, that it immediately broke down; and the street traffic was suspended until matters inside the power-house could be set right. And all because somebody's sense of neatness instigated him to scrape off some kind of dirt from a dynamo with the handiest tool at his command. There is a familiar American saying which warns people against "monkeying with a band saw;" but the danger of meddling in an unauthorized way with the dynamo, even in the interest of cleanliness, is all the greater for being unsuspected until the damage is done. Seeing how small a margin for safe working is permitted by the construction of electrical power machinery, the marvel is not that breakdowns occasionally occur, but rather that dynamos and their armatures do not go wrong more frequently than is actually the case.

There seems to be a deplorable waste of power in electrical tramway systems, which requires stopping before this means of working can claim to be regarded as economical, in the scientific sense of the term. What is described as an excellent example of the Thomson-Houston single-trolley system has been laid down in Brussels, to the order of the Municipality; and, after a year's contractors' trial, it is to be taken over by the authorities this month. It is to be hoped they will be satisfied with their bargain. There are about 5¾ miles of line running through a thickly-populated district, of which the well-known Nord Railway Station constitutes one terminus. The wires are carried overhead, on standards placed at the edge of the pavement; the arrangement being described as "not unsightly." Of course, everything connected with the line is first class; and everybody concerned with its construction and working, including the public, is reported to be pleased with the whole outfit. But here comes the singular feature of the undertaking. To work this 5¾ miles of double tramway with 22 cars, each designed to carry 35 passengers—the heaviest incline being a slope of 6·8 per cent.—there are provided five 180-horse power engines, with as many dynamos. The cars, full and empty, weigh 6½ tons and 2½ tons respectively. What an enermous surplusage of electrical power, as compared with horseflesh, marks this installation! A pair of Flemish horses could easily run away with one of these loaded cars; and though the speed at which they are stated to be driven by electricity is perhaps double that of an ordinary horse tramcar, there must be something very crude about a system which needs 900 indicated horse power to keep 22 tramcars moving.

An instructive example of the difficulties attending the introduction of electric lighting into places where it is not required except for the "fancy," is supplied by the proposals of the Highways Committee of the London County Council for electrically lighting the Victoria Embankment and Gardens and Waterloo and Westminster Bridges. This matter has been before the Council for years; and it has hitherto been found impossible to make any progress towards the realization of the general idea, which has received the approval of the Council and been provided for by one of their Money Acts. In 1893, a scheme was propounded which would have cost a capital sum of £20,000, and involved an estimate annual expenditure of nearly £4000. As this was a greater outlay than the Council thought it desirable to incur for such an object; and as, moreover, it was doubtful whether the new system of lighting the Embankment could have been carried out without spoiling the finest thoroughfare and "pleasure quay" in Europe, the Council deferred consideration of the project until the spring of this year. Then the Highways Committee went at it again; and, with a view to reducing the expenses, they decided in their new scheme to leave out the lighting of the Embankment Gardens. Moreover, they decided only to do the job by halves—putting the electric lamp standards along the kerb line on each side of the roadway, and leaving the parapet lamps to be lighted "when required" by gas as at present. This would bring down the estimated first cost to £16,590, with an estimated annual charge of £2768. The scheme is, however, open to the fatal objection that it does not provide for the electric lighting of the Embankment, but only for placing a few electric arc lamps in juxtaposition with the gas-lamps, to the detriment of the useful and ornamental effect of both. The Committee offer the interesting statement that, in the event of their scheme being sanctioned, they propose "to ask the Technical Education Board to allow its inspectors of art schools and classes to assist them in preparing designs for the lamp standards; and they hope to be able to obtain a design for a standard lamp which would be worthy of being placed in that, the first thoroughfare in London." There will be no harm in starting the competition, even if the lamp-columns are never destined to be placed on the Embankment. It would be very interesting indeed to see what would be the outcome of such a competition.

THE REPORT OF THE BOARD OF TRADE COMMITTEE ON PHOTOMETRIC STANDARDS.

IN the JOURNAL for May 14 last, we noticed the presentation to Parliament of the Report of the Committee appointed by the Board of Trade "to inquire into, and report to them upon, the subject of the standards to be used for testing the illuminating power of coal gas." The report, with the appendix, was issued last Thursday as a parliamentary paper. The text of the report was given in the number of the JOURNAL above mentioned, as well as the section of the appendix devoted to a description of Mr. Dibdin's ten-candle pentane air-gas standard, which, it will be remembered, was recommended by the Committee for adoption. We now briefly notice the rest of the matter contained in the appendix.

Section I. sets forth the circumstances under which the Committee was appointed on Dec. 23, 1891. It was constituted as follows: Mr. W. J. Dibdin, F.I.C., F.C.S.; Dr. E. Frankland, F.R.S.; Mr. Henry E. Jones, M.Inst.C.E.; Mr. George Livesey, M.Inst.C.E.; Dr. W. Odling, F.R.S.; Mr. G. Rose-Innes; Dr. W. J. Russell, F.R.S.; Mr. G. C. Trewby, M.Inst.C.E.; and the Metropolitan Gas Referees (Mr. A. G. Vernon Harcourt, F.R.S.; Dr. W. Pole, F.R.S.; and Professor A. W. Rücker, F.R.S.). Dr. Odling was selected to preside over the deliberations of the Committee; and Professor Vivian B. Lewes, F.I.C., F.C.S., was appointed Secretary. Section II. treats of the use of sperm candles

as a standard of light; the conclusion arrived at by the Committee being that they are not to be depended upon, and therefore should give place to "some more uniform and reliable unit." When considering this subject, the Committee had before them Mr. G. T. Miller to give evidence as to the changes which have taken place in the manufacture of sperm candles since 1876. A verbatim report of this evidence is given as an *addendum* to the section under notice. Sperm candles having been condemned, the Committee proceeded to look for a substitute. Section III. is therefore devoted to an illustrated description of Mr. Vernon Harcourt's one-candle pentane air-gas unit; appended thereto being a summary of observations on the amount of light given by the pentane flame at different heights. Section IV. contains an epitome of the evidence obtainable, at the time of the appointment of the Committee, as to the relative value of the one-candle pentane air-gas flame and the light emitted by an average standard candle; and we learn therefrom that the value of the former is 1·021 sperm candles when burning at a height of 63·5 millimetres. The Committee next considered the effect, on the amount of light emitted, of setting the height of the one-candle pentane flame with and without a screen; and the results of their investigations are to be found in Section V. Four series of observations were made—the first with a 100-inch improved Evans-Sugg photometer; the other three, with a Letheby open-bar photometer. A ten-candle pentane Argand was arranged at one end of the bar as a constant source of light; while the one-candle unit, set alternately with and without the aid of a screen, was used to test its illuminating value. The first series of observations (66 in number) showed a mean difference of 2·7 per cent.; the second (102 observations), 2·4 per cent.; the third (108 observations), 3·1 per cent.; and the fourth (216 observations), 2·4 per cent.—or, for the 492 observations, a mean difference of 2·59 per cent. The Committee had reason to believe that in previous experiments the height of the pentane flame was fixed when the eye of the observer was not screened. According to the results given in Section V., therefore, the value of the pentane one-candle flame, expressed in terms of standard candles, would be 2·6 per cent. too high. The tabulated results in Section IV. are therefore corrected in Section VI.; and the value of 1·007 instead of 1·021 candles is given to the flame, or, omitting one abnormally high result, 1·001 candles. Section VII. is devoted to the Dibdin ten-candle pentane Argand; a large number of results being given of tests made with the flame at various heights, and with different chimneys. In the following section (VIII.), the Committee consider the possibilty of simplifying this burner, and determining the height at which the flame should be screened off in order to emit a constant light of ten candles. Section IX. contains a description of the Dibdin ten-candle standard as recommended by the Committee. This section, as already mentioned, has been given in its entirety in the JOURNAL. Section X. is on the effect of the humidity of the atmosphere upon the amount of light emitted by luminous flames. In Section XI., some interesting particulars are to be found in regard to pentane; and Section XII. consists of a report of the interview which took place between the Committee and representatives of the Incorporated Institution of Gas Engineers and the Incorporated Gas Institute on the general question of gas-testing. This section is reproduced in another column to-day.

Death of Herr Schiele.—We regret to record the death, after a few days' illness, from lung disease, of Herr Simon Schiele, of Frankfort-on-the-Main. Deceased was one of the founders of the Association of German Gas and Water Engineers, and was for some years the President. He was a very able man; and his memory will be highly cherished by his colleagues.

Deaths of Two German Gas Engineers.—The death is announced of Herr Carl Heinrich Ballauf, Manager of the Dortmund Gas Company—an appointment he had held since 1884. He was a very active member of the Association of Rhenish and Westphalian Gas and Water Engineers. Herr Louis Hartmann, who from 1860 to 1885 was Manager of the Zurich Gas-Works, has lately died after a protracted illness. He was one of the founders, and an honorary member, of the Swiss Association of Gas and Water Engineers.

Mr. Marshall's Gas Institution Paper on the Monier System.—It is due to readers of the JOURNAL who were interested in Mr. Marshall's paper, read before the Incorporated Institution of Gas Engineers, on the Monier system of building construction, that they should be warned against taking the formulæ of Mr. Marshall's Appendix (see JOURNAL for June 11, p. 1247 *et seq.*) as correctly expressed for English readers. This appendix was printed from a copy specially supplied to us by Mr. Marshall; but he now desires to correct it in various particulars, which is, of course, impossible without reprinting it in full. The formulæ contain in several places the sign ÷, which, if read in the usual English way as a sign of division, deprives the expressions of meaning. This sign as employed by Mr. Marshall, we are now informed, is to be read as another way of writing the minus sign —. This is a most regrettable confusion, for which we are not responsible. Mr. Marshall states, in response to an inquiry, that all information respecting the Monier system is to be obtained from the Actien Gesell. für Monier Bauten, Leipzigerstrasse, 101 and 102, Berlin.

DIPS INTO THE PAST.—PROJECTS THAT FAILED.

(*Concluded from p.* 136.)

IN discoursing on "projects that failed," the difficulty is not to find examples wherewith to point the moral, but to make suitable selection among the numerous instances that have occurred during the growth of the gas industry. Many have been the processes designed—like White's—to revolutionize the method of producing coal gas, which have met, in the long run, with no better success. Such an one was Dr. Eveleigh's, which, on its introduction some twenty-five years ago, was commonly supposed "would produce something like a revolution in gas affairs." This "improved" method of gas making went to the root of the matter in endeavouring to convict the ordinary method of being founded upon a wrong principle. Thus, instead of aiming at converting the coal immediately into gas, by the employment of a sufficiently high temperature, the process was divided into two operations. The coal was carbonized at a low heat, and the resulting tar subsequently vaporized, and the vapours conducted through highly-heated retorts, in order that they might be converted into gas. The process was fairly tried, for three years, on a working scale; but, notwithstanding the modification of many of its details, as experience suggested, it was found impossible to make it a practical success—chiefly owing to persistent stoppages of the pipes and apparatus by thickened tar and pitch, and the irregularity of the product obtained—and the process was eventually discarded.

Proceeding from the production of gas to its subsequent treatment and purification, we find that, as invention has here been most active, the endeavours after improvement are studded with examples of error which deserved to fail, as well as with instances of commendable ingenuity, perseveringly applied, that met with but partial success. Take the apparently simple operation of eliminating from the foul gas the ammonia it contains. It would seem that nothing could more efficiently and economically serve this purpose than washing or scrubbing with water, as is now almost universally practised. Yet it has taken a long course of invention and improvement in matters of detail to bring this operation to its present perfection, so as to recover the ammonia without having to employ an excessive quantity of water; and numerous have been the endeavours to supersede water by some other material. The only argument that could be urged to justify the change was that, by washing with water, some of the illuminating constituents were abstracted from the gas. With regard to this matter, there has been considerable difference of opinion. On the one hand, it was contended that "water cannot be used to dissolve the impurities of gas without, at the same time, dissolving its most valuable illuminating constituents; and whenever it is used in sufficient quantity to remove what is hurtful, it reduces the illuminating value very much." On the other hand, water was said to have "little or no influence on any of the hydrocarbons except acetylene; and as this exists in gas only to a very small extent, there is little or no danger from a copious washing of the gas before it goes to the purifiers." If we examine the facts which the opponents of water washing advanced to support their contention, we may appreciate (if we cannot reconcile) the different views taken by the two parties. Wrote one of the former: "Valuable illuminants are produced and then washed away and rendered useless. Any engineer may satisfy himself of this by determining the illuminating power of his gas, and then passing a few feet of it slowly through a large cask of water into a test gasholder." Now the conditions of the experiment thus proposed, for demonstrating the evil effects of water washing, are not the same as obtained in an intelligently designed and well-regulated apparatus for washing or scrubbing gas. In fact, those who relied upon it and similar experiments merely showed that it is possible to deteriorate the quality of illuminating gas by rigorous treatment with sufficient cold water, and not that such deterioration invariably occurs in the ordinary process of washing or scrubbing gas.

In the early days of gas purification, when the removal of the ammonia, after being long neglected, was at last forced upon the attention of gas engineers, it was an obvious step to make use of acids for the purpose. While completely effective in arresting ammonia, however, it was soon perceived that the injurious effect of acids upon the illuminating constituents of the gas was a fatal objection to their continued employment. The use of various metallic and earthy salts, and other chemical substances, was then proposed, and in many cases patented. "Indeed, it would appear," it has been aptly said, "as if all the refuse matters of the arts had been successively tried and patented, in the hope of their becoming a means of extracting the impurities from coal gas."

One of the substances proposed for abstracting the ammonia without injuring the illuminating constituents of the gas, which attracted some attention, was common clay, introduced for this purpose by Bowditch, in 1854. It was said to be as effective in removing ammonia as acids or metallic salts, while exerting no deleterious effect on the other constituents of the gas. After being used for purifying gas, the clay could be sold as a manure. The removal of ammonia by water in the end prevailed, however, because it possessed the great advantage over all the other substances proposed, that it allowed of utilizing to the full the power of ammonia to combine with the acid impurities

(sulphuretted hydrogen and carbonic acid) in the gas. It thus, in effect, acted as an auxiliary to the ordinary purifying process. And, further, the solution of ammonia in water was found, in the long run, to be the most generally useful, and therefore the most valuable form in which it could be had. The importance of this latter consideration is brought out in connection with a more recent project for the removal of ammonia without the use of water.

So recently as the year 1881 some considerable stir in the gas world was caused by the introduction of a patented process for removing ammonia from foul gas by its absorption in commercial superphosphate of lime, placed on trays in the ordinary purifiers. The process was cared for by a strong Company, directed by several eminent engineers and scientific experts. It was tried on an extensive scale in one of the principal gas-works of the Metropolis, and subsequently in one of the most ably-directed gas-works on the Continent; and the reports of experts—including some of the highest authorities in the gas profession—were unanimous in asserting that the material was the most efficient agent ever introduced for absolutely removing every trace of ammonia from the gas. The process did not involve any deterioration whatever of the illuminating constituents of the gas. Moreover, the spent material formed a highly valuable manure. Thus everything seemed to indicate the inauguration of a new era in gas purification, when scrubbing or washing with water would become a thing of the past. Yet the process never came into general or any extensive use; but after achieving a little notoriety, it dropped out of sight, and was no more heard of. In fact, the process had its economical as well as its technical aspect to be considered. As was remarked in the JOURNAL on the introduction of the process, the question upon which its future wholly depended was as to whether the bye-product it recovered was more valuable in the form of ammoniated superphosphate than as common ammoniacal liquor. In the absence of information to the contrary, we must conclude that this was the rock on which the hopeful venture split.

Many examples of failure are found among the attempts of inventors to improve upon the mechanical appliances of gas manufacture. Some of these attempts exhibit considerable ingenuity which failed in effect through insufficient acquaintance with the real conditions under which the work aimed at has to be done. Others were too extravagant in conception ever to be transformed into actual working possibilities. To take examples only from the purifying department. Hills, who first proposed the admission of a little air with the gas, in the working of oxide purifiers, found that, under the treatment, the material caked into a hard mass on the grids, thereby throwing considerable back-pressure on the apparatus. This he endeavoured to remedy by inventing a mechanical arrangement of stirrers within the purifier, whereby the cake of oxide could be disintegrated or broken up, so as to offer less resistance to the gas. It was found, however, in practice, that the moving parts corroded and stuck fast; and therefore it was soon discarded as unworkable.

Another inventor, with greater boldness, designed a purifying apparatus, for use with oxide, in which, by ingenious mechanical arrangements, the material was to be kept in slow motion and gradual descent through the several tiers or floors of the purifier all the time the gas was being purified, until, by the time the oxide became spent, it reached the lowermost (a detached) chamber, wherein it was exposed to a current of air, and so revivified; the revivified material being subsequently raised again by an elevator to the upper tier of the purifier, when the process began *de novo*. Another as bold a scheme was proposed for dealing with sulphided lime purifiers, when the removal of the spent material, in the ordinary way, gave rise to offensive effluvia. It was proposed to make the purifiers themselves portable, and remove the whole apparatus bodily with its contents, when foul, to some distant spot, where it might be emptied without causing any nuisance—in a somewhat similar manner to the present system of taking out to sea the sewage-sludge of London and other large cities.

(*To be continued.*)

GROVES AND THORP'S "CHEMICAL TECHNOLOGY."

CONCLUDING NOTICE.

THE fact that the section of Groves and Thorp's text-book devoted to the subject of "Lamps" extends to ninety-two pages, and is studded with upwards of 140 illustrations, shows the importance attached by the Editors to this portion of the work. The author of the section is Mr. Boverton Redwood; and he has included oil gas, air-gas machines, and carburettors in the scheme of his labours. This circumstance should add greatly to the value of the book as a whole, particularly for gas engineers, especially since no comprehensive and critical work upon carburettors and cognate appliances exists. In treating of lamps, Mr. Redwood begins at the beginning with the Roman form, which suggests, as the author observes, that the primitive lamp was made out of a shell from the sea-shore or the skull of an animal. Lamps of classical form are still commonly used in olive-oil producing countries; and wretched affairs they are, for all their beauty of shape and interesting associations. They give a miserably poor glimmer of light; and the flame is extinguished by the faintest puff of air. As domestic conveniences, they are excelled by the northern rushlight. The line of lamp improvement followed by Mr. Redwood is that which had for its object the maintenance of a constant oil-level, which quickly leads him to the moderator and the carcel. He then retraces his steps, and recounts the efforts made to eliminate the shadow of the oil reservoir, and to improve the supply of air to the flame. The author hardly lays sufficient stress upon the revolution brought about in lamp manufacture by the introduction of glass chimneys, the credit for which apparently belongs to Argand.

The evolution of the mineral oil lamp has a chapter to itself, which is quite deserved; for although to casual inspection there would not appear to be any radical difference of type between the lamp used for burning fixed oils and the similar appliance adapted to burn mineral oil, the essential distinctions between the characteristics of the two kinds of fuel are paralleled in the constructive features of the respective lamps. It is one thing to burn, by means of a wick, a vegetable or mineral oil which will not ignite of itself in bulk, and does not give off inflammable vapour at the temperatures attained in the reservoir of the lamp, and a totally different task to burn safely and regularly, by the same means, a fluid comparatively volatile, easily rendered explosive by the heat developed in its own burning, and heavily loaded with carbon. The first mineral oil lamps that were used to any great extent were the so-called "camphine" lamps, with which the name of Young is identified; and, from this starting-point, Mr. Redwood quickly runs through the improvements in this class of lamps introduced by the Youngs, Hinks, Rowatt, Silber, and others. After describing and illustrating the mineral oil lamp in its principal commercial patterns, the author devotes another chapter to the explanation of the principles that should govern their construction, and discusses lamp accidents and their prevention. He maintains the view that the safety of lamp lighting depends upon very much more than the flash-point of the oil; and he gives his reasons for this opinion.

On the subject of the lighting value to be obtained from mineral oil, Mr. Redwood has some interesting information to give—the fruit of experiments extending over a long series of years. This effect is wholly a question of the lamp; the Argand type giving more light per unit of oil than flat-wick burners. The minimum consumption of oil per candle light per hour in the case of flat-wick burners is ordinarily about 50 grains, as compared with about 41 grains in the case of Argand burners. As the result of experiments made in 1879, it was found that, with the leading patterns of lamps then in use, the consumption of oil ranged from about 45 grains to 65 grains per candle light per hour; while a series of not strictly comparable experiments made more recently exhibit a range from about 41 grains to more than 70 grains. It does not appear from these figures that the useful duty of mineral oil lamps is being noticeably improved upon. The air supply to lamp flames, and the subject of wicks, are discussed by Mr. Redwood in separate chapters. It is recognized that a very important precaution in preparing a lamp for use is that of thoroughly drying the wick; moisture in the cotton greatly impairing its capillary properties. Spirit vapour and air-blast lamps are described and illustrated from good modern examples.

In dealing with the subject of oil gas, Mr. Redwood truly remarks that "this important illuminating agent may be considered as the forerunner of coal gas, although its employment was almost discontinued until quite recently." He omits to state, however, why this happened—an explanation which might easily have been given in a few words, and would have saved the neophyte in such studies from mystifying himself. Describing the manufacture of oil gas in retorts, Mr. Redwood observes that "the colour of the gas at the time of production should be nut brown; and the tar separated from the gas in its passage through the hydraulic main should, when dropped on white paper, not exhibit a greasy margin. If the oil be supplied to the retort too abundantly, or if the temperature of the retort be insufficiently high, the gas will be light brown or white in colour; and the greasy margin referred to will be formed. On the other hand, if too little oil be passed into the retort, or if the temperature of the retort be too high, the colour of the gas will be dark brown, and flakes of soot will be discernible." There is hardly sufficient distinction made here between the different colours which samples of crude oil gas can exhibit. The gas only passes from brown to white through several distinct shades of yellow; and it is one of these—rather than "nut brown"—that is preferred by experts in the manufacture. Mr. Redwood gives the cost of oil gas "manufactured at Blackwall by the Trinity House authorities" at 10s. per 1000 cubic feet. This is certainly above the average cost at which the same gas is manufactured by the principal English Railway Companies.

In concluding his chapter on the subject, Mr. Redwood states that "practical experience has demonstrated that, with a view to the production of a permanent gas suitable for use in the enriching of coal gas, the dissociation of mineral oils can be most advantageously effected by the heating of the vapour in admixture with a gaseous vehicle, such as water gas." This is not correct. Mr. Redwood knows, or at any rate says, nothing about the Young and Bell oil gas. This is to be regretted, as the omission of any reference to this system of making oil gas

for use in the enrichment of coal gas, with the consequent disclosure of the existence of a difference between the photometric and enrichment value of the product, deprives his work of a reputation for completeness. Mr. Redwood has hardly had sufficient grip of the latest developments in this branch of the subject to qualify as an authority upon it. He seems to be aware of this; and he accordingly refers inquirers after further information to the communications of Professor Lewes, and the JOURNAL.

The chapter on carburetting and carburettors is not so full of matter as could have been wished; and what there is, is treated with an absence of the critical or informing spirit. Happily the Maxim arrangement is included; and consequently the student is enabled to learn how carburetting is done by a good modern apparatus. Curiously enough, Mr. Redwood omits to mention the use of "albo-carbon" for carburetting, which has been far and away the most popular device of the kind for gas consumers' use, before incandescent gas-burners came to supersede all other methods for obtaining a gas-light of the highest possible brilliancy. In his brief account of railway carriage lamps, Mr. Redwood should have found space for mention of the Clark regenerative lamp, which had so much to do with the development of this principle in lamp construction.

A section, which bears the joint names of Mr. Boverton Redwood and Mr. D. A. Louis, is devoted to miners' safety-lamps and the conditions attending their use in fiery mines and other situations where the atmosphere is explosive. A circumstance which has always struck us as unaccountable—the fact of the precursor of the safety-lamp having been the machine known as the "steel mill"—is mentioned and slightly discussed by the authors in passing. Why a stream of sparks, generated by the friction of a piece of flint and a steel disc, should be employable with even a colourable amount of security in a fiery mine has always been a mystery, seeing that many a gas explosion has been traceable to ignition by a spark. It is noted here that experiments made for the information of Her Majesty's Chief Inspector of Explosives have indicated that an explosive mixture of petroleum vapour and air cannot be ignited by an ordinary spark. There are evidently, therefore, sparks and sparks; because the high temperature electric spark will ignite any explosive gaseous mixture, while so long as the temperature of the spark of flint and steel can be kept down below an undefined limit, it will not ignite anything of the kind. The description of the "Davy" type of safety-lamp in this volume effectually disposes of the notion which readers of books of "popular" science are apt to get hold of, that the safety lamp sprang in a state of perfection from the hands of the illustrious philosopher. Like every other product of human ingenuity, the safety-lamp is the product of accumulated effort; the merit of Davy being that of prescribing the fundamental principles, by observing which a flame might be caused to burn in an enclosed lamp, in a fiery atmosphere. This was a great thing to do; but infinite perseverance and patience were required to embody the principles in a practicable lamp. The section includes much information respecting the means whereby the presence of inflammable gas or vapour in the atmosphere may be detected, by the appearance of the safety-lamp flame or otherwise.

In concluding our notice of Messrs. Groves and Thorp's new volume, we desire to repeat what has been said in the course of our articles with regard to the general excellence and value of the work. It is, besides, well printed, illustrated, and indexed. As already remarked, Mr. Redwood's chapters on oil gas and the carburetting of coal gas need supplementing by references to the contents of the recent volumes of the JOURNAL; but this is the severest criticism we have to pass upon the work, which should certainly find a place upon the shelves of every gas engineer's technical library.

Gas-Engines for Electric Lighting Plant in America.—At Danbury (Conn.), gas-engines have been in use for driving the dynamos of the Gas and Electric Lighting Company. There are three 100-horse power engines of the "Otto" type, two-cylinder, single-acting; the cylinders being placed one over the other, with connecting-rods engaging a single crank. The engines were placed side by side, with the crank-shafts in line; and to extensions of these shafts there were fitted clutches, so that the engines could be coupled together with the cranks 180° or 120° apart. At first the engines were arranged to regulate the power by either admitting a full charge of gas or cutting it off altogether, as the load increased or diminished. Experiment showed, however, that with the producer gas it was possible, by regulating the quantity of gas admitted to the cylinders per impulse, to obtain impulses varying considerably in power; that it was possible to ignite a very weak mixture of gas and air; and that the loss of economy due to the use of a reduced charge of gas was not serious. The engines were subsequently fitted with conical governor cams, by which means the supply of gas per impulse is varied according to the power required. The producer gas used in the engines is made in two generators 5 feet diameter and 10 feet high, which are worked alternately day by day. The gas is of about 150 thermal units per cubic foot, at 0° C., and 76 mm. pressure. The engines are fitted with an attachment by which illuminating gas can be substituted for producer gas without stopping or reducing speed.

NOTES.

The Use of Breeze in Sewage Filtration.

Mr. W. J. Dibdin, the Chemist to the London County Council, has reported to this authority upon a series of experiments conducted for the Main Drainage Committee, with a view to ascertaining the best method of filtering the sewage effluent from the Northern Outfall precipitation works. The operations began in June, 1892; and by the month of August of the same year, it had been found that the best filtering material that could be obtained was coke breeze. The condition of success of the various materials experimented with, was discovered to consist simply in porosity and the consequent power of reabsorbing atmospheric oxygen. The object aimed at in these trials was the attainment of the highest rate of speed of filtration, consistent with such a degree of purification as would remove all objection in respect of odour, colour, and liability to after putrefaction. In a second series of experiments, every filter covered an area of one acre. By observing an intermittent course of charging and aëration, it was found that an acre of coke breeze could be made to pass an average of a million gallons of effluent per day, for many weeks. Nitrification proceeded satisfactorily; and the filter was apparently capable of continuing to work for an indefinite time. Great importance attaches to the fact that the filter worked satisfactorily all through the extraordinary frost of the early part of the present year. The experiments are summed up by the *Engineer* as representing a gain of knowledge of the method of treating sewage of the highest practical importance. It is reported that, by the aid of coke breeze, sewage, especially if previously clarified by precipitation, may be purified to any desired degree. If a purification of 75 per cent. is regarded as sufficient, the area required for the treatment of the whole of the Metropolitan sewage in this way is only 180 acres; and Mr. Dibdin shows how the area may even be reduced to 120 acres. In either case, carefully managed filter-beds take the place of open land, and costly sewage farms can be dispensed with. Experiments with sewage undiluted by rainfall, conducted by the local authority of Sutton, in Surrey, go to confirm these Metropolitan results. Thus the humble agency of coke breeze, manipulated in accordance with the teaching of biological science, will be efficacious in saving millions sterling for the ratepayers of the United Kingdom, and solving a sanitary problem of the first magnitude, and hitherto of the greatest difficulty.

The Conditions of Success in Electric Heating.

Mr. W. S. Hadaway discusses what he describes as "the new science of electric heating" in a recent number of the *Engineering Review*. He observes that any system of heat and electricity generation and transmission, derives its value largely from the benefits of concentrated control, like other systems of public works. We are to regard heat agents as commodities which can be economically generated, transmitted, and applied. Electricity as a heat agent is not to be regarded as a source of heat, as the expression is generally understood; but, technically, as the high-potential heat factor in a telethermal system, where the heat obtained is generated by simple resistance, or the electricity may be employed as an agent for producing available heat by operating a thermal engine by means of motors. Mr. Hadaway thinks that high-potential electrical heating might be easily combined with low-potential heating obtained from the exhaust steam of the electrical generating station. This he calls a multi-potential thermal system, because all heat required at a temperature above 212° Fahr. would be derived from the electricity, and all heating below this figure from the steam. This system, of course, involves a highly concentrated supply district. In sketching it out, however, the author has arrived at one or two interesting determinations—such as that in a multi-potential thermal system, the useful heat available is practically five parts low-potential heat and one part high-potential heat. In domestic life, the ratio of heats required is found to be practically five parts diffused heat, and one part high temperature heat. Hence he derives the conclusion that, over limited distances, it is possible to economically operate multi-potential heating systems, using electricity as the high potential factor.

The Defect of Internal Combustion Engines.

In a notice of the prime motors of the day exhibited at the last Royal Agricultural Society's show, at Darlington, the *Engineer* remarks that for none of them can be claimed that marked advance towards the realization of the higher thermodynamic efficiency, of the possibility of which there is no doubt. At present, the range of temperature which attends the combustion of oil vapour or gas is greater than is dynamically available; and the forced dissipation of heat, which is the necessary bye-product of the required process, remains much the same in engines of the several systems, whether this dissipation be effected or sought by transference to a water jacket, by radiation from radiator surfaces, or by rejection through the exhaust. The heat thus purposely thrown away remains almost as great as two years or more ago; and internal vapourization by the bye-product heat does not bring about that thermal advantage that might be naturally expected. Curiously enough, it is found cheaper in connection with certain oil-engines to burn an external lamp consuming oil for the ignition-tube and for supplementary heating of the vapourizer, than to use an

engine which does not require such assistance and consumes every drop of oil as combustible energy-yielding material. It is complained that at present the academic writings on the subject have done as much to hinder the development of the oil-engine as to help it, and that little has been written which in any way assists the inventor and practical experimentalist. It is the weakness of thermo-dynamic theory to be only wise after the event.

The Dividend of The Gaslight and Coke Company.—We learn from the Secretary and General Manager of The Gaslight and Coke Company (Mr. J. W. Field) that the balance to the credit of the net revenue account will, subject to audit, enable the Directors to recommend the payment of a dividend for the half year ending June 30 last at the rate of 12¾ per cent. per annum; carrying forward a balance of £256,800 19s. 1d. The dividend is an increase of ¾ per cent. as compared with the two preceding half years, when the balances carried forward were £255,254 and £239,791 respectively; and, moreover, the price of gas has been reduced and meter-rental abolished.

A Shareholder's Complaint.—Mr. John Miles, a shareholder of the Hornsey Gas Company, is addressing his fellow-shareholders on the subject of what he regards as the unjust policy pursued by the Board in reducing the price of gas to consumers without allowing the proprietors to participate in an increased dividend. He hopes thereby to secure a good attendance at the next meeting of the Company, when some questions will be put to the Directors on the matter. The ground of Mr. Miles's complaint is that whereas the Company have the power, having reduced their price 7d. per 1000 cubic feet, to pay 11¾ and 8¾ per cent. on the two classes of stocks, they continue the dividends at 10 and 7 per cent.—the rates payable if no concession had been granted to the consumers. Mr. Miles asserts that not only is this policy unfair to the shareholders, but is prejudicial to the value of the Company's stock on the market. In support of this statement, he cites the case of the Tottenham and Edmonton Gas Company, who, while paying ¼ per cent. less dividend than, as he contends, the Hornsey Company could declare, lately sold £20,000 of 7 per cent. stock at such a figure as to produce £15,000 premium; whereas £10,000 of similar stock of the Hornsey Company only brought them £4400 premium—both undertakings being equally sound and prosperous. We are not in a position to-day to discuss the policy of the Board of the Hornsey Gas Company. Mr. Miles seems to have cause for complaint; but, on the other hand, the Directors may be able—and there are capable men on the Board—to justify their action. The shareholders would do well to take the advice offered to them, and attend the next general meeting. It is not customary for reporters to be admitted to meetings of this Company; but, if an exception were made on the next occasion, good might result to other undertakings than the one specially concerned.

The Gas and Water Interests in the New Parliament.—As far as the returns have come to hand, the gas and water interests will be fairly well represented in the Parliament which will assemble at the close of the General Election now in progress. For the first time, we believe, in the history of the gas industry, a practical gas engineer will take his seat in the House of Commons. Mr. D. Ford Goddard, formerly the Engineer and General Manager, and now a Director, of the Ipswich Gas Company, and Chairman of the South African Lighting Association and of the Gas Purification and Chemical Company, has been returned for that borough at the top of the poll with 4396 votes; his colleague, Sir Charles Dalrymple, Bart., polling 4293 votes. Mr. Goddard unsuccessfully contested the borough in the Radical interest in 1892, when he polled 4054 votes. He is a member of the Ipswich Corporation; and he was elected Mayor in 1891, but resigned in order to seek the suffrages of the electors. Sir Julian Goldsmid, who, in his capacity of Chairman of the Imperial Continental Gas Association, occupies a conspicuous position in connection with the business of gas supply on the Continent, retains his seat for South St. Pancras. Mr. John Aird, the head of the firm of Messrs. John Aird and Sons, and a Director of The Gaslight and Coke Company, who is engaged not only in the conduct, but also in the carrying out of gas and water works, will continue to represent North Paddington; and Mr. W. Woodall has been again returned for Hanley. Colonel Sadler, known the world over as a chemical manufacturer, and the Past-President of the North of England Association of Gas Managers, was unfortunately not successful in defeating Mr. J. Havelock Wilson at Middlesbrough; but Mr. J. E. Spencer goes back unopposed for West Bromwich. With regard to water supply, Mr. F. G. Banbury holds his seat for Peckham; and Mr. Boulnois his for East Marylebone. As connected with the legislation affecting both gas and water undertakings, we may mention that Mr. C. A. Cripps, Q.C., has been returned for Stroud, and Mr. J. Shiress Will, Q.C., for Montrose Burghs. Mr. James Rowlands, whose name came prominently before our readers in connection with the recent agitation in regard to the charge for gas in the Metropolis, will no longer represent Finsbury. Mr. G. Howell and Mr. Keir Hardie, the well-known Labour candidates, have lost their seats for Bethnal Green and West Ham; but Mr. John Burns, Mr. T. Burt, and Mr. H. Broadhurst, other Labour candidates, will continue to sit for Battersea, Morpeth, and Leicester.

TECHNICAL RECORD.

COMMUNICATIONS FROM THE CHEMICO-TECHNICAL SECTION OF THE TECHNICAL COLLEGE OF CARLSRUHE.

By Dr. H. Bunte.

We have received from Dr. Bunte a copy of his preliminary report on work now in progress at the Carlsruhe Technical College. The subjects dealt with are all of interest to gas engineers; and in the following abstract-translation of the paper, we follow the author's grouping of his matter under three heads:—

I.—*The Products of Combustion of Gas-Flames.*

The constantly recurring assertion of the detriment to health of gas lighting, and the statements of some chemists that ordinary batswing and Argand burners yield carbonic oxide, have given occasion for a fresh consideration of the question. Since this investigation was undertaken, many other experimentalists—among whom Renck, Grehant, and Geelmuyden may be mentioned—have attacked the problem, especially with reference to incandescent lighting; but their methods were dissimilar in many respects to those used at Carlsruhe; and this investigation deals also with flames for heating purposes, as well as for lighting. The experiments described here were conducted by Herr A. Weber and Dr. Haber.

The endeavour was made, on the one hand, in no way to disturb the normal form of the flame; and, on the other hand, to keep the products of combustion as far as possible from dilution with air before analysis. A metal funnel was inverted over the flame, as closely to it as possible without affecting the draught; and any desired proportion of the products of combustion was drawn off through a side limb on the stem of the funnel. The products of combustion pass into the body of the funnel, and escape round the brim; and without interference with the flame, a portion of the gases can be drawn into a reservoir.

Some experiments were made on flames burning within a chimney, and on the verge of smoking, to determine how great an excess of air was drawn through the chimney under these conditions. A burner of the "London Argand" pattern, consuming 5 cubic feet per hour, and two petroleum lamps with cylindrical burners—one with, and one without deflecting disc—were used. There was 11·1 per cent. of carbonic acid and 3·8 per cent. of oxygen with the Argand burner; and 9·9 and 9·6 per cent. of carbonic acid, and 7·3 and 7·9 per cent. of oxygen with the two petroleum lamps, in the chimney gases—giving co-efficients of 1·2 for the Argand and 1·5 and 1·55 for the petroleum lamps, to represent the excess of air. Therefore the air is relatively very completely used up in the Argand burner with the flame on the verge of smoking. The conditions are different with the incandescent light, where combustion follows the admixture with air in the Bunsen burner-tube. The zone of most intense combustion should coincide with the surface of the mantle, to give the greatest brightness. With a well-regulated burner, there was found, at a point 5 mm. above the mantle support, 12·6 per cent. of carbonic acid and 0·3 per cent. of oxygen, showing therefore only a small excess of air; while towards the interior, products of incomplete combustion were found—for example, 3·8 per cent. of carbonic oxide. Directly the flame has penetrated the mantle, the last of the carbonic oxide disappears; and therefore the mantle is, as it were, enveloped in flame. Besides the air used for the combustion, a tolerably large excess is drawn through the chimney; so that the exit gases show a much lower percentage of carbonic acid. With a large number of various incandescent burners, from 4·7 to 7·4 per cent. was found; and the large excess of air drawn up, and the high temperature prevailing, preclude the possibility of a trace of incompletely burnt gas escaping.

For the solving of the main problem, whether products of imperfect combustion occur in the exit gas, a portion of this gas was led through a train of apparatus in which the carbonic acid and water were first absorbed. Incompletely burnt gas was then consumed, by being passed through a capillary containing incandescent copper oxide; and the products were passed into a weighed apparatus. Ten incandescent burners, with the mantles in varying states of preservation, were used; and an Argand, a hollow-top batswing burner, and a cylindrical petroleum lamp were also thus investigated. Calculating into percentages of carbonic oxide in the undiluted exit gases, it was found in most cases that the amount was expressed in thousandths of a volume per cent. only; and consequently it was within the limit of experimental error. Therefore the combustion must be regarded as perfect with these various burners. If it is remembered that, under ordinary conditions, these products of combustion are mixed with large quantities of air, the futility of attempting an exact estimation of such products in the air of a room is obvious; and it may be concluded, on the evidence afforded by these investigations, that the ordinary gas-flame under normal conditions, and the incandescent light also, yield no quantitatively determinable amount of products of imperfect combustion.

Flames used for heating by direct contact with the bodies to be heated, must necessarily be furnished by gas previously

admixed with air; and the greater the proportion of this primary air, the less is the supply of air—secondary air—subsequently needed. This principle was first applied in the Bunsen burner. There is, however, a limit to the amount of air that can be mixed with the gas before combustion; as beyond a certain degree of dilution—viz., about 80 parts of air to 20 parts of gas—the mixture becomes explosive. Therefore, practically, less than 80 per cent. of air must be mixed with the gas. But the more nearly this limit is approached, the more certain becomes complete combustion of the gas. A first-class German burner proved to have nearly attained this maximum admissible air supply, and combustion was complete; but a burner of French origin, with too small an air supply, allowed appreciable quantities of unburnt gases to escape.

For the collection of the products of combustion from heating burners, a flat-bottomed circular vessel, with water circulation, was placed over the ring of burners, so that the spent gases passed into the space between the vertical wall of the vessel and an eaves-like metal plate, which was soldered to the wall at its upper edge, and projected beyond it at its lower edge. The gases were drawn off from this space through a tube, in the same manner as from the funnel already described; and the examination for incompletely-consumed gas was made in a similar way. In order to equalize as far as possible the conditions for all the burners, the consumption was regulated to give from 6 to 7 per cent. of carbonic acid in the spent gases in all cases. Two German and two French types of boiling apparatus were tested, as was also a Bunsen burner with Teclu air-regulator.* In the experiments with the boiling apparatus, with 76·1 per cent. of air, 0·029 per cent. of carbonic oxide was found in the spent gas; with 74·2 per cent. of air, 0·072 per cent.; with 60·07 per cent. of air, 0·468 per cent.; and with 51·5 per cent. of air, 0·546 per cent. The effect of the too small proportion of the air in permitting carbonic oxide to escape unburnt, is very marked in the last two cases. The Teclu burner, with a nearly explosive mixture containing 80 per cent. of air, yielded in the products of combustion only 0·04 per cent. of carbonic oxide; with 65·6 per cent. of air, 0·23 per cent.; and with only 21·8 per cent. of air, 0·51 per cent.—the carbonic acid in all three instances averaging about 6·5 per cent. Seven different incandescent burners were then examined in like manner; and it was found that, in all of them, the mixture of gas and air in the Bunsen tube contained over 70 per cent. of air, which approaches very nearly the proportion theoretically most conducive to perfect combustion.

II.—*Tests of Various Incandescent Burners.*

The large number of incandescent burners now competing in Germany with the Welsbach burner of the German Incandescent Light Company, rendered desirable a series of observations as to their durability and lighting power over a considerable period. To obtain strictly comparable results, eight burners were fitted to one pipe, which, by means of knuckle-joints, could be turned so that any burner was brought into position on the photometer-table without further adjustment. In addition to the gas supply from the common service, which could be shut off from any burner by means of taps, each burner was provided with a side supply, by means of which the gas consumed during photometrical observations could be measured before admission to the burner. The whole of the lights burnt under precisely similar conditions; and at certain intervals—generally once a day—all were extinguished, and each in turn supplied from the experimental meter, and tested on the photometer. The Hefner lamp was used as the standard of comparison; and ten readings were taken with each burner, which was during the course of the observations turned three times by about 120° on its axis.

The tests were carried out by Dr. Scharrer; and the results obtained with fourteen different burners are tabulated. The burners and mantles were in most cases bought in the ordinary way; and generally three mantles were tried with each burner. Every mantle was tested with the burner for which it was devised. With eight burners, the observations have already been continued up to 1000 burning hours, or until the light failed. Four only of these were efficient at the end of that period; and they had a greatly diminished illuminating value. A burner made by Tobias Forster and Co., of Munich, gave perhaps the best result; but that of the German Incandescent Light Company was practically equal to it. One made by Fischer and Co., of Mayence, and one by Gericke and Co., of Berlin, showed less initial lighting power; but at the end of 1000 hours, it gave almost similar values to the two first mentioned. The next series of observations on six burners is not yet complete. A detailed account of the behaviour of each burner cannot yet be given; but it may be remarked that the rise in lighting value occasionally observed after many hours' use is to be ascribed chiefly to change of shape of the mantle, though fluctuations in the gas pressure often cause considerable variations.

Experiments are in progress on the nature and chemical composition of the mantles. It may provisionally be said that the weight of the various mantles is very similar. The total weight is about 4 grammes, of which nearly 90 per cent. is that of the muslin, and only about 10 per cent. that of the earthy mantle which remains on incineration. Though the results with other burners show that the original Welsbach is still foremost in respect of illuminating power, durability, and uniformity, nevertheless the efforts of other inventors to compete with it have not been without good result.

* See JOURNAL, Vol. LXII., p. 849.

III.—*Carburetting.*

The earlier communications of the author on carburetting* have chiefly treated of the enrichment of coal gas by means of various hydrocarbons, which are on the market in more or less abundance at moderate prices. Benzol is the most generally acceptable of these hydrocarbons, and, under present conditions, is very economical. It has now been practically used, not only in Germany, but also in England and France. As it has proved quite suitable, and as the apparatus is simple and readily adapted to various conditions, a large extension of carburetting with benzol may be anticipated. For some time past, apparatus for carburetting on a large scale has been at work, and has given satisfaction—indeed, it is found that the consumption of benzol for a given degree of enrichment is lower than on the experimental scale. The raising of illuminating power by benzol depends on a large number of conditions—such as the composition of the gas enriched, the method of consumption, and the burner used.

In the early experiments, the effect of benzol and other hydrocarbons was studied exclusively on coal gas disillumined by means of fuming sulphuric acid. It appeared interesting to observe the effect of different carburetting agents on water gas, and on each of the constituents—*i.e.*, hydrogen and carbonic oxide—of the latter separately. Herr L. Walther undertook this investigation. The experiments were so carried out that benzol, toluol, pentane, and hexane, the typical hydrocarbons used, were added to the gas in such quantity that, for a consumption of about 100 litres (3·53 cubic feet) per hour in a hollow top batswing burner, an illuminating power of about 10 to 12 Hefner units (8·8 to 10·5 English candles) was obtained. Different burners were tried in each case, in order to obtain a favourable result; this being an especially necessary precaution, as the specific gravities and rates of combustion of hydrogen and carbonic oxide are so divergent. The results obtained with hydrogen, carbonic oxide, and water gas, and benzol, toluol, pentane, and hexane, are given in the following table:—

Gas Examined.	Consumption of Carburetting Agent per English Candle per Hour.			
	Aromatic Hydrocarbons.		Paraffins.	
	Benzol.	Toluol.	Pentane.	Hexane.
Hydrogen	16·90 grs.	19·00 grs.	64·50 grs.	60·30 grs.
Carbonic oxide . .	23·05 ,,	22·15 ,,	99·20 ,,	89·90 ,,
Water gas	19·20 ,,	17·60 ,,	81·60 ,,	67·60 ,,

To complete the series, the experiments should be extended to methane.

A comparison of these figures with those previously found for the carburetting of disillumined coal gas with which only about 8·8 grains of benzol or toluol, or 31·7 grains of pentane or hexane were needed per candle per hour, will show that with hydrogen the quantities required are about double, and with carbonic oxide about treble those with the coal-gas residue. On a working scale, too, the figures for coal gas are even lower. Though the statement occasionally made, that water gas cannot be carburetted with benzol, is untenable, yet a far larger expenditure of enriching material is needed with water gas than with disillumined—*i.e.*, feebly illuminating—coal gas, for a given accession of luminosity. The explanation evidently lies in the fact that about one-third of the coal gas consists of methane, the heating power of which develops the full illuminating value of the hydrocarbons. There is little difference in the enriching power of the different members of the same series of hydrocarbons; but there is considerable difference between members of the aromatic and those of the paraffin series. In accordance with former results, for the same enrichment, there is needed of a paraffin (pentane) three or four times the quantity that is required of an aromatic hydrocarbon (benzol). This fact greatly favours the employment of benzol and the homologous hydrocarbons.

The experience of many years proves that, with the use of either crude petroleum (naphtha) or pure paraffins, a considerable increase of illuminating power can be obtained by "fixing" or "superheating"—that is, by a partial breaking up of the hydrocarbons; and this method is generally used in the American water-gas processes. To ascertain the effect of this superheating on the volume and illuminating power of carburetted gas, experiments were made by heating to about 600° C. hydrogen and water gas which had been previously charged with pentane vapour. The results are contained in the next table.

* See JOURNAL, Vol. LXII., p. 717; and Vol. LXIII., p. 484.

Experiments on the Fixing of Hydrogen and Water Gas Carburetted with Pentane.

	Pentane in 100 Litres (3·53 C. Ft.) of Gas.	Illuminating Power of Unfixed Gas per 100 Litres.	Fixed Gas.		Accession of Illuminating Power to 100 Litres of Unfixed Gas.	Temperature of Fixing.
			Volume from 100 Litres.	Illuminating Power per 100 Litres.		
	Grains.	English Candles.	Litres.	English Candles.	English Candles.	Deg. Fahr.
Hydrogen.	872	16·2	120	14·6	1·3	930
	"	"	—	15·0	1·8	1100
	"	"	—	15·8	2·8	1100–1200
	1131	21 4	120	20 9	3 7	930
	"	"	130	20·6	5·4	1130
	1363	23 4	110	23·4	2·3	930
	"	"	120	22·5	3·6	1100
	"	"	130	24·1	7·9	1100–1200
Water Gas.	644	9·5	114	11 2	3 3	930
	"	"	124	10·4	3·4	1100
	1042	18·9	119	21·6	6 8	930
	"	"	122	22·5	8·5	1100
			124	21·5	7 8	1100–1200

These figures, which need checking and amplifying in several directions, show that in the "fixing" process a breaking up of the hydrocarbons occurs, with an increase of volume amounting to from 20 or 30 per cent., according to circumstances. Generally the absolute lighting power of the gas is reduced; but having regard to the volume of the unfixed gas, it will be seen that there is really a gain in lighting power, which, under the above experimental conditions, was greatest at 1100° to 1200° Fahr. The nature of the changes brought about by the "fixing" could not be established from the fixed gas, as the dilution renders it almost impossible to isolate single gaseous constituents.

Experiments have been undertaken by Dr. Haber and Herren Samoilowitz and Oechelhäuser, on the decomposition by heat of the undiluted hydrocarbons, especially hexane. They are not yet completed; and provisionally it can only be said that, by the decomposition of paraffin hydrocarbons, such as hexane, only very small amounts—scarcely 2 per cent.—of aromatic hydrocarbons and acetylene result, and the reaction that very possibly occurs is the formation of homologues of ethylene with the splitting off of methane. Further results of the experiments will be reported later.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Annual Congress in Paris.

The Twenty-second Annual Congress of this Society was held in Paris from the 17th to the 19th ult., under the presidency of M. de Lachomette. The meeting has already been noticed in the Journal (*ante*, p. 75); and the following abstract report of the proceedings is translated from the *Journal des Usines à Gaz*, the official organ of the Society.

There were about 125 members present when the chair was taken on the morning of the 17th ult. The first business was the adoption of the report of the meeting held at Nîmes last year, as contained in the published Transactions of the Society. Next came the admission of new members and associates, of whom there were 23 and 7 respectively; the President of The Gas Institute for next year (Mr. W. R. Chester) being elected an honorary member. The report of the Committee was then presented by the President. It referred to the loss of 13 members by death; sympathetic allusion being made to the decease of Mr. G. Garnett. Allowing for withdrawals and exclusions, the total number of members at the close of the year was 611, divided as follows: Honorary members, 16; ordinary members, 498; and associates, 97. The contributions made to the funds of the Society by gas companies and firms amounted to 22,230 frs. (£889); being a slight falling off as compared with the preceding year. The Treasurer (M. Deleury) likewise submitted his report. It showed that at the close of the year 1894 the capital had risen to 165,055 frs. (£6602); being an increase of 17,261 frs. (£690) during the twelve months. The next business was the election of eight members of the Committee, five to replace those retiring—MM. Brouardel, Deleury, Monnier, Piaton, and Visinet, who were eligible for re-election—and three to take the positions vacated by M. de Lachomette (the retiring President), M. des Gouttes, whose name had been removed, and M. de Vigne, deceased. The result of the ballot was the restoration of MM. Visinet, Deleury, Piaton, and Brouardel to their places for three years; M. Alfred Lebon being substituted for M. Monnier, who was elected for two years, and MM. Thibaudet and Bigeard each for one year. This completed the general business at the morning sitting. The Committee afterwards held a meeting for the election of officers for the ensuing year. The following was the result:—

President . . . . . M. de Lachomette.
Vice-President . . . . M. Delahaye.
Secretaries . . . . . MM. Visinet and Frère.
Treasurer . . . . . M. Deleury.

At the afternoon sitting, there were 230 members present to hear M. de Lachomette deliver his address, of which the following is a full abstract translation:—

Inaugural Address.

The President began by remarking that most of the questions bearing upon the gas industry had been so ably dealt with on previous occasions, that his task was rendered especially difficult; and were it not for the respect he owed to tradition, he should certainly refrain from doing over again what had already been done so well. He felt that his hearers would lose nothing by this course; but they would certainly not be altogether pleased with him for setting a bad example which his successors might be tempted to follow, and possibly deprive the members of addresses full of talent and interest. He therefore proposed to review certain matters of daily practice, and offer a few suggestions as to the relations which should subsist between suppliers of gas and their customers, with the object of extending their business. He went on to remark that in the gas industry, as in many others, the commercial side has more consideration than the purely technical one; but he pointed out that, to ensure complete success, neither of these branches should be neglected to the advantage of the other. It was by the proper division of the gas manager's time, labour, and intelligence that efficient management in the works could be so combined with judicious administration of the outdoor business as to be productive of commercial success. It had been said that profits were made in the retort-house. It was therefore to their raw material—coal—that he would first direct his hearers' attention.

Without dwelling upon the various kinds of coal and their proper admixture, the President proceeded to consider the question of storage, which, he remarked, was one of primary importance, whether from the point of view of handling or of preservation. He said he was telling his colleagues nothing new in stating that coal stacked in the open air for a certain time loses both in the quantity and the quality of its constituent volatile matter, and yields, on carbonization, coke of very inferior character. This was a fact they had sometimes learnt to their cost. What, he asked, was the extent of these inconveniences; and what means should be employed to lessen their effects? It was in M. Henri Fayol's work "*Sur l'Altération et la Combustion Spontanée de la Houille exposée à l'Air*" that he had found the most complete solution of this twofold question. The application of the principles laid down by M. Fayol had led him (the President), after several years' experience, to the attainment of the best results; and he thought he should be doing useful work if he gave a summary of them.

Proceeding to deal at some length with this subject, the President referred first of all to the experiments carried out by M. Regnault with the coals of Anzin and Mons, as described in a report on "The Manufacture of Gas" published by him in 1855. Coals which had been tested twenty years previously, and preserved in flasks imperfectly corked, were submitted to fresh analysis, and the result showed that no change had taken place in their character—they had not suffered from any spontaneous decomposition appreciable by delicate tests. He did not deny that certain coals, principally those containing pyrites, might, when exposed to the air, become in time altered in composition, and unsuitable for the production of a good quality of coke; but in the case of the coal of Mons, no remarkable change was found by experiment even after ten months. Regnault therefore doubted that air has any prejudicial action on coals; although those containing pyrites appeared to him to be liable to change in the long run. M. de Marsilly was of opinion that fire-damp coal exposed to the air threw off carburetted hydrogen, and lost a portion of the properties necessary for the production of good coke.

After reviewing the conclusions come to by the Royal Commission appointed in 1876 to inquire into the causes of the spontaneous combustion of coal, and the doubts expressed by various authors as to the effect of pyrites, to which the Commission attached much importance, the President quoted the opinion expressed by M. Haton de la Goupillère, in 1878, in his report on the best means of preventing explosions of fire-damp. He considered that a very frequent cause of fire lay in the combustible itself, which was too often susceptible of spontaneous heating. Oxidation of the pyrites or of certain organic substances was often the primary cause.

Coming to the experiments of M. Fayol on various kinds of coal, the President made the following remarks: The conclusion arrived at by this investigator was that all coals exposed to the air absorb oxygen; and that this absorption is always followed by a more or less appreciable change of character. The volume absorbed may be equal to a hundred times that of the coal. Under the action of the atmosphere between 25° C. and 400° C., coals first lose a part of their weight, then recover what they have lost, and even add materially to their original weight. At the end of a certain time, at high temperatures, the weight again diminishes, and appears to have no power to stop its decrease. The loss and increase of weight are not the same in all coal; but the nature of the coal has no appreciable influence on these variations, as anthracites are found in the same rank as fat coals and lignites. The state of division of the coal has a notable influence on the alterations in weight. These changes are therefore produced more slowly when the coal is in large pieces.

Temperature plays the principal part. Each of the periods

of change of weight mentioned above is shorter and of more marked effect the higher the temperature. This is shown by the following table :—

——	Temperature of the Air.			
	25° C.	50° C.	100° C.	200° C.
First Period.				
Maximum loss . .	0·53 p. ct.	0·81 p. ct.	1·50 p. ct.	1·60 p. ct.
Time	15 days	24 hours	12 hours	1 hour
Second Period.				
Total increase . .	0·20 p. ct.	0·20 p. ct.	4·70 p. ct.	5·00 p. ct.
Duration of exposure	150 days	150 days	240 days	8 days
Third Period.				
Loss	nil	nil	nil	30·00 p. ct.
Duration of exposure	240 days	240 days	240 days	240 days

The figures represent averages. In the case of anthracites, as well as of fat coals and lignites, increases in weight to the extent of 7, 8, and even 10 per cent. have been met with.

The increase in the weight of coal in air can only be attributed to two things—the absorption of gas or of water; and it results mainly from taking in the oxygen of the air. This is a chemical phenomenon, not a mechanical action. Generally, the action of the air makes itself apparent first by a slight increase, then by a gradual diminution, in the residue of calcination. With regard to the yield of gas, the action of air on coal has a contrary effect to that produced from the point of view of the yield of coke. After starting with a slight increase, an appreciable diminution ensues; then comes a further increase, which attains tolerably large proportions. This is shown by the following tables:—

Percentage of Residue after Calcination.

——	25° C.	50° C.	100° C.	200° C.	400° C.
Before exposure . . .	72·75	72·75	72·75	72·75	72·75
After 1 day	74·60	74·40	74·10	76·00	72·30
„ 2 days	74·50	74·60	75·30	77·08	58·80
„ 4 „	74·60	75·10	75·80	72·60	28·00
„ 8 „	76·60	76·30	76·10	67·50	14·58
„ 15 „	78·10	77·40	77·20	64·35	Ash
„ 1 month . . .	79·60	78·20	77·10	59·80	..
„ 2 months . . .	79·80	80·30	76·30	57·80	..
„ 4 „ . . .	77·70	77·10	74·60	49·60	..
„ 8 „ . . .	77·11	76·69	70·50	39·20	..

Yield of Gas in Litres.

——	25° C.	50° C.	100° C.	200° C.	400° C.
Before exposure . . .	26·36	26·36	26·36	26·36	26·36
After 1 day	26·70	24·80	24·85	25·30	19·50
„ 2 days	26·70	24·80	24·85	25·30	15·80
„ 4 „	26·50	24·60	24·60	25·30	6·60
„ 8 „	26·10	24·50	24·60	24·80	..
„ 15 „	25·70	24·90	24·80	24·70	..
„ 1 month . . .	25·10	25·10	26·70	23·60	..
„ 2 months . . .	24·40	26·00	26·70	23·90	..
„ 4 „ . . .	26·80	27·10	27·80	23·80	..
„ 8 „ . . .	29·15	30·34	29·50	23·45	..

The illuminating power diminishes very quickly by the exposure of the coal to the action of air and heat. This is shown by the following table :—

——	100° C.*		200° C.		400° C.	
	Dust.	Grains.	Dust.	Grains.	Dust.	Grains.
	Days.	Days.	Days.	Days.	Hours.	Hours.
Anthracite coal . .	25	45	3	5	..	..
			Hours.			
Fat coal	55	55	12	15	3	12
Flaming coal . .	55	95	36	5	4	12
Lignite coal . . .	15	15	24	4	..	..

* At 25° C. and 50° C., the time was more than 240 days.

The lighting power lasts longer in the fat coals than in other kinds. It resists high temperatures for only a short time, and is maintained better in grains than in dust. Many experiments made with the coal of Commentry, in small pieces and in dust, which had remained for two years in water at the ordinary temperature, showed that this coal had undergone no appreciable change, either in appearance or in constitution. The same coal tested after 100 days' immersion in water at 80° C. to 90° C., showed that neither the agglomerating nor the lighting power had even then suffered diminution; while the look of the coal remained the same.

The principal facts arrived at may be summarized as follows: (1) Coal when exposed to the air changes in character—the change consisting in a diminution of agglomerating as well as of lighting power, and probably also of heating power. (2) The change is more rapid the higher the temperature, and the more divided the coal. (3) In the small pieces, the change in the character of the coal is greater on the surface than in the interior. In heaps of coal permeated by the air, the change is greater in the centre than on the surface. When the air cannot penetrate to the centre, the surface undergoes the greatest change. (4) Small coal washed is less liable to change than unwashed. (5) Large pieces of coal are only liable to change after a certain number of years' exposure to the air. The small coal is affected very quickly if it happens to be under conditions likely to raise its temperature. In a few months it is capable of entirely losing its agglomerating and lighting power. (6) Heaps of small coal become heated; but stacks of large coal do not heat to an appreciable degree. These explanations enable us to understand the results obtained by Regnault in his experiments already quoted, which led this illustrious scientist to express doubts as to the change undergone by coal exposed to the air.

From the foregoing considerations, it will be seen that the best means of preserving coal from change in its constitution is to protect it from the air, and keep it at a low temperature. Immersion in water would satisfy these two conditions; but this is rarely practicable. The same result may be obtained by enclosing the coal in an impermeable covering, composed of clay or fine dust. Small coal should not be stacked in too large heaps. Experience has shown: (1) that coal stacked in low heaps does not become heated; (2) that the heat increases with the height of the stack; and (3) that at about the height of 3 or 4 metres the temperature rises progressively, and then descends without having exceeded 60° C. or 70° C. At this height, it is usual to see steam issuing about the end of the third month; then follows a colourless gas having a strong odour like that of petroleum; and afterwards smoke appears near the top of the heap. If the heap is opened, white and yellow smoke comes out in large quantities; the temperature rises; and at about 300° C. ignition takes place. Combustion is checked by covering with coal dust the part which has become ignited. But distillation goes on; and the coal soon loses its volatile properties, and is transformed into a very light puffy coke. Ventilation of the interior of stacks of coal, by means of bundles of faggots, has been tried. When these have been well arranged, combustion has been prevented; but when placed irregularly, fire has occurred much sooner than in heaps not so treated. Ventilation by this means is therefore not the best method of preserving coal from taking fire. A surer way is to make the heaps smaller. The inner temperature of a stack 2 metres high does not usually exceed 40° C. to 50° C.

These extracts enable us to appreciate the importance of M. Fayol's experiments; and they afford considerable help. All gas-works have not the necessary space to allow of coal being stored in low heaps; but, whenever this is possible, advantage will always follow. And in order to realize it, the necessary expense must not be spared. But whatever arrangements are adopted, a sharp look-out should be kept on the temperature of the stack. A very simple method of ascertaining this is to insert iron rods, which can be drawn out from time to time, and their temperature found approximately by the hand. Apart from the stacking of coal, there is its carriage from the store to the retort-house, which, in large works, calls for the exercise of much foresight.

Coming now to carbonization, the President remarked that attention should be given to the following points: The temperature of the ovens, the stanchness of the retorts; and the pressure in them. With regard to heating, generator furnaces with recuperation offer undeniable advantages. These appear not only in the reduction of the quantity of fuel consumed, but in the facility they afford for keeping up the fires and for regular working. Skilled firemen are not necessary; and by regulating the dampers the required temperature can be secured by the manager himself. This system of heating is destined to become general in both small and large works. The stanchness of the retorts does not depend solely upon their quality, but also upon the precautions taken in setting them. Great care should be exercised in this work, as well as in the selection of the material employed in the construction of the furnace. Retort-settings have to be kept at work for several months in succession; and a retort out of action reduces the producing power of the furnace, and increases the proportion of fuel employed. When an accident happens, the cause should always be sought without any preconceived opinion. In support of this very trite remark, the President recalled to his hearers' minds the communication made to the Society by M. Meizel in regard to the method employed at the gas-works at St. Etienne to prevent the cracking and breakage of retorts. When the fires were started, and after a few days' working, it often happened that one or more retorts were found to be cracked or split perpendicularly to their length; and this notwithstanding that the greatest precautions had been taken when lighting up. Meizel was led to inquire as to whether these accidents did not arise from causes preceding the firing up. In examining the unfired furnaces contiguous to those in use, he noticed that several retorts were already split. The same result followed each observation, which was repeated a number of times. The breakages were due to forcing the neighbouring furnace fires after they had been lighted. The following method was therefore adopted: Instead of quite completing the front wall, it was only finished for the two furnaces placed back to back, situated at one end of the row, and first lighted; and with regard to the others, an uncompleted band, something like 25 centimetres wide, was left from top to

bottom and at each side of the furnaces. The wall was not finished until the furnaces were lit. Before these precautions were taken, the proportion of broken retorts rose to an average of 28 per cent. for seven years. After they were adopted, and during a period of four years, only 2·65 per cent. of broken or cracked retorts were found.

The pressure of gas in the retorts in works where no exhausters are employed would be the same as it is in the holders, in addition to the resistances caused by the pipes and the various portions of the plant. Great care should be taken to reduce these pressures by providing ample room for the passage of the gas, and avoiding obstructions, especially in the condensing and purifying plant, and by so counterbalancing the gasholders as to reduce their weight to the minimum necessary to ensure the proper pressure in the mains. The adoption of exhausters enables these resistances to be overcome. Their employment is not general in small works, especially in those located in places where the price of coal is high. The kind mostly used is the rotary or Beale type. Steam-jet exhausters, which were greatly in vogue at the time of their invention, are economically fitted up and easily maintained when the steam for working them can be produced by the waste heat of the furnaces; but there is now a tendency to put them aside, since the employment of gas-heated furnaces renders more difficult the production of steam in the way indicated. Rotary exhausters are being again used; and this is justified by the ease with which they are driven by means of gas-engines. In small works, where economy should be the first consideration, the engine could be utilized at the same time to run the washer, the pumps, the coke-breaker, and the repairing plant in a small workshop. The gas-engine should be employed in preference to the steam-engine, even where fuel is cheap, because it can be more easily looked after; and, moreover, it affords an excellent opportunity, which should not be neglected, of setting a good example to customers by employing ourselves what we recommend them to adopt.

All that has been written on condensation and purification shows that ideas are far from being exhausted on these two questions. The first of these subjects will be dealt with in a paper by one of our colleagues; and I will say a few words only on naphthalene—that bugbear of our business. I believe that the reactions which cause its formation take place exclusively during the distillation of the coal in the retort; and that, contrary to certain beliefs, it is not formed afterwards. If that is so, the cooling of the gas or mechanical absorption should suffice to get rid of the trouble once for all. This reflection is suggested by the following occurrence: In 1872, the Vaise Gas-Works were provided with only a small extent of purifying plant and sheds for the revivification of the spent oxide. It was thought to effect the latter operation by subjecting the material to a current of steam on its removal from the purifiers; and the process was carried on in a kind of lime-kiln. It was really revivification in a closed vessel. At each operation, there was an abundant sublimation of naphthalene, yet not a trace of it in the pipes, either on the works or under the streets. I suppose that the purifying material—and it would be the case with any other porous substance—had certain absorbent power for naphthalene, which enabled it to mechanically retain the latter until complete saturation took place. Revivification by the process I have indicated restored to the material all its powers of absorption; and by constantly repeating the operation, the naphthalene was prevented from going forward. The process was unfortunately expensive; and it was abandoned after a few years, when the works were enlarged.

In many works, no precaution is adopted to prevent freezing of the water in the tanks of gasholders. It is generally thought sufficient to break up the ice several times a day. The tanks suffer deterioration if they are of brick; the holders themselves are put out of shape; and the rigidity of the guide-framing is affected. These annoyances and inconveniences may be easily and cheaply got rid of by adopting steam heating, or by using a thermo-syphon. I will give as an example a telescopic gasholder of 3000 cubic metres capacity, in a metal tank constructed entirely above ground. The volume of water is 1700 cubic metres (375,000 gallons). The heating is effected by a thermo-syphon which cost 600 frs. During the winter of 1894-5, the heating necessitated the consumption of 500 kilos. of coke per diem. When the atmospheric temperature was down to 15° C. below zero, not an atom of ice was formed. The other holders, in brick tanks which had not been heated, caused all kinds of trouble.

The question of distribution is one of the most intricate we have to solve. Our object should be to obtain sufficient pressure over the whole system to ensure the proper working of the various appliances served, and at the same time to avoid excessive pressures, which result in increase of leakage. If there are great differences of level, each should be controlled separately by a special governor, if this arrangement does not necessitate a very extensive system of mains and services; or governors may be placed at the base of slopes leading to higher levels. One or more trunk mains should always come from the works, and terminate at central points, whence the distributing-pipes may start. This arrangement has long been recommended; but I fear it has not been duly appreciated, and its application is often neglected where it would have given the best results.

The question of leakage is one which should have serious attention. With regard to the frequently exaggerated complaints of the public, it is well not to accept responsibility without first ascertaining if the fault does not rest with others. The checking of leakage should begin with an exact measurement of the quantity of gas manufactured. Attention should be given to variations of temperature; and there should be proper supervision of consumers' meters. Due vigilance against fraud should be exercised, even though the company be accused, as sometimes they are, of inquisitorial conduct. Governors should be fitted to the public lamps, and be employed in all cases where the consumption is not checked by meters. It is important also to ascertain what gas is used within and outside the works for the company's own purposes; and the best plan is to have a meter for each service. These precautions are useful in helping a manager to arrive at the total quantity of gas lost by leakage in distribution. A perfect joint—one which will yield without deterioration to changes in the level of the pipes, variations of temperature, and so forth—has still to be found. The best appears to be the one made of india-rubber; but in the neighbourhood of the works it is affected by the light oils contained in the gas. Where it is employed, the use of benzene or similar products to clear pipes obstructed by naphthalene, must be avoided; as otherwise the india-rubber would melt and the joint be broken. Ordinary lead joints lack elasticity, and are affected by changes of temperature. Leakage resulting from bad jointing may be obviated to a great extent by the employment of careful main layers working under good supervision. A fresh cause of deterioration in mains is their proximity to electric conductors, especially those employed for tramway traction. This constitutes for gas managers a new enemy to be combated.

Suppliers of gas have been charged, more or less justly, with neglecting to make some effort to develop the consumption of gas. This reproach is not always well founded; and certainly during the past few years considerable sacrifices have been made to attain this object. The first thing to be done is to enable the consumer to have gas fittings and appliances at as small an expense to him as possible—making the connection with the main without charge, or at only a nominal one, and letting fittings on hire with easy terms of purchase. In some cases, the fittings become the property of the consumer when the gas burnt reaches a certain quantity. The special means selected to stimulate consumption will necessarily be governed by local requirements. A show-room furnished with the various kinds of appliances, and in charge of an intelligent attendant to demonstrate their utility and give general information to the inquirer, is an excellent medium of publicity; while cookery lectures have been followed by very satisfactory results. Periodical domiciliary inspections by competent officials would be productive of much good. At Bayonne, at the suggestion of the Directors of the Gas Company, the inspection of gas cooking-stoves has been entrusted to a lady. The idea may at first appear strange; but one can easily see that a properly trained lady would be able to give consumers much information respecting matters which come specially within her province. She would be able to show practically the best way of using gas-stoves; and, moreover, she would be in a position to give a few hints as to the necessity for cleanliness in connection with culinary operations. At any rate, at Bayonne satisfactory results have attended the introduction of this novel system.

We all know what trouble arises from the freezing of water in the consumers' meters. This was particularly noticeable last February. Alcohol is frequently employed to obviate the difficulty; but it is expensive and evaporates. Glycerine solutions have been recommended; but these, although harmless when first used, in time form a greasy substance which interferes with the working of the meter, and even eventually act upon certain metals. Solutions of chloride of calcium have been well spoken of; but, even when non-acid, there is diversity of opinion as to their harmless nature. It would be of great advantage to gas managers if there could be found an uncongealable liquid which could be used in meters without risk of interference with their working or detriment to their constituent parts.

And now a few words in conclusion. When constructing new works, or enlarging or altering those already erected, first prepare a general plan which, while satisfying present requirements, shall also provide for the future. Build large enough, but not too large; and let what you build be solid and durable in every part, in view of the rough use to which gas-works plant is sometimes put, and the long service it has to render. Outlay should only be incurred when it is absolutely indispensable, when it is likely to be productive, and when the capital sunk can be soon redeemed. We should look beyond our own works, and even our own country, to enable us not only to adopt what is good, but also to avoid what is bad. Experience is doubtless the best thing, provided it does not cost too much to acquire it. The great thing is to profit by that gained by others. Do not lay yourselves open to the charge of being mere routinists; but be prudent in the application of new processes. The knowledge of what has preceded us or surrounds us, not merely in our own industry but in the sciences which are allied to it, is indispensable to good management. By becoming more enlightened, we avoid regrets, disillusions, and loss of time and money. After we have

given to the management of our undertakings all the attention it demands of us, let us—and here I address more particularly the young—devote a portion of our time to study. The field of transformations and fruitful creations is unlimited. Each fresh discovery should become in its turn the starting-point for further progress. Notwithstanding all our knowledge, there are some very simple facts which lie close to us in our path, yet of which we are ignorant, simply because we have not learned to see them.

I have dwelt at some length upon matters of current practice. But you must not suppose that I ignore the necessity for the study of fresh questions. On the contrary, I consider they should occupy us, even though they may be still in the domain of theory. We live in times when these questions abound. I need not enumerate them. You know what they are; and you will give to them a portion of your attention.

A report was presented from the Committee on the subject of the papers submitted in competition for the Society's premiums. One of these, bearing the title of "The Chemical Purification of Illuminating Gas," was by MM. Delseaux and Renard; and the Committee considered it worthy of a premium of 750 frs. Another, on "Water Gas," by M. Effenterre, gained a premium of 500 frs. A paper by M. Derval, on "Gas Generators," was, with the author's consent, submitted as an ordinary communication. A paper by M. Châtaignier on "The Production of Incandescent Light by Means of Illuminating Gas," sent in last year to compete for one of the Society's premiums, gave rise to some severe criticism which prevented its acceptance as a competitive paper. The author, however, withdrew it from this category, and, after making certain corrections, sent it in as an ordinary contribution to the proceedings. The Committee were of opinion that he had been at considerable labour in preparing his paper; and, as it contained matter likely to give rise to useful discussion, they thought that he should be encouraged by the award of a prize of 250 frs.

As customary, prizes of 200 frs. were awarded to aged foremen or workmen for good conduct and long service. There were 23 recipients, whose ages ranged from 50 to 81 years; and their periods of service, from 32 to 53 years. Medals and diplomas were also bestowed by the Minister of Commerce and Industry (M. Alfred Libon) upon seven gas workers selected by the Society as being specially worthy of this distinction. They had served in gas-works for periods ranging from 34 to 42 years.

On the evening of the first day of the meeting, the usual banquet took place at the Hôtel Continental, under the presidency of M. de Lachomette. Among the guests were M. Alfred Picard, Commissioner-General for the Exhibition of 1900 (who was accompanied by several of his colleagues), MM. Troost, Laroche, Godot, and Bertrand, Directors, and a number of the officials of the Paris Gas Company, and several foreign members of the Society, among them being Mr. Corbet Woodall and M. Weil-Goetz.

We shall notice in subsequent issues the papers read at the meeting.

THE DETERMINATION OF WATER IN COMMERCIAL SAMPLES OF SULPHATE OF AMMONIA.

The following article on the above subject was contributed to a recent number of the *Chemical News* by Mr. John Hughes, F.I.C.:—

It is not generally usual to state the percentage of water present in commercial samples of sulphate of ammonia. Occasionally chemists are asked to do so, and also to specify the amount of acidity; and in such case the figures are given. But usually only the percentage of nitrogen equal to ammonia is reported. The writer thinks it would be desirable and useful that the percentage of water lost at 212° Fahr., and the acidity expressed as sulphuric acid (H_2SO_4), should always accompany the figures for nitrogen and ammonia on the certificate.

Sulphate of ammonia, when ground up in a mortar, rapidly loses moisture in a hot, dry atmosphere. Consequently, in order to make a correct report on the percentage of nitrogen contained in the sulphate of ammonia in its natural state as received, it becomes necessary to make two water determinations—one in the sample as turned out in its rough, damp state before grinding, and one in the finely-ground portion prepared for the purposes of analysis; the analytical results being afterwards calculated into the natural state as received, and reported accordingly.

The question of water really is a most important one, bearing in mind the commercial value of the material and the fact that every 1 per cent. of water lost represents an increase of 0·25 per cent. of ammonia. It is true that the introduction of centrifugal machines has largely reduced the proportions of water and acidity in the sulphate of ammonia as sent out; but there is still sufficient difference between the dampness respectively at the top and the bottom of the bags to make the sampling a matter of great importance.

The following twelve samples, representing one delivery of yellow sulphate of ammonia, were furnished to the writer by a large London manure firm; six bags being selected, and samples drawn respectively from the top and bottom of each. The proportions of water and acidity were then carefully determined as above suggested; a weak solution of litmus being employed as the indicator in titration for acidity:—

Top Samples.

	Water as Received.	Water as Analyzed	Water Lost During Preparation.	Free Acid Calculated as H_2SO_4.
1.	1·98	1·26	0·72	0·97
2.	1·81	1·42	0·39	0·63
3.	1·59	1·20	0·39	0·65
4.	0·87	0·48	0·39	0·81
5.	1·12	0·50	0·62	0·79
6.	1·32	0·72	0·60	1·03
Average	1·45	0·93	0·52	0·81

Bottom Samples.

	Water as Received.	Water as Analyzed.	Water Lost During Preparation.	Free Acid Calculated as H_2SO_4.
1.	2·62	1·64	0·98	1·24
2.	2·65	1·94	0·71	0·81
3.	2·53	1·76	0·77	0·80
4.	3·14	2·12	1·02	1·22
5.	1·97	1·24	0·73	0·71
6.	2·39	1·84	0·55	1·07
Average	2·55	1·76	0·79	0·97

It will be noticed that the differences are considerable; the top samples being much drier than the bottom ones. In No. 4, the difference was as much as 2·27 per cent.—representing 0·56 per cent. of ammonia; and the water lost during preparation amounted in some cases to upwards of 1 per cent., or equal to 0·25 per cent. of ammonia. Of course, this loss during preparation will vary with the degree of grinding, the time exposed, and the temperature and humidity of the atmosphere.

The following figures in seven other samples, each representing a separate delivery, and analyzed at a different time, will serve to indicate the variation that may be expected:—

Colour.	Water as Received.	Water as Analyzed.	Water Lost During Preparation.	Free Acid Calculated as H_2SO_4.
White	2·20	1·80	0·40	0·29
Yellow	1·94	1·50	0·44	0·31
Do.	2·31	2·06	0·25	0·15
Grey	2·96	2·74	0·22	0·38
White	1·70	1·10	0·60	0·15
Do.	1·90	1·40	0·50	0·23
Do.	1·89	1·32	0·57	0·25
Average	2·13	1·70	0·42	0·25

The amount of acidity is of importance, because, if not excessive—say, not more than 0·5 per cent.—the sulphate of ammonia can be safely shipped in double bags, instead of in the more expensive casks which were formerly used. If the certificate of the analyst contains information as to the percentage of water and acidity, in addition to the figures for nitrogen equal to ammonia, the identity of the sample with the bulk can be more readily established than when the figures for ammonia only are stated.

New Gas Examiner for Sheffield.—Mr. C. K. Baker, F.I.C., is to be recommended to the Sheffield Corporation by the General Purposes Committee for the appointment of Gas Examiner in the borough, which position has been resigned by Mr. Jonathan Wilkinson.

Drilling a Gas Well with an Electric Motor.—The Westinghouse Electric Company have commenced the drilling of a well for natural gas on land in front of their new works at East Pittsburg; and the novel experiment of using electricity for power is being made. An ordinary 25-horse power motor, such as is used in a traction car, will be placed in the engine-house instead of a steam-engine, and the electricity will be supplied from the works.

North British Association of Gas Managers.—The 34th annual general meeting of this Association is to be held in the Corn Exchange, Melrose, next Thursday, under the presidency of Mr. A. Wilson, of Dawsholm. We learn from the programme issued by the Secretary (Mr. R. S. Carlow) that, in addition to the Inaugural Address, there will be four papers; and the contents of the "Question-Box" may possibly furnish a few technical items. Mr. W. Young, of Peebles, will contribute some "Notes on the Chemical Constitution of Illuminating Gas in Relation to Its Illuminating Value, and on Some of the Physico-Chemical Conditions which Influence the Luminosity of Gas-Flames;" Mr. J. Napier Myers, of Saltcoats, will put in "A Plea for Standardizing Meter Unions;" Mr. D. Vass, of Portobello, will deal with the subject of "The Heating Value of Coal Gas;" and Mr. A. Waddell, of Broughty Ferry, will consider the question of "The Working of Shale and Splint Coal *versus* Oil and Splint Coal." After the business, the members will dine together in the George and Abbotsford Hotel. As the meeting is to be held in a district so full of historical associations, it is only what might be expected that arrangements would be made for the members and their lady friends to visit Abbotsford. This will be done on Friday morning. On the return to Melrose, luncheon will be served, and afterwards an opportunity will be afforded of visiting the famous Abbey.

REGISTER OF PATENTS.

Manufacturing Gas.—Mayer, F., of Baltimore, U.S.A. No. 13,758; July 17, 1894.

The claims put forward for this invention embrace twin generators, having two pipes or tubes extending through the brickwork thereof. In communication with them are blast-pipes (small pipes connecting them with the generators) and a gas-pipe leading from each pipe or tube to a hydraulic main. A system of steam-pipes is provided, whereby steam may be introduced into the pipes or tubes alternately; vertically moving the dip-valves in the hydraulic main. Suitable mechanism connects the dip-valves, whereby on the elevation of one valve the other is depressed or lowered. There is an indicator or a pointer, having a movement in common with the dip-valves, to indicate their positions in the hydraulic main, and also to indicate which controlling steam-valve is to be opened at certain stages of the gas-making operation. A gas-pipe leads from the bottom of each generator (and underneath the fuel therein) to the hydraulic main, and through the water in the said main to a point somewhat above the water-level. In this are placed dip-valves, which at all times cover the gas-pipes, and are sealed by the water. Mechanism is provided, whereby the dip-valves are moved together—vertically, but in opposite directions. In this way the relative resistance offered by the two valves to the passage of gas from the two generators may be changed, or the resistance equalized.

The general arrangement of the plant is not described in the specification apart from the drawings (eight sheets) which accompany same.

Retorts for the Manufacture of Gas from Coal, Oil, Tar, &c.—Scott, A., and M'Lean, P., of Galashiels. No. 13,841; July 18, 1894.

In the case of cast iron or other metal retorts, the patentees remark, it is found that—either owing to unequal heating, or to expansion and contraction due to the comparatively cold oil, tar, or other gas-producing material, coming into contact with the heated surface, or from other causes—the retort is very liable to burn out or crack on the underside (generally near the inlet end), thus allowing the gas and gas-producing material to leak through in quantity, and speedily render the retort useless. The purpose of the present invention is to preserve the retort from so burning out or cracking, by introducing inside the retort a liner made of malleable iron, steel, or other material, extending either the full length of the retort or such distance from the inlet end as, found necessary. This acts as a shield, and prevents the oil, tar, &c., from immediately impinging on the heated retort; and thus allows the latter to remain at a more uniform temperature throughout. At the same time, if there be any crack in the bottom of the retort, it prevents leakage of the gas or gas-producing material, as the interstices between the retort and the liner are quickly filled with carbon. Preferably the liner should be about ⅜ inch thick, and should be of similar form to the inside of the retort.

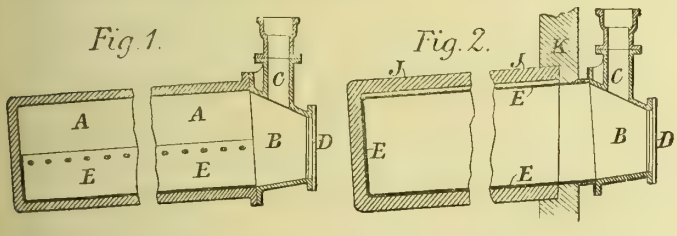


Fig. 1 shows a sectional elevation of a cast-metal retort A. Bolted to it is a mouthpiece B, having a gas-escape branch C, and door D. Inside this is the liner E, full length inside the retort, and but half the diameter. It is fixed with set-screws, tapped into the side of the retort. The holes throughout the liner are made oblong, to allow of expansion. The liner in this case has a closed or solid end. Another method of fixing the liner consists of angle or T-shaped half rings, bolted to the sides of the liner, and pressing hard against the upper side of the retort, thus keeping it in place. Another method is by casting snugs on each side of the retort, into which the upper edge of the liner fits. Or, again, if it is desired to have liners filling the inside of the retort, these can be dropped in loosely, or cast with the retort, or expanded into place.

Fire-clay retorts are at present unsuitable for producing gas from oil, tar, or any other liquid or semi-liquid gas-producing material; as when heated, the material is absorbed by, or percolates through, the pores of the fire-clay, and is lost. In this case, the patentees propose to insert a malleable iron or steel liner, or inner retort, preferably ⅜ inch thick, and of circular shape, nearly filling the space inside the retort, but leaving sufficient room for expansion. This liner or inner retort has one closed end—welded, riveted, or otherwise securely fixed and made tight. The other end projects out through the open end of the fire-clay retort, and has a flange to which the mouthpiece can be bolted. The use of the outer fire-clay retort is to transmit the heat to, and yet protect the inner liner or retort from the furnace gases or flame.

Fig. 2 is a longitudinal section of such an arrangement. J is the retort; E, the malleable iron or steel liner or inner retort; B, the mouthpiece bolted to it; and K, the front supporting wall on the frame of the retort-bench.

Protecting Metal Surfaces, or Surfaces Containing Metals, against Corrosion by Water or other Fluids.—Paskin, J. A., and Ackroyd W., of Halifax. No. 16,886; Sept. 5, 1894.

The object of this invention is to keep water from contact with lead or other metal piping by lining or coating the inside of the pipes with gutta-percha, so that the water may not become contaminated, also protecting such metal pipes or surfaces against corrosion. The gutta-percha is deposited either in solution, or by coating the interior of the pipes with the melted gutta-percha by mechanical means.

Igniting Gas-Burners.—Duke, J. F., of Newington, Surrey. No. 969; Jan. 15, 1895.

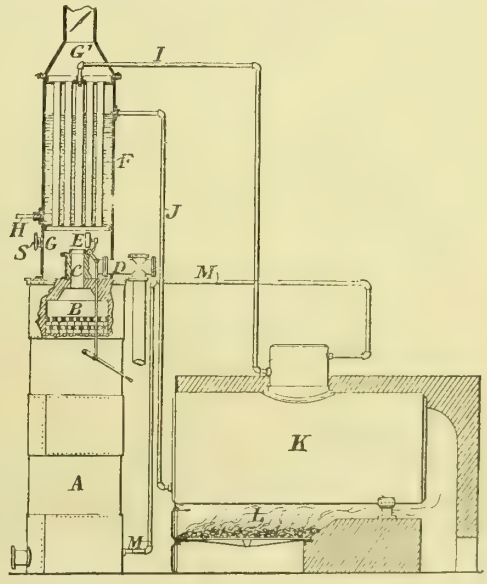
The utility of this invention was pointed out and illustrated in the JOURNAL for June 25 last (p. 1378). In explanation of his invention, the patentee says: It is well known that platinum black or spongy platinum will occlude a large quantity of oxygen from the air; and that, if a stream of hydrogen be directed upon the platinum, the chemical combination of the two gases takes place with sufficient energy to raise the temperature of the platinum. Attempts have already been made to take advantage of this property of platinum, by applying it to the automatic ignition of gas. In these attempts, the gas issuing from an ordinary burner has been caused to blow upon the platinum contained in a receptacle, so as to warm the platinum sufficiently to render incandescent a fine wire of platinum carried from the platinum in the receptacle to a position where it comes into contact with the gas as it issues from the burner; and this wire, on becoming incandescent, ignites the gas. None of these attempts has proved a practical success; but the patentee claims to have found by experiment that metallic platinum in the very finely-divided form known as platinum black or platinum mohr, is the only form of platinum that will cause the combination of the coal gas with its occluded oxygen, at the ordinary temperature, with sufficient energy to produce the heat requisite to render incandescent a length of platinum wire when a current of cold carburetted hydrogen or ordinary illuminating gas plays upon it. He has always found that after a time the atoms of the platinum black coalesce, because the heat communicated to them by the flame and by their own act of occlusion, combined with the free access of the oxygen in the air, tend to decarbonize or fuse the platinum black. When the particles have more or less coalesced, they are not in a finely enough divided condition to bring about the combination of the coal gas with the oxygen of the air, at the ordinary temperature, with sufficient rapidity to render the wire incandescent when a stream of cold carburetted hydrogen is passed over or along it. His invention therefore consists in the employment of a block of porous material, in the pores of which platinum black is contained, so that the particles of platinum black are effectually prevented from coalescing. The invention also comprises the method of getting atoms of platinum black into the pores of the block.

For the purpose of the invention, the patentee takes a solution of a platinum salt soluble in water, and immerses therein a block of suitable porous material, so that it may absorb some of the solution. Meerschaum is eminently adapted for the purpose. He subjects the material containing the platinum salt in its pores to the action of a substance which, by causing a chemical reaction, will reduce the platinum salt to the metallic state without having any chemical action on the material of which the block is composed; the metallic platinum remaining in the pores in so finely divided a form as to constitute platinum black.

In carrying out the invention, the patentee preferably uses a solution of bi-chloride of platinum—5 cubic centimetres of water to 1 oz. of the platinum bi-chloride, or a weaker solution may be used, with repeated immersions and drying. After the meerschaum has absorbed into its pores as much of it as it can take up, he subjects the meerschaum to the action of carburetted hydrogen, taking care to exclude the atmospheric air; the carburetted hydrogen being heated to a sufficient temperature (say, about 150° C.) to cause its hydrogen to combine with the chlorine of the platinum bi-chloride, and form hydrochloric acid gas. The platinum is thus reduced within the pores of the meerschaum to the metallic state known as platinum black or platinum mohr.

Manufacture of Water Gas.—Glasgow, A. G., of Victoria Street, Westminster. No. 1487; Jan. 22, 1895.

Alluding to his invention—which has for its object "to provide a supply of steam for the generator or generators, for the blower engine or engines, and for the other usual purpose, with a minimum expenditure of coal"—the patentee remarks that it has been attempted heretofore to utilize the heat of the waste gases issuing from the generator or superheater (according to the type of the apparatus) to heat a boiler from which the steam supply of the generator is drawn.



But as this source of heat is irregular and uncontrollable—there being no relation between the supply and the demand—this attempt has met with indifferent success in the manufacture of uncarburetted water gas, and has, it is said, been entirely abandoned in the case of carburetted water gas. Generally speaking, the invention consists in combining with the generator a boiler, the tubes of which form part of the

conduit for escaping gases, and also a boiler heated by means independent of the escaping gases, uniting the steam spaces of the boilers, and also, preferably, the water spaces.

A is the water-gas generator, with air-blast connection at foot. M is the steam-supply pipe. B is a fixing chamber, superimposed on the generator. C is the flue leading from the chamber B, connecting with the gas-flue D, and delivering (when the valve E is open) into the blast-gas conduit G G^1. S is the inlet for the air necessary to complete the combustion of the escaping blast-gases, provided the flue G be practically closed as shown. In case the space G be left freely open to the atmosphere, the indraught of air to complete the combustion of the escaping blast-gases is regulated by the damper shown. E is the valve by which the course of the gases is governed. F is a boiler set in the blast-gases conduit G G^1, the upper and lower parts of which connect through the boiler-flues. H is the feed-water supply-pipe; I, a steam-pipe leading from the steam space of the boiler F; and J, a water-pipe leading from the water-level of the boiler F to a boiler K, with the steam space of which the pipe I connects, as shown. The boiler K is independently heated by a furnace L; and, preferably from it, leads the steam-supply pipe M. Obviously the steam pressure in the two boilers, F and K, is always the same, as they are connected by the pipe I; and the boiler, heated by means independent of the gases escaping from the gas-generator, can be so run as to obtain the full benefit of all the waste heat of the gases passing through the boiler F, while at the same time its own independent furnace ensures a heat supply sufficient at all times to maintain the necessary steam for use in the generators, blower-engines, and for the other usual purposes.

APPLICATIONS FOR LETTERS PATENT.

12,685.—Stevens, J. H., and Tourtel, J. M., "Gas or other measuring or delivering mechanism to be set in operation by presence of a coin or coins." July 1.

12,702.—Zerbe, J. S., "Using hydrocarbon oils and gases for fuel purposes." July 1.

12,744.—Clarke, A., "Gas heating apparatus." July 2.

12,777.—Arnotte, F., "Gas, oil, and other stoves." July 2.

12,848.—Brockhues, B., "Lighter for lanterns with incandescent gas-light." July 3.

12,854.—Potter, W. G., "Bunsen burners for incandescent gas lighting, and protecting mantles." July 3.

12,916.—Camelinat, E. G., "Heating and illuminating lamps." July 4.

13,005.—Monks, J., and Bush, R. N., "Heating drying-cylinders by gas in place of steam." July 5.

13,019.—Newton, H. E., "Gas plant." A communication from R. N. Oakman, jun. July 5.

13,047.—Compagnon, A. Le, and Guibert, J., "Gas or petroleum motors." July 5.

13,048.—Taylor, G., "Loading and discharging trams, railway waggons, and coal vessels, and transferring coal and other substances from one place or level to another." July 6.

13,080.—Day, E. A., "Pipe-joints." July 6.

13,083.—Jones, A., "Pipe-joints." July 6.

13,111.—Crocker, S. H., "Manufacture of incandescent tissue for lamps." July 6.

13,197.—Priestley, G. F., and Bancroft, W. S., "Regenerative furnaces and fans for inducing draught." July 9.

13,200.—Cowan, W. and W. H., "Prepayment gas-meters." July 9.

13,221.—Bromhead, S. S., "Central-draught lamps." A communication from C. S. Upton. July 9.

13,230.—Mayer, F., "Manufacture of oil gas." July 9.

13,236.—The "Cannon" Hollow-Ware Company, Ltd., and Ward, T., "Conduits or tubes of gas-burners through which mixed gas and air pass to the outlets at which they are burnt." July 9.

13,256.—Leeman, J., "Cartridges for increasing the illuminating power of petroleum and like hydrocarbons." July 9.

13,259.—Bergier, L., "Gas-burners." July 9.

13,313.—Gunn, L., "Gas or other hydrocarbon engines." July 10.

13,357.—Barwise, S., "Preventing the bursting of lead or other pipes or tubes through the action of frost." July 11.

13,403.—Cundall, J. S., R. D., W. D., and H. C., "Gas and oil motor engines." July 12.

13,446.—Cutler, S., "Controlling gear for steam supply to water-gas generators." July 12.

13,456.—Raydt, W., "Obtaining carbonic acid from gas mixtures in the dry way." July 12.

13,467.—Oehlmann, E. H. C., "Burners for incandescent lighting." July 12.

13,497.—Rochford, T. H., "Water-taps for the prevention of waste of water." July 13.

13,510.—Green, J., "Obtaining hydrogen gas from water, and also obtaining carburetted hydrogen and other combinations of hydrogen." July 13.

13,524.—Kershaw, A., "Gas-pressure regulators." July 13.

15,529.—Janse, B., and Witte, J. de, "Gas heater for a carriage." July 13.

The Sale of Coke in London.—For carrying out the provisions of the Weights and Measures Act in London, the London County Council employ a staff of 81 inspectors and their assistants; and the result of their labours last year is recorded in the lately issued report of the Public Control Department of the Council. Reference is made therein to the sale of coke. Under the provisions of an old Act, coke has to be sold by weight, but, having regard to the fact that it is capable of absorbing considerable moisture, this requirement, in the interests of the purchaser, has not been enforced. The coal officers of the Council have found, however, that small dealers and hawkers utilize as measures fruit and margarine baskets, which are always of less capacity than the measures they are intended to represent, and the use of proper measures stamped by an inspector is now insisted upon.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Labour Question.

Sir,—The constant references to the labour question in the Journal are evidence of its prominence in the thoughts of gas managers; and they invite further discussion on the subject.

In a letter which appeared on the 28th of May last, Mr. Goodson, of Heckmondwike, struck a key-note both by the expression of broad and enlightened views and by his statement "that the subject has now reached a most acute stage, and is a stern and grim reality." This accounts for the interest it creates, and should impel to action of some kind.

In the presidential address at the meeting of The Gas Institute in Edinburgh on the 11th of June, my friend Mr. Mitchell went a little out of his way to condemn my proposal for workmen directors. Of this, I certainly do not complain; and I would only remark that those who condemn an attempt to meet a difficulty should be prepared to suggest a better plan, or prove either that the difficulty does not exist, or will not be met by the plan proposed. Failing this, their objections have no weight with those who are earnestly desirous of doing what they can in the direction of improvement.

On the 9th inst. you published Mr. M'Crae's paper and the discussion thereon. The paper does great credit to the writer's kindness of heart. But it certainly does not go to the root of the matter; for it is little more than an amplification of his statement that the "disputes, difficulties, and disturbances" that have taken place in gas-works, in his opinion, "might have been averted by a conciliatory spirit all round," which was disputed by some of the subsequent speakers.

Now, "conciliation" is a very smooth and taking word; but it represents weakness rather than strength. It is very commonly one-sided, and is useless where a real difference exists, because it means that, for the sake of peace, both sides should give up part of their rights. This is not a solid foundation for lasting peace; for human nature vividly remembers what has been given up, but generally forgets the equivalent that was received. What is wanted, in the first and supreme place, between employer and employed, is just dealing; and it is of scarcely less importance that both sides, and especially the employed, should know that even-handed justice prevails.

The earnest and spirited discussion on Mr. M'Crae's paper, however, was of greater interest than the paper itself, not merely on account of what was said, but also for the strong feeling or motive power that was evidently behind, and prompted the speeches. I have much sympathy with the remarks of Mr. William Carr in reference to the displacement of labour by machinery. *If the men would act fairly and honourably*, as they generally did before the advent of the Gas Workers' Union, and often do still where the Union has lost its power, then surely it is neither right nor wise to introduce machinery simply to displace them. I must say, in Mr. Carr's defence—though he is about the last man to need a defender—that his opponents ignored his repeated statements that it "was apart from any consideration of saving of cost," and that they were told "that it would be better in every respect—apart from any economical considerations, and however amicable the relations between the workers and the employers might be—to do with 20 men instead of 200." No man who knows Mr. Carr can suppose he objects to machinery where it cheapens production—in fact, he says as much in this week's Journal. It is equally certain that the preference of other speakers for machinery was due more to a desire to be independent of labour, for which, no doubt, they have sufficient reason. Doubts and fears and difficulties, present and future, were probably in their minds; and, in despair of finding means for placing employers and employed on a satisfactory footing, the leading idea was to dispense with labour to the utmost possible extent. This, however, will be no remedy. A number of stokers may be displaced; but other workmen will probably increase. Consequently, the idea of overcoming the labour difficulty in this way cannot but be limited in its effect; and those who are trusting to it are leaning on a broken reed.

The present, it is true, is a time of comparative peace, with sufficient mutterings here and there to indicate that, on the return of suitable conditions, there will be another outbreak of the storm. This, therefore, is the time to prepare to meet it, or rather to take such steps as will quell it at its source, or, better still, divert and unite its forces—the forces of labour—to those of capital, for their mutual advantage and the general good of the country. I believe this is possible and practicable. But, as you have so often forcibly said, the employers must take the initiative. Some of them are spoken of as "Captains of Industry," which is meaningless unless they take their proper positions as the trusted leaders of both companies of the industrial host.

I have no desire, either directly or indirectly, to reopen just now the discussion on the knotty point of workmen directors; but the main object of this letter is to invite suggestions to meet the difficulty. Some probably believe that it will pass away without effort on their part, or, at any rate, that no effort of theirs will be of any avail. But what real ground is there for hope that it will thus disappear while strenuous efforts continue to be made all over the country that tend to deepen and intensify it? The extremists on the other side have a policy—adopted by an overwhelming majority at the Trades Union Congress at Norwich in 1894. At the instance of their Parliamentary Committee, a conference took place at Manchester on the 10th inst. of 130 delegates, professedly representing a million trade unionists, to formulate the conditions on which their support would be given to parliamentary candidates. In those conditions, they have included the socialistic resolution of the Norwich Congress "to nationalize the land and the whole of the means of production, distribution, and exchange." Of course, no man in his senses for a moment believes in the possibility of such an insane proposal; but, for all that, it is capable of doing much mischief by creating and maintaining a feeling of discontent, and raising vain hopes in the minds of workmen—thus diverting their attention from practical measures for the bettering of their condition.

Seeing there is no probability that the difficulty will pass away of itself, whatever happens can only be the result of individual effort. It therefore behoves all who are interested in its removal to do their part. None can say that the JOURNAL has not done its part well; and it remains for directors and managers of gas-works to do theirs. Will not some of them begin by giving their views on the question, by proposing a remedy or by suggesting the lines on which to work? The time is propitious. The rout of the so-called Labour leaders and semi-Socialists and their friends in the elections will discredit them with their followers—in fact, their one-time followers have already lost faith in them, as is proved by the votes of working-class constituencies; and now is the opportunity for the employers to take their proper position as leaders in the ranks of industry. It is certain there are many gas directors and managers who are anxiously seeking, and are sincerely desirous of finding, some satisfactory solution. The circumstances of the gas industry are most favourable; and all who will help, by discussion or otherwise, in the good work, will certainly have their reward.

GEORGE LIVESEY.

Reigate, July 18, 1895.

The Discussion on Mr. M'Crae's Gas Institute Paper.

SIR,—I have not the least intention of being drawn into a correspondence on the subject of my Gas Institute paper of June, 1894; but the further reference thereto by Mr. William Carr, in your correspondence columns, seems to call for some slight notice.

Mr. Carr was present at the reading of my paper, and spoke to it. Its "inhumanity" did not then seem to have occurred to him. I cannot understand why, after so long an interval, he should have come to the discussion of Mr. M'Crae's contribution to the late meeting with one very innocent paragraph from that paper "briefed" out, on which to found his most unexpected and uncalled-for attack.

It seems that everyone mistook the purport of Mr. Carr's observations; though I cannot think this was from the cause he suggests. At any rate, there is no "hoarseness" in his letter, which nevertheless conveys to me exactly the same ideas as did his remarks in Edinburgh. The only points I care to refer to are those in which I am directly accused of introducing carburetted water-gas plant for the simple pleasure of giving the men "one back," and, later on, when it is assumed that I am one of those who have "taken refuge behind an unprofitable machine" rather than keep "in sympathy and in touch" with my men. Neither of these assumptions is true. As the summing up of the whole matter, I claimed that I had been able to produce 21-candle gas by the new process at less cost than 17-candle coal and cannel gas, which should afford sufficient justification for the adoption of the system.

Further, when Mr. Carr was wading through my paper in search of the delinquent paragraph—which, by the way, occupies but eight lines out of nearly nineteen pages—it must have occurred to him that there were several reasons advanced in favour of the use of carburetted water gas other than that selected for his animadversion. I need not repeat them, but may say that I ventured to claim a dozen distinct advantages, of which the saving in labour came last.

I only wish to add that, if the substitution of 24 men for 340 men, and the production of 21-candle gas at less cost than was heretofore incurred for 17-candle gas, is not good enough for a man who is "in favour of real labour-saving appliances, and economy of production in every form," he must be very hard to please, and is very likely to be misunderstood. It seems to me that, in the adoption of a method offering such enormous advantages, we have merely followed, to a modified extent, the lead of Mr. Carr, who "never allowed any consideration for the men to stand in the way of those things." What an inhuman sentiment!

JAMES STELFOX.

Belfast, July 17, 1895.

Mr. Irwin's Paper at the Society of Chemical Industry.

SIR,—In your issue of this week, you reproduce a paper read by me before the Manchester Section of the Society of Chemical Industry in May last. Unfortunately, owing to absence from home, I was unable to correct the proofs of the paper before going to press; and hence there are a few errors which I would prefer to have been rectified. The chief one is in the impression given of a photograph of a disillumined gas-flame, which does not show at all the non-luminous band referred to in my paper, and which I consider of extreme interest in connection with the general subject of flame luminosity. Photographing such a slightly luminous body as a disillumined gas-flame is not an easy matter; the lengthy exposure necessary, and the flickering of the flame, being apt to obscure any but the general features. You will see, however, by the print enclosed, that a distinct non-luminous band is visible.*

A question was asked by one gentleman concerning the effect of naphthenes as enrichers. You, I see, have printed it (as well as in my reply) "naphthalenes," which, of course, is incorrect.

While I am writing, I should like to refer to Mr. Stenhouse's paper in the same issue. In it he shows that petroleum spirit is not so good an enricher as carburine. I have found, on the contrary, that (putting on one side the question of deposition in the pipes) the higher the boiling-point of the paraffin series of hydrocarbons, the greater is their enriching value. This is only what one could expect from the constitution of the various members of that series. One of the points, however, which I tried to bring out in my paper was that the advantage of using the Argand burner over the union jet was much greater in the case of hydrocarbons containing high percentages of hydrogen over those, such as benzene, containing a lower percentage of hydrogen. The difference, then, between the enriching value of the lower and higher fractions of petroleum spirit would not be so great in Mr. Stenhouse's experiments with the Argand burner as in mine with the union jet; still I think there should have been a slight advantage of ordinary spirit over carburine, as I suppose the latter to be merely the lighter fractions from the former.

WILFRED IRWIN.

Manchester, July 20, 1895.

* The print referred to, which we had not time to reproduce, clearly shows the non-luminous band.—ED. J.G.L.

SIR,—In the course of the discussion on the paper recently read by Mr. W. Irwin before the Manchester Section of the Society of Chemical Industry, Mr. Ball indicated with sufficient clearness the points in the methods of photometry and "carburation" employed by the author of the paper in his experiments that would not appeal to the practical gas manager. It is already generally known that, by such a method of photometry as would make Manchester gas to be of 12·6 candles, almost any case could be proved. What would the friends of any particular enriching material exclaim if someone were to test the unenriched gas to its fullest advantage and the enriched gas to manifest disadvantage, and show, as would be quite easy, that the material in question had a negative effect?

Mr. Irwin, in his paper, says that, in a recent paper, I laid great stress upon a relation between the total effective carbon vapour in any gas and its illuminating power; and he calls my attention to the case of naphthalene and hydrogen. The simple relation I pointed out as existing in the case of coal, cannel, oil gas, and the gas in the flame of a petroleum lamp was not assumed for *any* gas. It was specially pointed out that the case of hydrocarbons alone or in simple mixture was quite different, and was not to be confounded with their behaviour in complicated mixtures, such as the commercial illuminating gases with which we are acquainted, and the cases of which were cited.

It would be an exceedingly simple matter if the illuminating power (intrinsic luminosity) of each hydrocarbon could be determined by an arbitrary method at the free will of the investigator, and then for all the world to be able to say such and such illuminating gas contains so much per cent. of hydrocarbon A at so many candles, so much per cent. of hydrocarbon B at so many candles, and so on through the whole of the constituents of the illuminating gas in question, and then to assert that the total is so many candles, and that that is its illuminating power. This view, which I call the additive view, it was one of the objects of my paper to controvert. The argument was that such illuminating gases as we deal with in practice contain a variety of hydrocarbons, some of high and some of low carbon precipitating power; and the most that those of high precipitating power can do *in the burner that has to be employed for the mixture* would be to fill up the gaps left by those of low carbon precipitating power.

Mr. Irwin has observed the same phenomenon, and has arrived at a somewhat similar observation, which, however, he explains differently. He explains it as "overlapping" (*vide* where he says: "You cannot get the full value of both the olefines and the benzene when burnt in any proportion together").

The argument drawn from the case of Paris gas, and its comparison with Manchester gas, will not have any weight with practical men, unless some reason can be suggested why such gas should owe its illuminating power more entirely to benzene vapour than do the gases of other places. Is there anything in the coal employed and its method of treatment that suggests that this should always be the case in Paris? The argument would have more weight also if it could be shown that Berthelot had tested Manchester gas by the same method of analysis, and had found the Paris gas richer in benzene vapour, and if the comparative analysis had extended over some period of time.

I do not see how the case of a mixture of naphthalene and hydrogen affects the arguments of those who assert that by adding hydrocarbons to gas its calorific value is thereby increased. Has not the naphthalene a higher calorific value than the hydrogen displaced?

The experiments by which Mr. Irwin shows that 20-candle gas, by being washed with its own bulk of water, is reduced to 2 candles, is interesting; but I would ask whether the quantity of washed gas was sufficient to enable him to determine its candle power. Half a bottleful appears but a small quantity for such a purpose.

LEWIS T. WRIGHT.

1, *Victoria Street, S.W., July* 20, 1895.

Sloping Retorts at Brentford.

SIR,—Kindly allow me to repeat, for the benefit of Mr. Husband, the following paragraph in my letter of the 2nd inst.: "Mr. T. Banbury Ball, of Rochdale, erected and worked the first installation, consisting of five beds of seven through retorts, in 1890." It will be seen that I here refer to the *straight through* inclined retort as now worked, and not the old Coze pattern with the cast-iron bent mouthpiece, which was a failure. The only single setting working at that time was the experimental one at the Southall Gas-Works.

Mr. Husband also says that "no improvements have been made since the first installation at Brentford." I have been always given to understand that the alterations that were made to the inclineds in No. 1 House at this works—viz., the change from seven retorts to six larger retorts in a bed, together with the alterations in the furnaces, have vastly improved the heating arrangements; and that it was upon this successful basis that No. 2 House was built.

I trust that this explanation will be clear to those who are conversant with this system.

MAURICE GRAHAM.

July 18, 1895.

Distributing Experts.

SIR,—In the JOURNAL for the 2nd inst., appeared an article headed "*Pro Bono Publico*," on the wisdom of having one or more practical gas-fitters, of good address, and fair scientific knowledge of the principles of lighting and heating by gas. Well, Mr. Foulis, Engineer-in-Chief to the Glasgow Gas Trust, has always encouraged the growth of such a class of distributing experts as is advocated. His outdoor foremen, besides superintending all new supplies and alterations on old ones, advise the public on all matters relating to economical lighting, heating, and cooking by gas, also gas motors. If it were necessary, numerous instances could be cited of the value of such advice, and the public appreciation of the same.

It is not to be expected that architects, speculating builders, and ordinary gas-fitters—much less the general public—can know what experts should know relating to the sizes of pipes, and the best way to take them; the most suitable burners, their position and number. And when we consider the late rapid developments in the field of heating, cooking, and motive power, all with coal gas, the need of

advice is still more felt. Particularly is this the case with respect to probable cost of fitting up, the after effectiveness of the appliance, the removal of the fumes, &c.

It is almost the daily experience of such men to be asked, even by architects and master plumbers, to enlarge services or meters, or both, in order to overcome defects located in the interior of the building, arising from too small pipes, old burners or unsuitable ones, or improperly adjusted burners, or something which experienced "Inspectors-in-General" (the title suggested in the article referred to) would soon detect.

Undoubtedly much of the increase in the consumption of gas, in spite of its powerful rivals, oil and electricity, and especially the great strides in heating, cooking, and motive power which have taken place here in Glasgow, is due to the efforts of Mr. Foulis's trained staff of experts, and the liberality of his Committee in granting supplies of gas on easy terms, and hiring out stoves on equally easy conditions—to the furtherance of which Mr. Foulis gives his powerful aid.

LIGHT AND HEAT.

Glasgow, July 18, 1895.

Professor Lewes on Gas-Stoves, &c.

SIR,—Professor Lewes, in his paper on "The Combustion of Coal Gas for Fuel Purposes," seems to convey that British manufacturers are behind their Foreign competitors in regard to the adoption of the regenerator principle as applied to gas-stoves. Our answer to that is that we have not allowed the principle to lie dormant. For many years, we have made and sold a "Regenerator" heating stove; but it was not tested by Professor Lewes against the German regenerator stove he refers to. The fact is, Professor Lewes made a comparative test of stoves constructed on totally different principles. Practical men do not need to be told that a competitive test between a slow-combustion coal-stove and an open coal-fire would be of no practical value; for the English public will have the open fire, with its cheerful glow and blazing fuel, in spite of the taste for closed stoves of our Continental neighbours. As it is with coal-fires, so it is with gas-fires. Englishmen want a glowing fuel fire, and are willing to pay for the luxury. There is nothing easier than to make an efficient gas-stove on regenerator principles (and such are made); but the public demand—as gas engineers know—is for fuel-fires; and manufacturers have to follow the public taste in such matters.

R. & A. MAIN.

Glasgow, July 17, 1895.

The Water Supply of Leicester.—The Water Committee of the Leicester Corporation may be congratulated upon the healthy position of the water supply of the borough, compared with this period of last year. They had on Monday last week 632½ million gallons in their reservoirs, which have a total capacity of 889 million gallons. Therefore, notwithstanding the dry weather, there is a deficiency of only 256 million gallons, as against 667 million gallons on the corresponding date last year.

Cheshire Alkali and Salt Company, Limited.—A Company has been registered under this title with a capital of £85,000, divided into 10,000 "A" preference, 17,000 "B" ordinary, and 7000 "C" deferred shares of £2 10s. each respectively, to acquire the business, undertaking, and assets of the Cheshire Alkali Company, Limited, now in liquidation, or such of them as the Board shall think fit, in accordance with a scheme of arrangement sanctioned by an order of Court dated Feb. 4, 1895, and generally to carry on the businesses of chemical manufacturers, salt masters, distillers, dyers, printers, gas makers, coke manufacturers, miners, metallurgists, shipowners, and chemical engineers, &c., in all or any of their respective branches.

Coal Contracts at Oldham.—The subject of the coal supply for the Oldham Gas-Works has lately, as our readers are aware, been the subject of some discussion in the Town Council; and the matter has been investigated by a Sub-Committee (see *ante*, p. 91). It came up again on the presentation of the minutes at the meeting of the Committee on the 10th inst., when the accuracy of the statement which, as he said, "purported to be the report of the Sub-Committee," was questioned by Mr. Shaw. He remarked that it was there stated that there was an apparent advantage in favour of the Higginshaw works of 11d. per ton, compared with Hollinwood; but he did not remember 11d. having been mentioned. Mr. Harrop said that this statement was certainly incorrect. The Town Clerk asked Mr. Shaw if he contended that the minutes of the special meeting at which the report was discussed did not present a true record of what took place. Mr. Shaw said he did. Alderman Hall thought the matter should be dealt with by the Sub-Committee. Mr. Harrop said the figures at which the Sub-Committee arrived showed an advantage in favour of Hollinwood over Higginshaw of 1d. per ton for three months, but an advantage to Higginshaw over Hollinwood of 1½d. per ton for twelve months. They took into consideration candle power and everything else before they arrived at that result. He moved that the minutes be corrected in accordance with the figures given. After a remonstrance from the Mayor (Mr. R. Whittaker) at the time of the Committee being wasted, the minutes were passed with the exception of the sentence referring to the 11d.; the Chairman (Alderman Smith) remarking that the question could be raised again if necessary. The Assistant Town Clerk then read a letter from the Chamber Colliery Company, Limited, in reply to one from the Committee inviting an amended tender for coal, in which the Company declined to quote a lower price, but offered to pay for an independent analysis of their coal, and to accept what that analysis decided to be a fair market price. The letter had previously been before the Committee, and a gentleman had been selected to make the analysis. In reply to a question, the Gas Superintendent (Mr. Andrew) said no coal had been sent to the gentleman named, as he had not received any intimation of his appointment. After some remarks, Mr. Johnson moved that the resolution respecting the private analysis be rescinded. Mr. Harrop seconded the motion—to show, he said, the confidence he had in their Manager (Mr. Chadwick); and the motion was carried. Subsequently, Mr. Chadwick gave particulars of tests of coals; and eventually the contract for 20,000 tons, at 8s. 9d. per ton, was placed with the above named Company.

LEGAL INTELLIGENCE.

JUDICIAL COMMITTEE OF THE PRIVY COUNCIL.

Wednesday, July 10.

(*Before Lords* WATSON, HOBHOUSE, MACNAGHTEN, *and* DAVEY, *and Sir* R. COUCH.)

The Bower-Barff Patent.

This was a petition by the Bower-Barff Rustless Iron Company, Limited, for the prolongation of letters patent granted to Frederick Settle Barff (since deceased), George Bower, and Anthony Spencer Bower, for "improvements in effecting the protection of iron and steel surfaces, and in the furnaces employed therein," dated July 28, 1881 (No. 3304).

Mr. MOULTON, Q.C., and Mr. LAWSON appeared for the petitioners; Mr. SUTTON represented the Crown.

The invention for which the letters patent were granted related to certain processes by which iron and steel can be protected from rust, and especially to the employment of a furnace constructed and arranged in a particular manner for carrying out the processes. It was stated that the invention was of great utility, and very beneficial to the public. The patent was subsequently purchased by the Bower-Barff Rustless Iron Company, Limited. The inventors took out various foreign and colonial patents in respect of the invention; but the petitioners had never had any transactions relating to them. It was contended that, owing to the difficulty experienced in inducing people to appreciate the advantages of the invention, they had incurred considerable expense, and they had lost large sums of money; and it was only now, when the patent was about to expire, that the real value of the invention was being understood, and its use established and extending. The petitioners had no doubt that, if a prolongation were granted, they would be enabled to obtain a fair remuneration, if not commensurate with the great public value and importance of the invention, yet probably sufficient to save them from the loss they had already sustained. It appeared that the inventors sold their patents in Great Britain, France, and America for sums amounting together to £30,000.

Lord WATSON, in delivering the judgment of their Lordships, said the important question which arose in the case appeared to be whether the petitioners were in a position to maintain the application. Cases which had been cited to their Lordships appeared to them to establish the principle that an assignee who had acquired a patent that was the subject of a commercial adventure was not entitled to obtain a prolongation when the inventor had no legitimate interest in making the application himself. In this case, the inventors would no longer have any interest in applying for a prolongation, because they had been sufficiently remunerated. There was no case to be found in which an extension had been granted to an assignee which did not directly or indirectly tend towards the benefit of the original inventor, who, had there been no assignation, would be in a position to claim the extension himself. In the present case, the inventors were not in that position. As their Lordships did not see any reason for departing from the principle already recognized in similar cases, they would recommend Her Majesty to refuse to grant the petition.

The Employees at the York Gas-Works and their Politics.

At the York City Police Court last Thursday, Thomas Brenthall, an employee at the York Gas-Works, and Robert Ellis Gerrard, of the *York Sentinel*, were charged with being guilty of disorderly behaviour by fighting in the streets. Brenthall was also summoned for assaulting Gerrard. The quarrel, which occurred on the previous Tuesday, arose out of the publication by Gerrard of a statement to the effect that because Mr. Charles Sellers, Engineer and Secretary of the York Gas Company, had refused to identify himself with the Liberal party in the recent parliamentary election, a number of the employees had decided to do the same. This assertion incensed Brenthall, who has been engaged for many years at the works, and stands extremely high in the estimation of his employers; and on meeting Gerrard in the street, an altercation occurred, which led to the parties being taken into custody. In the course of the proceedings on the summons, Mr. Wilkinson, who defended Brenthall, said the complainant was the editor of a scurrilous publication, which lived by slandering the citizens of York. The statement which had appeared in it about the gas men was a gross libel, and was absolutely untrue; and he suggested with confidence that the complainant knew it to be false when he wrote it. The paragraph was indignantly resented by his client and the men at the gas-works. They felt that the *Sentinel* had not only insulted them by insinuating that they had yielded to the Manager's influence to induce them to vote as he had done at the city election, but that it had also insulted the Manager by attributing to him conduct which was utterly false. Defendant was provoked, and with good reason. When he met Gerrard, he spoke to him about the paragraph, and asked for the names of his informants. Gerrard refused to give them; and, with a sneer, promised a "double dose" next week. Then followed the altercation. He (Mr. Wilkinson) said Brenthall might have struck Gerrard; and he cared very little if he did, as Gerrard richly deserved it. If he would libel men, and they could not get the remedy out of his pocket, they must get it out of his bones. Whatever decision the Bench came to, the thanks of the city were due to the defendant for what he had done. One of the men at the works was called to corroborate Mr. Wilkinson's version of the affair; and, in answer to the Bench, he stated that the paragraph in question had been the subject of much discussion among the men, and had caused them great annoyance. Their Worships said they had come to the conclusion that they must convict Brenthall of assaulting Gerrard, for which he would be fined 2s. 6d., without costs. For fighting in the street, Gerrard and Brenthall would be fined 5s. each, with costs. A number of working men had assembled outside the Court, and loudly cheered Brenthall when he came out; but Gerrard was heartily hooted.

A Fatal Omission in Summoning Water Companies.

At the Thames Police Court last Thursday, the East London Water-Works Company were summoned by Thomas Samuel Thorn, of 23, Matlock Street, Stepney, for not furnishing him with a supply of water. Mr. Bray and Mr. George Kebbell appeared for the Company; Mr. F. Deakin for the prosecutor. Mr. Deakin, in opening the case, said the summons was taken out under section 43 of the Water-Works Clauses Act; but there was a matter which must, of necessity, be proved before there could be a conviction. It was that the rent must have been paid or tendered by the person complaining; and he was bound to admit in this case it had not been done. At the same time, he contended the Company had waived their right by appointing collectors to collect the money at their own convenience. Mr. Mead said the omission to tender was fatal to the case. He did not think it was a case in which the waiving referred to was applicable, for it was a criminal offence. As a condition before the Company could be convicted under the section, the person complaining should either have paid or tendered his rate. This not having been done, an important element in the case was missing; and he had no option but to dismiss the summons.

Theft of Gas at Halifax.

At Halifax last Friday week, Jonas Hirst, an iron and tin-plate worker, carrying on business at Lee Bridge, was summoned, at the instance of the Corporation Gas Committee, for an offence under the Gas-Works Clauses Act. On June 13, one of the gas-meter inspectors (G. S. Clayton) called at defendant's workshop to examine the meter. On the work-bench he found a pan, in which lead was being melted by means of a gas-heater, which was being fed by an india-rubber tube. Defendant was in the workshop at the time; and as the inspector was walking towards the meter, he stepped in front of him. The inspector moved on one side, to get past, when defendant again stepped in front, as if to obstruct him. Then he went to the meter; and, before the inspector could get there, he suddenly wrenched the india-rubber tube away from its position at that end. As soon as he had done this, the gas-heater went out with a sudden explosion; and there was a strong smell of gas in the room. When the inspector reached the meter, he saw that the inlet-pipe was totally disconnected, that it was bent back a little, and that gas was escaping from it in full force. Seeing gas was being consumed, and that the inlet-pipe was disconnected, it followed that gas must have been taken from the main for the supply of the heater before passing through the meter. Defendant, on being charged at the time with improperly taking the gas, gave no explanation whatever. When, however, the inspector left, he followed him out, and asked him to look over the matter. The defence was that the defendant's lad, who had been using the gas-heater, found that the light received was not giving satisfaction. He accordingly, and without mentioning the matter to his master, went to the meter to charge it with water. Being unfamiliar, however, with its working, he unscrewed the inlet-pipe. Having done this, he went to the water-tap, and was in the act of getting water to take to the meter when the inspector put in his appearance. The lad also declared that the india-rubber tubing was attached to a branch-pipe in the wall, and not to the meter inlet-pipe. Evidence was given by the Gas Engineer (Mr. T. Holgate) and other officials. The Magistrates decided that the case was proved; and the full penalty of £5 was inflicted.

North Wales Cannel Collieries, Limited.—A Company has been registered under this title, with a capital of £75,000, in £1 shares (30,000 of them being 6 per cent. preference), to acquire the leasehold mineral properties known as the Coed Talon Collieries and Mineral Estates, and the Black Diamond Collieries and Mineral Estates, situate at Coed Talon, near Mold, Flintshire, North Wales, and to carry on the business of colliery proprietors.

Sales of Shares.—At the Mart, Tokenhouse Yard, E.C., last Wednesday, Messrs. Fox and Bousfield sold parts of freehold shares in the *New River Company*. Two 120ths of an Adventurer's share—the last dividend in respect of each was at the rate of £21 15s. 8d. per annum—realized £830 each; while 1-40th of a similar share was knocked down at the comparatively cheaper price of £2420. Two 100ths of a King's share, ranking last Christmas for a dividend of £26 each, fetched £1780 together; and for two 150ths of a similar share, £650 each was obtained. On the same occasion, seven £100 fully-paid new shares were disposed of for £400 to £405 per share. The portions of Adventurers' shares sold at the rate of from £96,800 to £99,600 per share; the fractions of King's shares, at £89,000 and £90,000 per share. Ordinary £10 original shares in the *Maidstone Water Company* have been recently sold at £29 10s. and £30 10s. each; and £10 7 per cent. shares, at from £18 to £18 10s.

Reductions in Price.—At the meeting of the Accrington and District Joint Gas and Water Board on the 11th inst., it was decided to reduce the price of gas on Oct. 1 next to 2s. 6½d. net per 1000 cubic feet to consumers of 70,000 cubic feet per quarter and upwards, and to 2s. 9½d. net to consumers of a smaller quantity; being a reduction of 3½d. per 1000 cubic feet all round. It was further decided to reduce the price of gas supplied to local authorities for public street lighting to 2s. 6d. per 1000 cubic feet—a decrease of 4d.; the object being to induce the authorities to light the streets more effectively. The question of lowering the price has been under consideration for some months. The sinking fund, as it stands at present, will only permit of the concessions named; but if, at the end of the next quarter, or even before, there is such a large increase in the consumption of gas as the members of the Board hope, they will take into consideration the question of a further reduction, either for day gas or generally. The Redcar Gas Company have reduced the price of gas 6d. per 1000 cubic feet to all consumers within their district as from the 1st inst. The Enniscorthy Gas Company have made the substantial reduction of 5d. in the price of gas, which brings the charge down to 5s. per 1000 cubic feet.

MISCELLANEOUS NEWS.

GAS ENGINEERS AND THE PHOTOMETRIC STANDARDS INQUIRY.

In another part of the JOURNAL, we notice the issue, as a parliamentary paper, of the report of the Board of Trade Committee on Photometric Standards, and give an epitome of the appendix to that document. As already mentioned, Section XII. contains an account of the interview which took place between the Committee and a deputation representing the Incorporated Institution of Gas Engineers and the Incorporated Gas Institute on the subject of gas testing. This section, in view of the interest attaching to the question under discussion, we reproduce in full below.

SECTION XII.—*Evidence and Recommendations of a Deputation from the Incorporated Institute of Gas Engineers, consisting of Messrs. Charles Hunt, R. O. Paterson, and J. Methven, and from the Incorporated Gas Institute, consisting of Messrs. W. A. Valon, Norton H. Humphrys, and J. West.*

The CHAIRMAN: Gentlemen, the Committee will be very glad to hear anything you have to say, and to consider it; and will be also grateful to you for any information you may be able to give them. The two bodies represented are the Incorporated Institution of Gas Engineers and the Incorporated Gas Institute; and, unless you have made some arrangement among yourselves, as we were first addressed by the Institution of Gas Engineers, I will call on Mr. Hunt, as President of that Institution, to address us first.

Mr. *Charles Hunt:* Mr. Valon is here as President of The Gas Institute; and, after I have asked a question, he will perhaps introduce the resolutions which have been proposed by The Gas Institute. I may say that we are anxious—regarding this matter as one of importance to the gas industry generally, not merely confined to the Metropolis—to know, in the first place, how far the Commission have proceeded in their work, if you have no objection to tell us, and also to what extent it is intended to proceed in the alteration of the standard, or the present methods of photometric procedure.

The CHAIRMAN: I do not know that I am really in a position to answer that question. We were appointed to make a recommendation to the Board of Trade as to what should be the future standard; and we have not yet come to any decision as to what the future standard that we shall recommend should be. Of course, the reason of this appointment is in itself based upon the dissatisfaction that exists with regard to the use of an actual candle. I may go so far as to say that we are not likely to recommend the continued use of the candle; but beyond that, I do not think I am in a position to give any definite statement.

Mr. *Hunt:* Mr. Valon will now read the resolution.

Mr. *Valon:* We came to this resolution this morning. I should like to say we are unanimous in wishing to get from the Commission what information we can in regard to that. The resolution passed by the Incorporated Gas Institute this morning will, I think, embody our views. It was resolved—"That the opinion be strongly impressed upon the Committee that no standard will be acceptable to the gas interest generally unless based upon, and of the same relative value as, the existing parliamentary standard candle or unit of light. The representatives of the Incorporated Gas Institute would also urge on the Committee the necessity that the present obligations of gas suppliers should not in any way be injuriously affected." After this resolution, which was accepted unanimously by the Institution of Gas Engineers as well as ourselves, a further discussion took place among the representatives elected by the two Councils, who agreed unanimously, the result of which Mr. Hunt will perhaps now state to the Committee.

Mr. *Hunt:* The first resolution is: "That attention be drawn to Mr. Methven's experiments showing the influence of the hygrometric condition of the atmosphere on the pentane unit of light; correction for this source of error appearing to be necessary to enable the pentane candle to be used for standardizing." The second is: "That air carburetted with pentane be used for testing purposes." The third is: "That a multiple of the standard candle equal to 10 candles be produced for testing purposes, by the application of a screen to an Argand burner; and that all tests be performed with an open-bar photometer, not less than 60 inches in length." The fourth is: "That the rate of consumption of gas to be tested be adjusted as nearly as practicable to the maximum efficiency of the various standard burners."

The CHAIRMAN: Does any member of the Committee wish to ask Mr. Hunt or Mr. Valon any questions? Perhaps Mr. Hunt would explain rather more fully what he means by the rate of consumption of gas to be tested being adjusted as nearly as practicable to the maximum efficiency of the various standard burners.

Mr. *Hunt:* It means that, as at present, by keeping to the 5-feet rate for all qualities of gas, the different qualities of gas are not tested under uniform conditions—that is to say, 12, 13, and 14 candle gas is tested under adverse conditions, as compared with 16 and 17 candle gas. The standard burner is shown by experiments to be applicable to any gas up to 17 candles. At about 17 candles, it gives variable results. If the gas is turned up—whether it be 10, 12, or 14 candle gas—to a certain height in the chimney, so that the flame does not pass over the top, then you get practically equal results.

Mr. LIVESEY: You mean that 10, 12, or 13 candle gas, if turned up to that height, gives a light equal to 16 candles?

Mr. *Hunt:* It would give a light proportionate to the luminosity it is capable of developing.

Mr. HARCOURT: Not equal results; but proportionate comparable results?

Mr. *Hunt:* Yes, our object is to get the whole gas tested under equal conditions.

Mr. *West:* We cannot test 20-candle gas with the London standard burner consuming 5 cubic feet an hour.

Mr. LIVESEY: Could you not test it by consuming less than 5 feet an hour?

Mr. *West:* Yes; but we do not get the proper result.

The CHAIRMAN: Has the attention of your body been called to the terms of the Act of Parliament which says something to this effect: That the gas shall be of such quality that, when burned from a particular burner at the rate of 5 feet per hour, it shall give such and such a light?

Mr. *Hunt:* It has; but no Act of Parliament is incapable of being amended.

The CHAIRMAN: We are not called upon, as a Committee, to recommend any alteration of the Act of Parliament definition.

Mr. *Methven:* But the Act refers to the candle—the sperm candle.

Mr. *Hunt:* The sperm candle and to the parliamentary burner.

Mr. *West:* We cannot burn the 5 cubic feet an hour in Manchester. The standard burner is not capable of burning 5 feet an hour.

Dr. FRANKLAND: To consume a similar volume, I suppose you consume at a lower rate. Is that detrimental?

Mr. *West:* Really, we test with the flat-flame in Manchester.

The CHAIRMAN: That is the case also in London, is it not, with the higher illuminating gas? There are two standard burners in fact—the Argand and the flat-flame.

Mr. TREWBY: Yes; that is so.

Dr. FRANKLAND: The flat-flame is mentioned in the Act of Parliament, I think, for testing cannel gas; so that you have the opportunity of using the flat-flame according to the present Act of Parliament.

Mr. *Methven:* The idea in that resolution is to use the gas at the rate which produces the best result in the burner specified. I think that is the idea.

The CHAIRMAN: Of course, I am only asking you for information; it is not to discuss or contend against you in any way. How do you propose that that should be determined?

Mr. *Hunt:* Either by limiting the flame in the chimney, which would give you comparable results under all conditions, or by limiting the top of the flame to within two rings, which might be marked round the glass at about ½ inch from the top, or any height which might be determined; the object being to obtain an uniform height of flame.

Mr. LIVESEY: Have you considered the other way, of taking the 16-candle gas and burning such a quantity of gas as to give a light equal to 16 candles?

Mr. *Hunt:* Yes, we have carefully considered it; and we came to the conclusion that there is very great liability to error where the lights to be compared are equal. We would very much rather have a greater amount of inequality of light between the two—the standard and the gas to be compared. Moreover, an equality of light such as has been named would do away practically with the uniformity of testing for different qualities of gas, because, if you adopted a 16-candle standard for 16-candle gas, naturally you would go to 14 candles for 14-candle gas, and so on. So that the 14-candle gas would still have to be compared under disadvantageous conditions.

Mr. HARCOURT: I may not have followed you perfectly; but I do not quite understand your answer to apply to the question which Mr. Livesey asked. I did not understand the question to be that of having a standard which would be the same with each quality of gas to be tested; but whether it would meet your views, or nearly meet them, if testings be made with a London Argand burner consuming such a quantity of gas as would give with that burner a light of 16 candles, and make the photometric result depend on the estimation of the volume of gas that needed then to be burnt.

Mr. *Hunt:* I think my answer is strictly applicable to that question, because, in the first place, there is a difficulty in ascertaining the exact illuminating power where the two lights are alike. There is a difficulty in the disc. Those who have made experiments with me, find that, with equal luminosity on each side of the disc, there is much greater difficulty than if one side of the disc is under illuminated. The question of range comes in, and it is very much smaller.

Mr. HARCOURT: Smaller?

Mr. *Hunt:* Very much less.

Mr. HARCOURT: My impression is that it is greater.

Mr. *Hunt:* That is our experience of it.

Mr. HARCOURT: That is a simple matter of geometry; and it is easily solved positively. My impression is that the range is greater near the middle of the bar. If you have a small light which is near the disc, a small movement of the disc makes a considerable difference of illumination; and to produce a given difference of illumination, you have but a small range through which the disc has to be moved. If, on the other hand, the disc is at a considerable distance—say, half the length of the bar—from each of the two sources of light from which it receives the light, you have to move the disc a much greater distance to produce the same difference of illumination. I do not think there can be two opinions about that.

Mr. *Paterson:* Perhaps there is a little confusion arising there. We do not exactly say that the range is less upon the position of the disc when we are testing with a 16-candle standard a 16-candle gas; but what we say is that the possibility of error—that is to say, the light upon two sides of the disc, the two lights of 16 candles each at either end of the bar—is such that the range of observation is limited to a very small space indeed, and the difficulty of determining that position is correspondingly great. But where you have a smaller field at one end than at the other, there is less difficulty in determining the neutral point, if I may say so, of the disc. Hence, our recommendation, which we would beg strongly to urge, of a 10-candle standard rather than a higher. We have also considered the question of the great convenience of a 10-candle standard as applicable to all conditions of gas-testing throughout the kingdom. I need not point out the convenience of that. But I am illustrating it. Supposing you are testing 16-candle gas with a 10-candle standard, the position of the disc, presumably, on the bar would be 1·6 and not 1. By moving your position to the right, you have your value, whatever gas it may be you are testing.

Mr. HARCOURT: I should like to point out that we have here two [illegible] questions before us: the one is the magnitude of the standard to be considered, the other is a question of whether the gas burning at the standard burner should be burnt in such a way as to fill the chimney, or in such a way as it does burn when 5 cubic feet of gas of varying quality is supplied to it, or in such a way as would yield a light of 16 candles. I would submit that that question is entirely distinct from the question (also important) of whether the standard with which it is to be compared should itself be of the value of 2 candles, or 10 candles, or 16 candles.

Mr. LIVESEY: We will deal with the flame first.

The CHAIRMAN: I think the Committee would be glad to hear any opinions of the representatives of these two bodies on both points stated by Mr. Harcourt. The point we have had specially before us until this meeting was allowing the gas to be tested to be burnt as it is now at the rate of 5 cubic feet an hour, or at such a rate that it gives the light required of 16 candles, so as to give a light of 16 candles if it is to be 16 candles, and then measuring the quantity burnt, or, as you suggest, at a particular height.

Dr. POLE: I do not know whether you know the Paris system of testing. It is exactly what is described here. The gas is made to burn to match a certain standard light, no matter what it burns; then the quality of the gas is gauged by the quantity of gas that is required. That plan has been adopted from time immemorial in France; and that is exactly what you wish, is it not?

Mr. *Hunt:* No; we wish to have a greater difference.

Dr. POLE: That is the other question; but I mean as to the flame. That is a question as to what the size of the standard should be. The French plan might be adopted with any kind of standard.

Mr. *Hunt:* What we propose is that the gas in all cases should be burnt at a uniform height in the chimney, and then tested, whatever might be its rate, regardless of the light it gives.

Mr. LIVESEY: Then you would have a double calculation. If the standard be 16; and it burns up to this height, it may give 17 candles?

Mr. *Hunt:* Yes.

Mr. LIVESEY: Then you have to make a double calculation to reduce it to 16, and then see what quantity of gas is burnt?

Mr. *Hunt:* You have to correct in all cases for the consumption.

Mr. LIVESEY: Yes; but as Dr. Pole and Mr. Harcourt put it, that is the only correction to be made with the French system.

Mr. *Hunt:* In the system we propose, there is only one correction, and that is for the consumption.

Mr. LIVESEY: Suppose 4½ feet gave 17-candle power?

Mr. *Hunt:* Then you have to multiply by 5, and divide by 4½.

Mr. *Methven:* I think, gentlemen, the question arises, if I might be permitted to make a suggestion, in this way: Provided that the present standard burner is used, those companies which supply 16-candle gas are better off than those which are tested by the same burner, and have to supply only 15-candle gas. The burner was originally designed and constructed to develop the light (we may say tolerably accurately) of 16-candle gas. Now, when 15-candle or 14-candle gas is burnt in the same burner, burning at the rate of 5 cubic feet an hour, the gas is not represented at its proper illuminating value. In other words, if the rate of supply to the burner were increased beyond 5 feet, the conditions under which 14-candle gas would then be burnt would be something similar to the conditions under which 16-candle gas would be burnt. It is with that view, I think, that we have framed this resolution. It is to cover the varying qualities of gas, and so treat them as to compare them under the same conditions.

The CHAIRMAN: What you mention is in accordance with what Dr. Pole has just said.

Mr. *Methven:* I think I am representing the views of our Committee correctly. Mr. Hunt will correct me if I am not; but I think that is the idea.

Mr. *Hunt:* I do not think it is quite the same thing as Dr. Pole has explained to us as the Paris system. I understand the Paris system is equal luminosity.

The CHAIRMAN: Equal luminosity of disc; not necessarily equal luminosity of the two sources of light on the opposite sides.

Mr. *Hunt:* The disc is fixed. In our case, we do not propose that the disc should be fixed.

The CHAIRMAN: That is really a mechanical question, whether the disc is to be movable or one of the lights.

Mr. POLE: In France nothing is movable.

The CHAIRMAN: Except the stop-cock.

Mr. HARCOURT: That really is the principle. With the 16-candle standard, the position of the disc would be mid-way; with a 10-candle standard, it would be fixed at the point 1·6. But in any case both the light and the disc would be fixed; and the measurement would be of the rate of consumption.

The CHAIRMAN: What is the objection you urge to that proposal, supposing there was a 10-candle standard light on the one side and gas on the other?

Mr. *Hunt:* Practically you would still be fixed to the 5-feet rate.

The CHAIRMAN: No; it would simply have to be calculated.

Mr. TREWBY: You would have to fix the 16-candle standard in the one case or the 15-candle in the other.

Mr. *Hunt:* Within a very slight range, you would be limited to 5 feet, because your object would be to give 14 or 15 candles illumination. If 5 feet will not give it, you may have to turn it up to 5·1 or 5·2 feet; but beyond that you will not go. You will not, under that system, get uniform testing for all qualities of gas.

Mr. LIVESEY: You mean 14, 15, 16, or 17 candles?

Mr. *Hunt:* 14 candles to 17 candles.

Dr. POLE: You might have so low a quality that the burner would not burn it without going above the chimney, which would be detrimental, of course.

Mr. *Hunt:* We have not met with a case of very low quality.

Dr. POLE: Would 14-candle gas burn in the ordinary Argand burner so as to give the same light?

Mr. *Hunt:* Oh, yes; practically the same light as 17 candle gas.

Dr. POLE: Without going above the chimney?

Mr. *Hunt:* Yes.

Mr. HARCOURT: And if you knew nothing of the consumption, you would not know which was which?

Mr. LIVESEY: Only if this was 14-candle gas, you would say that, burning to give a light equal to 14 candles, you are not doing the best with the gas.

Mr. *Hunt:* That is so by limiting it to 14 candles.

Mr. *West:* With the same burner and chimney.

Dr. Pole: If you get a reasonable flame, it seems to me the French method is unobjectionable. If you get a reasonable flame with several qualities of gas on the same burner, it simply tells you how much gas is required in each case, and that is their definition of their quality.

Mr. *Hunt:* That does not meet the objection we have to the different qualities of gas being tested under these conditions.

Dr. Pole: I am afraid I do not understand it.

Mr. Livesey: Suppose all gas were 16 candles, would you then say the same?

Mr. *Hunt:* No.

Mr. Livesey: You would then adopt Dr. Pole's suggestion?

Mr. *Hunt:* Yes.

Mr. Livesey: It is to meet the case of lower qualities?

Mr. *Hunt:* Yes.

Mr. Livesey: You think it would not be practicable to have a different burner?

Mr. *Methven:* The burner existing in London is generally adopted in the Provinces.

Dr. Pole: Is it adopted regardless of the quality of the gas that has to be tested? Suppose the company has only to give 14-candle gas by their Act, you would not adopt the London burner, would you?

Mr. *Methven:* I should advise a company not to do that; but I believe the standard burner is accepted—the light from a standard Argand generally.

Mr. Harcourt: You would use a chimney of less diameter.

Mr. *Paterson:* 15-candle gas is tested with a No. 1 London Argand burner, with an ordinary chimney, 6 by 1¾ inches.

Mr. Livesey: By your Act of Parliament?

Mr. *Paterson:* Yes.

Mr. Harcourt: A 1¾-inch chimney is ordinarily employed with gas of lower quality; 2 inches is the fixed diameter for London gas.

Mr. *Hunt:* It makes very little difference.

Mr. *Methven:* We should like to go farther than that.

Mr. *Hunt:* To get a uniform chimney, a uniform bar, and a uniform height of flame.

Mr. *Paterson:* The contention being that the No. 1 London Argand burner is a 16-candle burner.

The Chairman: Assuming that 14-candle gas is to be burnt out of a 16-candle Argand burner, you think there would be a disadvantage in getting a light of 14 candles, and measuring the quantity of gas that is required to give it, as compared with turning up the flame to a particular height.

Mr. *Hunt:* Certainly.

The Chairman: Turning up the flame to the height at which it gave 14 candles, and measuring the amount of gas which was required to give 14 candles, would not that be in effect the same thing?

Mr. *Hunt:* No, very different.

Mr. Livesey: You would turn up the flame, Mr. Chairman, to give 16 candles. He says that the 14-candle gas would burn at a disadvantage in the 16-candle burner, unless you turn it up to the height that it will give 16 candles.

Mr. *Hunt:* You want all gas to be burnt at the same height of flame in the chimney.

Dr. Russell: You can get that by burning a sufficient quantity of gas; but when you have that extra quantity, the gas does not burn to good advantage.

Mr. *Hunt:* When you have a smaller quantity, it does not burn to advantage.

The Chairman: Would it not also meet your view if the gas were burnt at such a rate as to give the light of 16 candles, and you then calculated it down to 14 candles?

Mr. *Hunt:* It would go a long way to meeting our views; but still it would not give the uniformity we want. What we are anxious to get is uniformity for all qualities of gas up to 16 candles, which we regard as the maximum for coal gas.

Mr. Trewby: To develop the full luminosity of the burner?

Mr. *Hunt:* Yes, up to 16 candles.

The Chairman: You would develop the full luminosity if you burnt 14 candles at such a rate as would give the light of 16 candles.

Mr. *Hunt:* Very nearly, not quite.

Dr. Pole: That would be the French plan.

Mr. Harcourt: You would burn it so as to get rather more.

Mr. *Hunt:* Probably you would get 18 or 19 candles out of a full chimney, whatever may be the quantity of gas.

Mr. Harcourt: Did you get that with a 6 inch by 2 inch chimney?

Mr. *Hunt:* That will give something about 19 candles.

Dr. Pole: The tester knows nothing about the quality of the gas until he tests it; he knows nothing about the standard and the gas-meter. What has he to do?

Mr. Livesey: Burn the gas up to a certain mark on the chimney; and then you want a double calculation.

Mr. *Hunt:* You ascertain by the position of the disc the illuminating power; and you correct that by the consumption to find the quality.

Mr. Harcourt: You have two variables—the position of the disc, and the rate of consumption?

Mr. *Hunt:* You have two variables; but only one correction, as in the case of the fixed disc.

Dr. Pole: He cannot have his result without calculating both elements.

Mr. Harcourt: Mr. Hunt means that the bar does the calculation for him in one respect.

Dr. Frankland: You could not have a bar that would be graduated so as to do the calculation for you of all these different qualities of gas?

Mr. *Hunt:* Bars are already graduated.

Dr. Frankland: Yes, for a particular quality of gas.

The Chairman: If you burn in a 16-candle Argand burner 14-candle gas, so as to give the light of 16 candles, of course you burn more gas, and get more heat. Do you not increase the draught a great deal, so as to get a disadvantage there against the gas?

Mr. *Hunt:* It is found, by experiment with the Argand burner, that the lower the flame, the greater the proportionate amount of air; and this destroys the luminosity. Whether it is increased or decreased by the chimney being full, I am not able to say; but at all events the effect is improved—that is to say, the amount of air going to the flame is more nearly proportionate to the need of luminous combustion.

Mr. Livesey: With a low flame, you get too much air?

Mr. *Hunt:* Yes.

Dr. Frankland: Independently of the draught in the chimney, is it not the fact that the greater the volume of gas you burn in one flame, the higher the illuminating power per foot of gas? It used to be so.

Mr. *Hunt:* That is certainly the case with the Argand burner up to a certain point.

Dr. Frankland: I mean independently of the draught.

Mr. *Hunt:* It is really the matter of draught; it is really the matter of supplying air to the burner.

Dr. Pole: The Lowe jet assumed a certain height, and corresponding to a certain height of flame; and you measured then the quantity. Does this apply also to the burning of various quantities in the London Argand burner? If so, the position is quite intelligible.

Mr. *Hunt:* I think it is quite a mistake to assume that the height of flame is absolute.

Dr. Pole: That is of the Lowe jet.

Mr. *Methven:* Provided the specific gravity of the gas remains constant.

Mr. Livesey: The jet is not absolutely reliable.

Mr. *Hunt:* Nor is the height of the flame in the Argand burner reliable.

Mr. Trewby: We have not heard Mr. Methven about the hygrometric conditions of the atmosphere.

Mr. *Methven:* I was rather anxious to know, Sir, whether any steps had been taken by Mr. Harcourt to alter his standard flame, or rather to correct it for the influence operating on the pentane unit by the varying hygrometric conditions of the atmosphere. It seems to me that, if this standard is to be lodged as a standard from which other lights are to be measured and compared, it must be one that would give the same light at all seasons of the year, and under all conditions of the atmosphere. My experience has led me to believe that the flames do not develop the same amount of light under the varying hygrometric conditions of the air, and that the flames are more susceptible the smaller their power may be. That is to say, the flame of the Argand burner is not so susceptible to hygrometric changes of the atmosphere as a flame of the size of the pentane unit of light. I was particularly anxious, before this standard was adopted by the Committee as the standard of light, that a consideration of this subject should be made. My impression is that there is an influence at work in the varying changes of the atmosphere which would, unless corrected in some manner, prevent the same development of light from the standard under the altered conditions of the air. It seems to me very necessary that this should be made perfectly clear before this standard is introduced.

The Chairman: Is that conclusion you have come to the result of any direct experiments you have made?

Mr. *Methven:* Direct experiments on the same subject, Sir. My experiments were conducted as a good many other laboratory experiments are—I have taken extreme measures. I have noted the development of light from the flame when it has been supplied with perfectly dry air, and also when it has been supplied with perfectly saturated air. I have also made my experiments over a range of temperature such as I have known to exist in some of the testing-places of the Metropolis; and under these extreme conditions of perfectly dry atmospheres and perfectly saturated atmospheres, in the development of light from the pentane burner, I have discovered a very serious difference. The experiments are published in my paper which I read before the Southern District Association of Gas Managers.* If you have the reference there, it would prevent my making mistakes. I am always afraid to say to what extent variation does take place; but it is rather large.

Dr. Frankland: I presume they were made with the 1-candle pentane burner?

Mr. *Methven:* Yes. If the Committee could spare me the time, I might read a few remarks I made in that paper. [Mr. Methven then read a passage from the paper.]

Dr. Frankland: There are two conditions somewhat mixed together there, are there not—that is, an increase in moisture, or a difference between dry air and moist air, and at the same time and in the same experiment differences of temperature? Can you separate one from the other? How do you know how much was due to difference in temperature, and how much to dry and moist air?

Mr. *Methven:* I think I have done that. The idea was to make the range of temperature a factor in the matter, because I knew that the higher the temperature of the air, the more moisture it would conduct into the neighbourhood of the flame.

Mr. Livesey: How would that affect the use of the pentane standard?

Mr. *Methven:* In this way. Suppose the pentane standard has been adopted and lodged with the Warden of the Standards, as a standard with which other lights are to be compared. If it was called into operation on a very wet day in the summer, it would return a certain value to the lights opposed to it or to the standards.

Mr. Livesey: It would give less light than on a dry day in winter?

Mr. *Methven:* It would represent the standard it was opposed to as being of higher value in the summer on a wet day than in the winter on a dry day. Then I say it is necessary, if there is anything in my argument at all, to consider it. I am quite open to be corrected by anyone who has made similar experiments; but I could not very well, with the knowledge I have on the subject, allow this matter to go forward without mentioning it.

Dr. Frankland: I think I understand you to say that one cause of the difference was the smallness of the pentane flame as compared with the gas-flame; that it affected a small flame less than a large one?

Mr. *Methven:* To a great degree, owing possibly to the character of the small flame.

Dr. Frankland: Suppose a pentane flame more nearly approached the luminosity of the gas-flame, would not the moisture or dryness be compensated for in the two flames?

Mr. *Methven:* It would serve the two flames in exactly the same

*See Journal, Vol. LIV., p. 968.

way; but in this case I take it you are determining the new pentane unit of light which is supposed to be equal to 1 candle, and from that pentane unit, I take it, you propose to standardize other standards—for instance, in developing the 16-candle standard, is not that so?

The CHAIRMAN: You may take that for the present at any rate.

Mr. *Methven*: So you see the importance of starting accurately.

Dr. FRANKLAND: Yes.

Mr. LIVESEY: If Mr. Sugg (say) makes a certain number of 16-light burners, and takes them to the Board of Trade to be standardized with the pentane in the summer, when the atmosphere is charged with moisture, those 16 candles would give a different amount of light to what another lot of burners would give if standardized in the winter on a dry day.

Mr. *Methven*: Yes.

Mr. *West*: I should like, Sir, to call attention to this resolution. It was resolved—"That the opinion be strongly impressed upon the Committee that no standard will be acceptable to the gas interest generally unless based upon, and of the same relative value as, the existing parliamentary standard candle or unit of light." I think the idea is that, if you adopt the pentane standard, it should first be ascertained if that is comparable to, and is of the same value as, the standard candle of light. If experiments are made, you will find that the pentane standard candle gives you more light than the standard candle gives; and if that is so (which I myself have no doubt about), it would be very much against the interest of gas companies to adopt it as a standard. That is a subject perhaps the Committee might have investigated; but from experiments I made some years ago, I found the pentane standard, when consuming 0·5 cubic foot per hour, gave more light than the standard candle. It is very important, if it has not already been ascertained to be in that position, that the Committee should have an investigation made. I look on it as one of the most important questions under consideration, that we should really know what value the pentane standard has in relation to the standard candle—that is, to the unit of light in all existing Acts of Parliament.

Mr. LIVESEY: Your resolution was that we should still retain the nominal standard candle.

Mr. *West*: Certainly; I wish to call particular attention to it.

Mr. *Hunt*: The value of the candle; not the candle itself.

Mr. *West*: My experiments worked out with Mr. Vernon Harcourt's pentane flame, gave more light than the candle did.

Mr. TREWBY: To what extent?

Mr. *West*: 3 or 4 per cent.

Mr. LIVESEY: What we have to find out is what is the equivalent of the average candle in pentane.

Mr. *West*: That is what I suggest. It is a very important matter for all gas companies.

The CHAIRMAN: You may be quite sure that this point will have full attention given to it.

Mr. LIVESEY: There is the point mentioned by Mr. Paterson as to the illumination of the disc. I understand him to say the brighter the illumination of the disc, the less easy it is to read compared with one not so brightly illuminated. Could you not get over that by lengthening the bar?

Mr. *Paterson*: Or having a 10-candle standard, which would be universally applicable to any quality of gas?

Mr. LIVESEY: Have you any objection to 10, 16, and 20 candle standards standardized from the same unit?

Mr. *Paterson*: We would urge the importance of having one standard, for this reason: Suppose you are legislating, there is legislation for more than one standard. There is 16 candles for London, 20 candles for cannel gas, and probably the general provincial standard is for 10 candles. We should be in this position, in all cases if there was an application made to Parliament, there would be a contention over the standard.

Mr. LIVESEY: How the gas was to be tested?

Mr. *Paterson*: Yes. There are in the provinces companies which at present are supplying 16-candle gas. There would be a contention between the local authority and the company whether it should be a 10-candle or 16-candle test. On that ground, we strongly recommend only one standard as a measure of light. Presumably you adopt the pentane as the unit, and standardize the 10-candle measure or the 10-candle standard, whichever you may call it, from pentane. There you have a unit of measure applicable to all conditions of photometrical testing in the kingdom.

Mr. LIVESEY: From 14 candles up to 28 or 30 candles?

Mr. *Paterson*: Whatever it may be.

Dr. POLE: Is not there a general wish that the distance from the disc to the two lights should be pretty nearly equal, on account of the fog, and so on? That would not be the case if you were measuring 16-candle gas with 10 candles.

Mr. *Paterson*: We find the difference between the distance of the two lights with 10 candles or 16 candles is reduced to a few inches.

Dr. POLE: You think it would not matter?

Mr. *Paterson*: No.

Mr. LIVESEY: You do not have fogs in Cheltenham as we do in London.

Mr. *Paterson*: I do not think you would be injured at all by the distance between 10 and 16 candles.

Mr. LIVESEY: There are 7½ inches between 10 and 16 candles.

Mr. *Hunt*: It is understood that the resolutions we have submitted on both sides are unanimous as regards the two Institutions.

The CHAIRMAN: Yes. We are really very much obliged to you for what you have told us. Many of the points you have urged are matters we have already had under consideration; and those we have not had under consideration, I can assure you we will give our attention to.

The deputation then withdrew.

Additional Coal Storage for the Leeds Gas-Works.—The accommodation for the storage of coal at the York Road Gas-Works of the Leeds Corporation has been inadequate for some time past; and last week a contract was let to Messrs. Oakes and Son, of Hunslet, for the erection of new coal stores upon land recently purchased for the purpose. The amount of the tender was £1655.

EUROPEAN GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held yesterday week, at the London Offices, Finsbury House, Blomfield Street, E.C.—Mr. J. BLACKET GILL in the chair.

The SECRETARY and GENERAL MANAGER (Mr. W. Williams) read the notice convening the meeting; and also the statement of accounts, and the following report of the Directors:—

Various unfavourable circumstances have prejudicially affected the Company's business during the past financial year, with the result that the aggregate rental at the seven stations shows a reduction of 1½ per cent., as compared with the previous year.

First among the causes of this decrease in rental must be mentioned the exceptionally severe weather experienced during the month of February, which so seriously interfered with business generally in provincial towns that all shops were closed early, and consequently less gas was burnt. Nearly half of the entire loss of rental for the year occurred during this month.

In the next place, the Company have now, with one exception, to contend with the electric light at all the stations. The Directors have, in many cases, been able to meet this competition by introducing incandescent gas-burners, and by making special concessions in price to large consumers; but, in spite of these measures, they have to acknowledge that their efforts are not entirely successful, and that, where the cost of lighting is not a consideration, they frequently lose good customers. The number of consumers on the Company's books is constantly increasing; but the shareholders will understand that, when a factory or large *café* abandons gas, many small consumers are required to make up the rental thus lost.

For many years, the Board have directed their efforts to extending the use of gas among small consumers; and, as a further step in this direction, they have decided to introduce prepayment meters at three of their stations—viz., Bolbec, Rouen, and Havre, where they have reason to believe the system will be a success. If such prove to be the case, similar measures will be adopted at other stations; and in this way the Board hope to greatly develop the use of gas among the working classes.

Coal is still being supplied under the contracts made in 1893; and therefore has not varied in price. But at one station—viz., Nantes—the cost has been enhanced by increased dues levied by the Municipality. This increase is a matter of considerable importance to the Company, as it represents an additional charge to the Nantes works of nearly £2000 per annum. The Directors have taken the highest legal opinion on the subject, and are advised that the Municipality of Nantes are not justified in enforcing payment of these dues. Under these circumstances, finding it impossible to come to an amicable arrangement with the authorities, the Directors, although very reluctant to engage in litigation with the town, felt it incumbent on them, in justice to the shareholders, to have the question tested in a Court of Law, and have instituted proceedings for that purpose.

The mild weather which prevailed during the early part of the winter, interfered with the ready sale of coke; and prices had to be reduced. But the extreme rigour of the season later on, although in some ways unfavourable to the Company's business, as already mentioned, enabled the Managers, in most cases, to dispose of their stocks of coke; and prices have since been advanced wherever possible. The total revenue, however, from coke is somewhat less than that obtained last year. Tar has slightly improved in value; but there has been a heavy fall in the price of sulphate of ammonia.

The Directors have had under consideration the rates hitherto carried for depreciation and redemption of capital—a fund which is rendered necessary by the fact that the Company's concessions are all terminable. After careful examination, they have found it possible to reduce the amount hitherto set aside each year for this fund, and thus, while continuing to carry annually a sum sufficient for the purpose in view, leave a larger amount of profits available for distribution. The Directors are therefore able, in spite of the disadvantages under which the Company have laboured during the year, to recommend the payment of the usual dividend—viz., 20s. per share on the fully-paid shares, and 15s. per share on those £7 10s. paid, less the interim dividend of 8s. and 6s. per share respectively paid on the 1st of February last; also the payment of a special bonus of 1 per cent. on all shares, according to the amount paid thereon. As the net profits for the year are £942 short of the amount required to pay above dividend and bonus, the Board propose that the difference be taken from the reserve of undivided profits. Both dividend and bonus would be paid free of income-tax on the 1st prox.

The Directors have to report, with much regret, the death of Mr. F. J. Roan, one of the Company's Auditors. Pursuant to the Regulations, they have temporarily filled up the vacancy, and appointed F. M. Fry, Esq., a duly qualified shareholder, to the post until the present meeting.

Notice has been given that two Directors (E. T. E. Besley, Esq., Q.C., and E. F. White, Esq.) and both Auditors (J. Reeson, Esq., and F. M. Fry, Esq.) retire from office at this meeting. All being eligible, they offer themselves for re-election.

The CHAIRMAN said the report which the shareholders had heard read entered so fully into the particulars of the business the Company had done during the past year that he did not know there was very much scope left for him, nor many points of interest he could dwell upon; but still he should like to say a few words on the accounts generally, which he must regard as satisfactory. The first thing that met them was, of course, the loss in the rental, which amounted to £3525—that was, at the rate of 1½ per cent. Circumstances over which the Directors had no control caused this. There was one satisfactory feature connected with this point—that the day consumption had increased by 2 per cent., raising it to 31 per cent. of the total consumption. This was particularly satisfactory; and it showed that their 40,000 stoves and more than 300 gas-engines were doing excellent work in earning for the shareholders a good profit. The consumers had been augmented by nearly 1000; so that the total number was now 31,000. With reference to the residual products, the increase in tar amounted to £480; but coke showed a loss of £826. This was accounted for to a great extent by the cement trade, which had been very bad both in this country and in France; and this, with the severe weather, accounted for the loss in revenue. There had been also a serious diminution in the item of sulphate of ammonia; the receipts being £1255 less than last year. Sulphate had been a drug both in this country and in France, and the Company had had considerable difficulty in getting rid of it. However, they were told by those who knew something about it that the worst had passed; and things were beginning to move up. He hoped this was so for all their sakes. They found the profit had increased by £1540. Some of the shareholders might say: "You have spoken of several losses, how is it the profit has increased?" The Directors had been re-arranging the accounts somewhat; and they had come to the conclusion that the amount of money placed to redemption and depreciation account might be somewhat lessened. He could

assure the shareholders that the present Board were fully alive to their duty in keeping this account up; so that they need be under no apprehension in this respect. By the course just mentioned, and, with £942 from the undivided profits (which stood at a satisfactory figure), the balance would enable them to pay a dividend and bonus at the same rate as last year. It would be recollected that, at the last meeting, he told them the bonus must be regarded as a special bonus; but their accounts were generally in such a healthy and satisfactory condition, that he did not think they need hesitate for a moment in enjoying the 1 per cent. bonus which it was proposed to declare on this occasion. The coal contracts entered into two years ago would last another year; but they were at a slightly higher figure than the present price. The Directors had arranged with some of the colliery owners to carry on the contracts for two years longer at a reduced figure; but the price now ruling for coal was very low—almost as low as it had been for years, which was a very good thing for gas companies, but he did not know that it was the most fortunate thing for the country. He and the General Manager had visited the Company's stations this year; and they found everything in a satisfactory condition as far as the works were concerned. They could not help being struck, however, by the great inroads electricity had already made among the consumers, because there were no shops of any standing at all that had not the electric light. The *cafés* were their most important consumers; and they had succeeded, by the aid of incandescent burners, in keeping out the enemy in a few cases. The proprietors told them that the people who visited the *cafés* almost insisted on the electric light—no matter at what cost; so that the Company found it very difficult to compete with it. In this country, a less price was charged for gas; and there was no doubt that the only way to compete with electricity was by cheapness. But though it was very desirable in the case of their Company, perhaps it was not altogether feasible, because they worked under very different conditions to the Metropolitan Companies. They had concessions from the Municipalities, who were glad to have a finger in their pie. The consequence was the Company could not charge so low as they could wish, because they had to pay considerable dues to the Municipalities. The report alluded to Nantes, where there was a case in point. Some years ago, a new agreement was made with the Municipality, and the concession was extended for a certain number of years. Nothing was said about *octroi* at all. To the great astonishment of the Directors, after the agreement was signed, an *octroi* was put upon the coal. The Directors protested, and hoped that some means of settling the difficulty might be found. But the Municipality had now doubled the *octroi;* and the shareholders would at once see that the extra £2000 a year at a station like Nantes was a very serious thing. The Directors had instructed one of the ablest barristers at the French Bar to fight the battles of the Company for them; but the law's delay in France was very much the same as the law's delay in England. The matter was pursuing its course; but it might be some time before they obtained a decision. By way of stimulating trade, the Board were thinking of introducing coin meters at three of their stations. They believed that these would be a great success in France, as they were in this country. Here the charge was a penny for 25 cubic feet of gas; but they would have to charge 10 centimes for about half that quantity of gas in France. This would possibly militate somewhat against the success of the system. The French workmen were different to English workmen. They were paid fortnightly; and the Company collected fortnightly in many of their districts. The Frenchman nearly always paid his gas bill; and the shareholders would see this was so when he stated that, although the total rental amounted to £236,000, they only lost £380 by bad debts. He (the Chairman) thought this was a remarkable record. It showed that the collectors were doing their work in an admirable manner; and that their customers were thrifty, and kept up to their obligations. Indeed, the bad debts would compare well with any company in this country. At the various stations, they had shops, in which were gas-fittings and every kind of appliances for lighting and cooking, and which were in charge of intelligent attendants. In these shops at night time, they created great illumination, which paled the electric light altogether; and probably some of the coin meters would be fixed in them, so that their working could be explained to the public. He was sorry to say that death had been busy in connection with the Company both at home and abroad. Among their friends abroad, they had lost M. Alépée, who had been for more than forty years in the service of the Company, and for many years had been their Manager at Havre. They greatly regretted losing one who had served the Company so faithfully and well. The Directors had induced M. Coindet, of the Rouen station, who had been with the Company 38 years, to take the responsible post at Havre; and they knew they would derive great benefit from this appointment. M. Gautier, of Boulogne, succeeded M. Coindet at Rouen; and they had given to M. Marchal, the Sub-Engineer at Havre, the management of the Boulogne works. The Company had also had the misfortune to lose Mr. Roan, who had served them faithfully as an Auditor for a number of years; and the Board, acting on the Articles of Association, had secured a properly qualified proprietor to assist Mr. Reeson to finish off the accounts. They selected for this work Mr. F. Morris Fry. He was a gentleman of position in the City; and he had spare time on his hands. Of course, it was entirely a question for the shareholders whether or not they re-elected him. In conclusion, the Chairman congratulated the shareholders upon the state of the Company. They had, he said, heard that day from Havre and Rouen that they had more applications for gas than they were really able to fit up; and the Directors were taking steps to supply this deficiency at once. Looking generally at the position of the Company, he saw nothing to prevent them—if not achieving such success as they had in the past, and advancing by leaps and bounds to prosperity—earning for years to come a fair and good dividend. He then moved that the report and statement of accounts be received and adopted.

Mr. N. E. B. Garey seconded the motion, which was agreed to.

The dividend and bonus having been declared,

The Chairman moved the re-election as a Director of Mr. E. T. E. Besley; and he took the opportunity of congratulating him upon the honour Her Majesty had recently conferred upon him in making him a Queen's Counsel.

Mr. Garey seconded the motion, which was passed.

On the proposition of the Chairman, seconded by Mr. Besley, Mr. E. F. White was also re-elected a Director.

The Auditors having been re-appointed,

Mr. H. E. Jones moved, and Mr. Martin seconded, a vote of thanks to the Chairman and Directors.

The Chairman, having responded, referred in eulogistic terms to the attention bestowed upon their work by the officials and the staffs at home and abroad, and moved a vote of thanks to them for their services.

Mr. Watson seconded the motion, which was heartily agreed to.

Mr. Williams suitably acknowledged the vote; and the proceedings then terminated.

ELECTRIC LIGHTING NOTES.

At the Meeting of the London County Council last Tuesday, the Highways Committee brought up a scheme for establishing the electric light on the Victoria Embankment and Westminster and Waterloo Bridges, for which purpose the Council obtained authority in their General Powers Act of 1893; £15,000 being provided in the Money Act of that year. The matter was before the Council last year, when its consideration was adjourned. In the revised scheme now proposed, duplicate plant is provided for; either set of plant being capable of lighting the Embankment and the bridges. The generating station is to be of fireproof construction, so securing the maximum of safety. The cost of the buildings has been reduced by omitting some of the more expensive items of ornamentation proposed in the original scheme; but the buildings will be quite as efficient. The electric lamp standards would be placed on the kerb of each of the footways—leaving the parapet lamps to be lighted, when required, by gas as at present; and the existing standards on the two bridges would be fitted with the electric light. It is proposed to provide 83 lamps in all. The Committee pointed out that the light on the Embankment would necessarily be to some extent obscured by the trees at the sides of the footways; and they did not see their way to obviate this. Should the Council decide to adopt the scheme, they proposed to ask the Technical Education Board to allow the inspectors of art schools and classes to assist them by preparing designs for the standards; and they hoped to be able to obtain a design for a standard and lamp which would be worthy of being placed in this, the finest thoroughfare in London. The capital cost of the scheme is estimated at £16,590, made up of the following items: Buildings, £4600; boilers and machinery, £5200; mains, £2250; lamps and standards, £4240; salaries, £300. About £3000 of the total expense is in respect of the two bridges. The estimated annual cost of maintenance is £2768, in which is included: Wages, £700; coal, £375; other stores and carbons, £325; repairs, £613; loan (interest and repayment), £672; rates and taxes, £83. In making these estimates, it has been assumed that the repayment of the loan would be spread over 42 years, which is the period for which the Council are now granting loans to Vestries for electric lighting purposes. The consideration of the scheme was deferred. The Highways Committee reported that the County of London and Brush Electric Lighting Company had asked the Board of Trade to give a definite decision upon the appeals of the Company which were the subject of an inquiry by the Board of Trade in December last. On the 24th of February, they reported that the Board had intimated that they were not prepared to hold that sufficient reasons had been advanced, either on the ground of public safety or of want of parliamentary sanction, to justify them in refusing to approve of a system of supply involving the use of transformer chambers in the public streets; and that the Board hoped this decision on the general question would render unnecessary any further action on the appeals lodged by the Company. The Board afterwards approved a description of the system of supply under the County of London (North) Order, 1892, which contained the following words: "The converting stations will be street-boxes of sufficient size and suitable construction to contain several transformers; room being also provided to enable a man to enter the box and conveniently examine the transformers and controlling apparatus." The Board of Trade had decided to hold a further inquiry into the matter, at which it was thought desirable that the Council should be represented. The Council adopted a recommendation of the Committee that they should be authorized to take all necessary measures for making known at the inquiry their objections to the transformer chambers being placed under the public streets.

In view of the increasing demand for electricity in Leeds, the Directors of the Yorkshire House-to-House Electricity Company, Limited, have decided upon a considerable extension of plant and buildings to meet the anticipated requirements for the winter of 1896. The existing buildings being now quite filled with plant, the Directors are considering plans for a new engine and boiler house, and propose to instal, in the first instance, additional plant of at least 1000 indicated horse power.

The estimate of the cost of the electric works and plant of the Cardiff Corporation was £32,500; but this has been exceeded by £5000. The Borough Engineer recommended the Electric Lighting Committee last Tuesday to borrow an additional sum of £7500 to meet this and other extra expenditure; and this they agreed to do.

At the Portsmouth County Court on the 11th inst., the hearing of the action instituted by the Portsmouth Corporation against Mr. F. Edwards, the landlord of the Wiltshire Lamb public-house, Southsea, to recover £5 for electricity alleged to have been used by him for lighting purposes, as mentioned in the Journal for the 9th inst. (p. 97), was resumed. It may be remembered that the defence was that the meter registering the current was unreliable, and that the consumption recorded by it was not so great as was indicated. The matter was adjourned to allow of expert evidence being called; and this was now adduced. After hearing both parties, the judge favoured the defendant's contention; and he gave judgment for him. The representative of the Corporation (Mr. G. H. King) asked for a further adjournment, in order that he might apply for leave to appeal, as the finding was a serious matter for the Corporation. Mr. Burbidge, for defendant, argued that Mr. King could not appeal on a question of fact; and his Honour concurred—saying he could not see any ground for an appeal. Mr. King could move for a new trial if he pleased.

Last Friday, Mr. F. H. Tulloch inquired into an application to the Local Government Board by the Halifax Corporation for sanction to borrow £10,000 for purposes of electric lighting. A statement was made by the Town Clerk (Mr. K. Walton) to the effect that in 1892 the Corporation obtained a Provisional Order, empowering them to erect works for the supply of electricity. They obtained permission of the Local Government Board to borrow £30,000; but they had since found they would require an additional £4947 to complete the original scheme, and £5000 for extensions. They had actually expended £34,947; whereas the original estimate was only £26,100. In the estimates, the Corporation proposed to utilize some land belonging to them; but, after further consideration, it was decided that a more convenient site should be obtained, which was done at a greater cost than the estimates provided. The amount included in the application for mains and services was only £500; and, as the Committee have decided to extend the mains to Skircoat, the Inspector agreed to this figure being doubled.

Through the medium of the *Manchester Guardian*, Messrs. T. Seymour Mead and Co., Limited, have drawn the attention of the City Councillors to the anomalous charges made for electric lighting as compared with those for gas lighting. They supply the following striking comparison of the cost of gas and electricity for lighting their premises:—

Gas.		*Electric Light.*	
September, 1892	£5 14 3	September, 1894	£22 11 6
December, 1892	16 2 6	December, 1894	34 7 5
March, 1893	18 0 9	March, 1895	37 8 9
June, 1893	5 19 3	June, 1895	24 0 3
	£45 16 9		£118 7 11

The works of the General Electric Company, Limited, of Salford, were destroyed by fire last Friday week. The full strength of the Salford Fire Brigade was in attendance; but, despite the exertions of the men, the works were almost burnt out. The damage is estimated at about £30,000.

METROPOLIS WATER SUPPLY.

Curtailment of the Supply at the East-End.

A short time ago, the East London Water-Works Company apprised their customers that, consequent on the prevailing dry weather on the one hand, and the waste of water on the other, the supply would have to be shut off from some of the service-pipes during a portion of the night. The matter has given rise to much newspaper correspondence and criticism; and the Secretary (Mr. I. A. Crookenden) has, by order of the Directors, issued the following statement:—

"The drought is unprecedented; and the storage reservoirs, which were full at the end of May, having become seriously depleted, the Directors found it necessary to diminish the hours of supply, the more so as the evident waste of water had assumed enormous proportions. About three-fourths of the district supplied was thereupon put upon the intermittent system; but although the hours of service have been materially restricted, the Company are even now pumping upwards of 30 gallons per head per day for all purposes. This should be ample, as it exceeds the quantity distributed by the Manchester, Liverpool, Nottingham, Birmingham, and many other municipal water-works. Even this possible contingency was fully appreciated by the Directors; and as long ago as 1890, they opened negotiations for acquiring upwards of 100 acres of suitable land upon which to construct reservoirs. Having succeeded therein, they promoted a Bill in Parliament for the purpose of greatly enlarging their works and reservoir capacity (1892). The Bill was, however, opposed by the London County Council; and, despite the warning of Mr. Mellor, the Chairman of Committees, who said 'the House would incur the very gravest responsibility if they refused to send the Bill to a Committee,' it was, on a party vote, rejected. In the following year, the Company introduced a similar measure, which was also vigorously opposed by the then Government, but was carried by a majority of one. The provisions in the Bill for increased storage not only commanded the approval of the Royal Commission on Water Supply, and of the Water Examiner (General A. de Courcy Scott, R.E.), but when the measure itself was considered by the Committee, they inserted a clause to the effect that the work should be commenced and proceeded with with all possible despatch; and this has been done. Had the Company's first Bill not been rejected in 1893, a very large portion of the work would now have been completed, and could have stored 200 million gallons of water. It has been, all through, a fight between those who are responsible for the supply of water to the East-end of London on the one part, and the London County Council, aided by their friends (who have no responsibility whatever), on the other; and, unfortunately, political considerations, utterly regardless of the needs of the people, and against the solemn protest of the Directors, carried the day. Whatever blame, therefore, has arisen out of the present limited supply of water, is traceable entirely to these influences, which the Company were powerless to resist. With regard to the present supply, there is no fear of any disaster if the people would be but more careful in the use of water. For years it has been wasted to a terrible extent; and although the supply at the present moment has been restricted, the quantity pumped into the district is ample for all legitimate use."

Some startling statistics have been prepared by the officers of the Company, respecting the continued dry weather. From these it appears that the existing drought is unprecedented. The rainfall during the present year has been less than ever before recorded; and much less than during the great drought of two years ago. The average rainfall at seven different stations in the Lea Valley up to the end of last month was 4·6 inches; whereas it should have been 12·5 inches. The Company's storage reservoirs are now practically empty; and all the available sources of supply are used to the utmost. Although an intermittent service is being given, the net quantity supplied per head per day for all purposes is 31 gallons. At the present time, 1600 men are employed in constructing additional storage works; and it will be absolutely impossible to resume the constant supply until there has been a heavy and prolonged rainfall. The water in the Lea has decreased ominously. In May the falling off in one day amounted to 11 million gallons. The waste in the Company's district is lamentable; and while each person is now receiving 31 gallons a day for all purposes, 25 gallons ought to be sufficient. Every drop of water the Company can obtain is being used, and none stored.

Commenting on this subject last Thursday, the *Standard* seemed to impute blame to the Directors of the Company for not taking steps to meet the present emergency. The writer of the article has a sufficient sense of justice to acknowledge that the County Council are responsible for at least a year's delay in the execution of additional storage works—a point which the Directors emphasize in the statement given above. The Company have at their command, as sources of supply, the River Lea, springs, and wells; and, with these three, the writer thinks they ought not to plead, as they do, "that they are utterly unable to meet the wants of the public." But do they plead this? They are sending out, as their Chief Engineer (Mr. W. B. Bryan, M.Inst.C.E.) states in a letter to that paper, more than 30 gallons of water per head per day, a great deal of which the consumers waste. He explains that the Thames works are capable of furnishing 10 million gallons a day; and practically this quantity was pumped to London during the whole of the frosts, and up to the end of March, as well as during May, June, and July up to the time of writing. In April, the daily average was 5,117,000 gallons. The stand-pipe—nearly 240 feet high—at the Thames works, was seriously damaged in its upper portion by the great gale of Sunday, the 24th of March; and it was, in consequence, impossible to pump the full quantity until the pipe was repaired. This, however, he says, had no effect whatever on the supply to the East London district, as the Walthamstow reservoirs were overflowing during the whole of April, and also until the 26th of May. With reference to the obstructive action of the County Council, Mr. Bryan repeats the Directors' statement, that but for it there would have been additional storage to the extent of 200 million gallons available before this, besides a further supply of three million gallons a day from other sources. In order to show that no delay occurred after parliamentary powers were obtained, Mr. Bryan states that the Royal Assent was given to the Company's Bill on Aug. 17, 1894; and at the first subsequent meeting of the Directors, held on Sept. 6, all the works authorized by the Act were ordered to be proceeded with without delay, and several were actually commenced a week later. The preparation of drawings and details, specifications, and the taking out of quantities for work to cost £200,000, and also the acquisition of certain necessary lands and easements, occupied some time; but, at the break-up of the frosts, the contracts were let to three eminent firms, and were immediately commenced and vigorously proceeded with—there being, at present, 1600 men employed thereon.

The Grand Junction Water Company and the Supply during the Frost.—The Hampton Wick District Council some time ago made a claim of £78 against the Grand Junction Water Company for delivering water to their customers in the district during the severe frost of the past winter; but the Company reduced the claim to £55. The matter has since been considered by their Engineer (Mr. A. Fraser, M.Inst.C.E.), and the Surveyor of the Council (Mr. W. H. Hope), with representatives of that body; and the result is that the Company have agreed to pay the full amount.

The Mourne Water-Works of the Belfast Water Commissioners.—Owing to the death of Mr. A. Gaul, the contractor for No. 3 contract of the Mourne water scheme of the Belfast City and District Water Commissioners—viz., the tunnel and conduit at Carryduff, which form part of the main conduit carrying the supply from the Mourne Mountains to the city—the Commissioners have concluded an agreement with Messrs. Fisher and Lefanu, of Belfast. The amount of the contract is rather in excess of the figure to be paid to Mr. Gaul; but it was the next lowest tender—viz., £140,000.

The Public Lighting of Esher and Ditton.—As some difficulty has arisen in regard to the power of the Esher and Ditton District Council in respect to the lighting of certain parts of the district, a case was submitted to Mr. Macmorran for his opinion thereon. This came before the Council at their meeting on the 9th ult., and was read by the Clerk. He expressed the opinion that the Council could not adopt the Lighting and Watching Act, 1833, for their district, or any part of it. He said the powers of an urban authority under section 163 of the Public Health Act, 1875, could be exercised in respect to the whole or any part of the district without the consent of the ratepayers being first obtained. In reply to the question, "The adoptive Acts being in force in two portions of two parishes, is the Urban District Council able to apply it to the whole district, or must the consent of the ratepayers of the portions of the district where the Act is not adopted be first obtained?" Mr. Macmorran said it seemed to him that the question was founded upon a misapprehension. Upon the constitution of the urban district, the Act of 1833 ceased to apply to those portions of parishes in which it was adopted. The powers of lighting inspectors ceased absolutely; and all funds and properties under their control passed to the new urban authority. The property of the lighting inspectors now belonged to the urban authority; and it was held by them for the entire district, subject to any such adjustment as was provided for by article 7 of the order made by the Council. The present position of affairs was that the urban district authority could continue to light the portions of the parishes hitherto lighted, and might also light any of the parts of their district; and that the expense of so doing would be defrayed out of the general district rates for the entire district, unless, for purposes of lighting, the urban authority divided their district. In reply to other questions, Mr. Macmorran stated that the lighting inspectors, having ceased to exist, had no power at present to make any payment. If they made any payments, the District Auditor would certainly surcharge them. As this case seemed to have been stated under a misapprehension of section 163 of the Public Health Act, 1875, it was possible that difficulties might have arisen by reason of the lighting inspectors having regarded themselves as still possessing some powers under the Act of 1833. If such were the case, he would supplement this opinion, or answer any question arising out of it.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

As intimated in another column of the JOURNAL, the arrangements or the meeting of the North British Association of Gas Managers at Melrose on Thursday are now completed. They have been later than sual in being got into shape, chiefly on account of the difficulty in rranging for the excursion on Friday. The district is rich in places of nterest to the pleasure-seeker; and there was a plethora of localities hich might have been visited. St. Mary's Loch was thought of; nd, I understand, it would have been adopted, but for the fact at there is not accommodation anywhere in the neighbourhood or such a large company, which would prove unfortunate in the ase of a wet day occurring. Dryburgh Abbey, the glen, and other laces, might have been visited; but the Committee have fallen back pon Abbotsford. Though a short excursion, this, considering it was e home of Sir Walter Scott, who made modern Scotland, is a place f supreme interest to Scotchmen, and not to them only, but to all English-speaking peoples. So much for the pleasure, which it seems little out of place to put before the business portion of the programme. The technical part, however, speaks for itself. The efforts f Mr. R. S. Carlow, the Secretary, to produce a programme of items ufficiently attractive to draw out members who otherwise might have een content, for the season, with the business pabulum which they eceived at the meeting of The Gas Institute in Edinburgh, and have remained at home, have been successful. I have no doubt the President's ddress will be a sound, common-sense production—nothing else could e expected of Mr. Wilson. But the interest of the meeting will centre n the paper by Mr. W. Young, of Peebles. I intended some weeks ago o have informed your readers that Mr. Young had gone for a holiday, hich was not altogether undertaken for the ordinary holiday reasons, ut which his medical attendant had some say in. But I refrained hen I heard that he was busy with a communication for the Association, as some might have thought that a paper written under such ircumstances might not be so carefully prepared as is his wont. It is haracteristic of the man that, instead of resting, as was the intention f his retirement, he should have devoted himself to the preparation f a paper on a subject which is more than usually technical, ven for him. The last two meetings of the Association have een largely devoted to the exposition, by Mr. Young and others, f his oil-gas process. This year he has gone further into the ubject, and deals, not so much with the production of gas by any articular process, as with the illustration of the elements and attributes f enrichment. The paper will, in itself, be sufficient to stamp the neeting as one of importance, and one to be remembered. The two ollowing papers—by Mr. Myers, of Saltcoats, and Mr. Vass, of Portoello—will be more of local interest, and will, I have no hesitation in aying, be more helpful to the managers of small works than the more earned dissertation of Mr. Young. They are papers of a sort which o local association should be without. Then the last paper of all—y Mr. Alex. Waddell, of Broughty Ferry—will again introduce the Peebles oil-gas process, which, as all your readers know, is my favourite nethod of enrichment. It will be a valuable addition to the statistical ide of the question of enrichment; and being so, will be of more than ocal interest.

The accounts of the Paisley Gas Corporation for the past financial ear were submitted at a meeting of the Town Council on Thursday ight. The gross revenue was £40,815, and the gross expenditure £30,481; leaving a balance of £10,334. From this, there was provided £2342 as interest on mortgages, and £570 as a sinking fund, leaving a urplus of £7421. This is still a progressive record; the net surplus ast year having been £4487. The particulars as to output I am nable to give, as they have not yet come to hand; but inasmuch as he price of gas was last year retained at 2s. 8d. per 1000 cubic feet, it s evident that there must have been a very substantial increase. This year, on the recommendation of the Gas Committee, the price has been reduced to 2s. 6d. per 1000 cubic feet. Ex-Bailie Macfarlane, who moved the approval of the accounts, said he would have liked to have made the price 2s. 4d., by which he would have expected to find, at the end of the year, a surplus of £5000; but to keep the Council united, he would move that it should be 2s. 6d. This remark requires explanation; and it is found in the practice of the Corporation in annexing gas surpluses for town improvements. That came out in the remarks of the seconder of the motion, who said that the balances in the Gas Trust had been very useful to the other trusts which had balances on the wrong side. Quite a discussion arose upon this point. One speaker objected to the fixing of the price of gas at a high figure, so as to produce a large surplus for other purposes, as it was "purely indirect taxation;" and he moved that the price of gas should be 2s. 4d. per 1000 cubic feet. Another speaker thought that the other trusts required help; and that it would have been more prudent to have continued the price of gas at 2s. 8d., and so have been able to reduce the debt on the other trusts. Another thought that, as they had no contingent fund, and did not write off anything for depreciation, they should have the price at 2s. 6d., so as to create a contingent fund and have something to help them with future alterations at the works. Provost Mackenzie pointed out that last year they lost £2000 by the miners' strike; and as they did not know what might happen in the current year, he thought they should be content with the reduction to 2s. 6d. In the midst of all this jargon about the appropriation—always a questionable proceeding, or at all events an objectionable one—the view cropped up oftener than once that, taking the quality into account, gas is cheaper in Paisley than anywhere else in Scotland. These, and such like expressions, are common at the meetings of local boards; and I find it difficult at times to hold the scales evenly as between different places. That being so, I give the statement, and only make the remark that my opinion was that the cheapest gas in Scotland was at Hamilton, where the price, for 25-candle gas, is 2s. 1d. per 1000 cubic feet. But whether cheapest or not, Mr. Hislop, the Manager at Paisley, has every reason to be proud of the results he obtains; and the community of Paisley are to be congratulated on the successful working of their gas undertaking. Perhaps I should say—because it is some evidence of enlightenment entering the minds of the Councillors on the subject of the appropriation of the gas surplus—that the policy of uniting the Council was not altogether successful, as the price of 2s. 6d. was only agreed to upon a vote, in which it was carried by seven to four.

It was reported to the Greenock Gas Trust on Tuesday that the revenue for the past financial year was £39,615, and the expenditure £37,456; leaving a net surplus of £2158. The revenue from gas amounted to £33,941, as against £32,690 in the preceding year; while the cost of coal and oil for carbonizing was £13,803—an increase of only £246. The output of gas was 3½ million cubic feet more than in the year preceding. Bailie M'Innes, in submitting the accounts, said that, in view of the advance in the price of oil, he thought it would be wise and prudent for them to watch narrowly the development of circumstances in regard to the price of oil and coal, during, say, the next six months, because, with both systems independent and interchangeable, they occupied a strong position, and were free to choose between the two, or the abandonment of the oil process for a time, if the price of coal should prove temptingly low. They had not yet obtained the full figures; but they inclined to the opinion that the percentage of unaccounted-for gas would be lower, and that the combined coal and oil gas which they supplied during the past six months was more permanent in its character, and better both as regarded illuminating power and volume. Residuals produced at the works realized about £500 less, on account of the fall in the price of sulphate of ammonia, which is now about £4 per ton lower than it was a year ago. He suggested that, as they had estimated to have a revenue surplus of £1500, they should place the amount above that to a contingent fund. The latter proposal was not adopted; Provost Shankland pointing out that the Police Board were responsible for the upkeep of the gas-works, and their Act distinctly stated that the Board "shall apply any surplus to the credit of the Board General Purposes Account." Greenock is another town where the gas profits are appropriated by the Corporation. All the members present agreed in congratulating Bailie M'Innes and his Committee on the satisfactory position of the Trust. The Manager (Mr. S. Stewart) and his staff were also very deservedly complimented on their work.

The report by Mr. Robert S. Carlow, the Manager of the Arbroath Corporation Gas-Works, to the Corporation, on the working of the undertaking during the past financial year, stated that the quantity of coal used was 5044 tons, as against 4629 tons in 1893-94; being an increase of 415 tons, or 8·96 per cent. The make of gas was 49,791,600 cubic feet, against 46,306,100 cubic feet the previous year—an increase of 3,485,500 cubic feet, or 7·53 per cent. The make of gas per ton of coal was 9872 cubic feet, which was a decrease of 132 cubic feet per ton, or 1·32 per cent.; and the gas sold was 8956 cubic feet—a decrease of 169 cubic feet, or 1·85 per cent. The unaccounted-for gas for the year 1893-94 was 8·792 per cent. of the quantity made; and last year it was 9·285 per cent.—an increase of 0·493 per cent. The illuminating power of the gas supplied to consumers during the year averaged 25·57 candles. The number of consumers for the year ending May, 1894, was 4965; while for the past year, it was 4949—a decrease of 16. The financial statement showed that the expenditure for the past year, including annuities and interest on loans, was £10,263 14s. 9d., and the revenue £10,265 17s. 1d.; leaving a balance of £2 2s. 4d. as surplus revenue or profit. The estimates for next year show a balance of £4 8s. 8d. The Finance Committee recommended that meter-rents be abolished, and that the price of gas be continued at 4s. 2d. per 1000 cubic feet. It was proposed that, instead of abolishing meter-rents, the price of gas should be reduced to 4s. 0½d. per 1000 cubic feet; but this was lost by five votes to eight. The accounts were approved. Mr. Carlow has reason to be satisfied with the outcome of the past year's working.

Mr. T. Douglas Hall, the Manager of the Montrose Gas-Works, reported to the shareholders at their annual meeting on Wednesday that there had been an increase in the quantity of coal carbonized, and that 27,329,500 cubic feet of gas had been manufactured—an increase of 855,300 cubic feet compared with the previous year. The quantity of coal carbonized was 2581 tons—an increase of 96 tons upon the preceding year. The average quantity of gas made per ton of coal was 10,620 cubic feet, which was 100 cubic feet less per ton than in the previous year; but the average illuminating power was 25·62 candles, or 0·62 candle higher. Gas unaccounted for amounted to 11·82 per cent., or 1·75 per cent. more than in the previous year. These results, the Chairman explained, were due to the severe weather of the past winter. It is noticeable that other places are similarly affected in the matters of output per ton and unaccounted-for gas. The balance-sheet showed that the income for the year had been £5986, which was a slight increase over last year, and the expenditure £4490; leaving a surplus of £1475. The Directors recommended that out of this surplus a dividend of 52s. 6d. per share be paid, carrying forward about £160. The reports and accounts were approved; and a vote of thanks was accorded to Mr. Hall for his efficient services during the year.

The Stow Gaslight Company have paid a dividend at the rate of 5 per cent. for the past year.

It was reported to the Forfar Gas Corporation, on Monday, that there had been an increase in the output of gas during the past month, compared with the corresponding month last year, of 74,200 cubic feet. The accounts for the year are not yet submitted; but it was stated that it was expected next year the Corporation would be able to sell gas at 3s. 9d. per 1000 cubic feet. Even thus early the good effects of the management of Mr. Waddell, who has not yet been a year in office, are being felt.

Sulphate of ammonia is now selling as low as £9 8s. 9d. per ton for spot delivery.

Cleveland Water Company.—After providing for preferential charges, the Cleveland Water Company have a balance of £3064 on the past half-year's working, which enables the Directors to recommend a dividend at the rate of 7 per cent. per annum on the original and "A" shares, and £4 18s. per cent. on the "B" shares. These, with the addition of £150 to the contingent fund, will absorb £2530, and leave £534 to be carried forward. The dividend proposed is an increase of 5s. per cent. on the "A" shares and 3s. 6d. per cent. on the "B" shares.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 20.

Sulphate of Ammonia.—During the week, the market has been quiet; and very low prices are reported to have been accepted on the East Coast and in Scotland. But at the close there is more disposition to buy—apparently, in great measure, to cover forward speculative contracts, which no doubt leave a nice margin of profit to sellers. Holders of stocks not having come out as sellers, and, consequently, only the actual production being available to fill current requirements, it would seem that the hands of operators are being rather forced, and that they are being obliged to cover their July contracts earlier than they intended. Forward quotations continue to be made by speculators at a moderate premium on prompt prices. The closing spot value at the ports is £9 10s. to £9 12s. 6d. per ton f.o.b.

Nitrate of Soda is unchanged; the spot value of fine quality being 8s. 3d. per cwt.

LONDON, *July* 20.

Tar Products.—The only redeeming feature in this extremely sluggish market is that pitch is inquired for, and that, notwithstanding the hot "summery" weather, considerable shipments are being made. Benzol and solvent show no signs of improvement, although there is an enormous decrease in the production, as is usual at this time of the year. The low price of aniline is undoubtedly extending its use; and it must be in this direction that any relief to benzol can come. Anthracene in second hands is not quite so strong; but the great bulk of the production is in the control of the Products Committee, who are firm in their ideas of value, and apparently sufficiently strong to maintain them. Tar contracts continue to be let at prices which in some cases must leave the distillers a loss; and should anything happen to the high value of pitch, as it may at any moment, the loss on tar distilling at prices being paid will be very serious indeed. Tar distillers, however, are differentiating more than before between the intrinsic values of tar. A wide variation exists in qualities, arising from the various modes of carbonizing at the gas-works. Indeed, some tars are hardly worth distilling at any price—they are so full of carbonaceous matter. Transactions during the week have been noted at the following rates: Tar, 18s. to 21s. Pitch, 35s. to 37s. 6d. Benzols, 90's, 11½d.; 50's, 11d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d.; salts, 18s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 5½d. Anthracene, nominal, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia continues dull and lifeless. It is said that considerable stocks are held in London, and that this is the cause of the low values obtaining. Of course, it must not be forgotten that there is an ever-increasing quantity of sulphate coming from coke-ovens. But it should also be remembered that the production of sulphate of ammonia is a small thing compared with the output of nitrate of soda; and, after all, the nitrogen value must regulate the price of sulphate. Business has been done during the week at prices ranging from £9 7s. 6d. to £9 12s. 6d., less 3½ per cent. discount. Gas liquor is offered at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The political contests in the various mining and manufacturing districts of Lancashire during the past week have necessarily considerably interfered with operations; and the position of the coal trade generally remains practically unchanged. There is nothing further to note with regard to gas-coal contracts; whilst in other descriptions of round coal, business remains extremely depressed. Three days per week represents the full average that pits are working; and supplies even with this restricted output are in excess of requirements. Nominally, the better qualities of round coal, except in special cases, have been held at late rates; but the commoner descriptions continue to tend steadily downwards, owing to the keen competition from outside districts. At the pit mouth, quotations may be given at about 10s. up to 10s. 6d. per ton for best Wigan Arley; 8s. 6d. to 9s., for Pemberton four-feet and seconds Arley; 7s. 6d. to 8s., for common house coal; 7s., for partially screened Arley gas coal; 6s. 6d., for Wigan four-feet screened gas coal; and about 6s., for steam and forge coals, with, however, as low as 5s. 6d. being taken for shipment. The colliery proprietors have no difficulty in moving away their small output of engine fuel; but the considerable stocks of slack still held at many of the collieries keep down prices. At the pit mouth, common qualities of slack do not average more than 3s. 6d. per ton, with the better qualities quoted at 4s. 6d. to 5s.

Northern Coal Trade.—The coal trade is steadier generally; and there is a stronger demand for gas coals especially. Best Northumbrian steam coals are firm at from 8s. 9d. to 9s. per ton f.o.b.; while second-class qualities are scarcely so steady, and vary from 8s. to 8s. 6d. per ton. Steam smalls are steady at 3s. 3d. to 3s. 9d. per ton, according to quality and position of colliery. Manufacturing coals are rather dull, but the consumption at some of the shipbuilding yards is increasing, though the range of prices shows no important alteration. Gas coals are in a little better demand; but there is no full working generally at the collieries yet. One or two pits which ship a large part of their output, are well occupied; but most of the gas-coal collieries are working short time, and it is probable that two months will elapse before there is an adequate use of the facilities. The price varies from 6s. to 7s. per ton f.o.b.; and recent contracts have been perhaps a little above the minimum rate of a few months ago. Deliveries on the new contracts are slightly larger than they were, and may be expected to rise more rapidly in the course of the next few weeks. There is a larger shipment of smithy coals; but in other classes, the variation is not important. Coke is steady; the local demand being rather larger, though the exports continue limited. The price is still from about 12s. 6d. to 13s. 6d. per ton f.o.b., according to quality. Gas coke is in low production, which is well taken up, at the old prices.

Scotch Coal Trade.—On account of the Glasgow fair holidays, there is no quotation relating to the Scotch coal trade for last week; but it is immaterial, because the business doing was very limited. The shipments are reported as having amounted to 159,970 tons—a decrease as compared with the preceding week of 11,144 tons, but an increase on the corresponding week of last year of 139,580 tons. For the year to date, the total shipments have been 3,616,529 tons—a decrease as compared with the same period of last year of 24,361 tons.

Taunton Gaslight Company.—The general cash account of this Company for the year ending June 30 shows that, including a balance of £4059 brought forward, the receipts amount to £19,344. The expenditure totalled to £13,900. A sum of £1727 has been expended on renewals and repairs; and it is noticed that, among other items, £1438 was paid away in wages and "bonuses," and £4554 for coal. The £13,900 also embraces £2723 for dividends, and £1109 for discounts to private consumers. The balance on this account is £5444. Including this sum, assets are shown to the amount of £8732. Deducting liabilities, there remains £4748. Adding to this sum, the stocks of fire goods, pipes, tools, &c., the furniture, and a balance of £3558 due from capital, account, makes the total assets £9518. The quantity of gas sent out during the twelvemonth was 64,114,800 cubic feet. The dividends recommended are 8 per cent. on the consolidated "A" stock, and 7 per cent. on the 1872 issue shares; and a further dividend of 1 per cent. on the "A" stock for the year 1890, when 7 per cent. only was declared. The Directors have reduced the price of gas 3d. per 1000 cubic feet, dating from June 15 last.

Thirlmere Water for Halton.—The Lunesdale Board of Guardians have had frequent discussions upon the question of a supply of water for Halton; and they have been wavering between two schemes. By one it was proposed to provide a supply from Caton, and by the other to take a supply from the Thirlmere pipe-line of the Manchester Corporation. By nine votes to eight, it was decided on the 8th inst. to adopt the latter scheme. Mr. Lee Booker, who had been to Manchester and Kendal in order to clear up certain facts as to the Thirlmere supply, said it was a matter of indifference to Manchester whether or not they furnished water to other places. They were, however, willing to supply water on the terms specified in the Act; the price to be calculated upon the expenditure incurred and the quantity of water conveyed. The amount of capital outlay had not yet been ascertained, as the work was not completed; but the cost of laying both lines of pipes had been estimated at £3,500,000. It was calculated that, when the first line of pipes was finished, the price that would be charged would be 10·1d. per 1000 gallons; but at the expiration of five years, when the second line of pipes would be completed, the price would drop to 5·83d. Mr. Booker gave a lengthy statistical statement, on the basis of the information supplied him at Manchester, showing that while the cost of the Caton scheme would be £4850, that of Thirlmere would only be £4341, so that the latter was not only unlimited in amount, but was actually cheaper.

The Barnsley Water Bill and Lead-Poisoning.—The Law and Parliamentary Committee of the West Riding County Council, in a report submitted last Wednesday week, dealt at considerable length with the Barnsley Corporation Water Bill. The County Council petitioned against the Bill with a view to its amendment on several points, one of which was to obtain safeguards in the Bill, obliging the Corporation to deal with the water so as to prevent lead-poisoning. The *locus standi* of the County Council was disallowed by the Lords' Committee; but the following clause was prepared and forms part of the Bill: "All water supplied by the Corporation shall be properly and thoroughly filtered, so as to remove its deleterious action on lead." This clause, the Committee remark, is a great gain as an innovation, and satisfies the main part of the principle contended for by the County Council—*i.e.*, the treatment of the water in such a way as to deprive it of its injurious action on lead. "To this extent," the report continues, "the opposition has its justification. But the mere creation of a new duty not enforceable in some summary manner may lead to the neglect which frequently arises where it is everyone's right to take action. The clause should be amended by requiring that the process of rendering the water proof against lead should be continuously applied to the satisfaction of a supervising authority—*e.g.*, the Local Government Board—who should have the right to sue for a penalty in case the treatment is inefficient." The Committee are of opinion that the opposition to the Bill should be persisted in for the continuous discharge of compensation water and in relation to lead-poisoning.

Salisbury Corporation Water Supply.—The Borough Surveyor of Salisbury has suggested to the Corporation Water Committee that, the additional engine, boiler, and pumps being completed, and the yield of water increased by the deep boring which has been made in the new well, the time has arrived when a constant supply of water should be given to the town. Recently the old machinery has been at work 22½ hours per day, supplying 720,000 gallons, or 45 gallons per head for all purposes to a population of 16,000; and this supply was not so satisfactory as it should have been—part of the district not being included, and the pressure in portions of the city being insufficient. The new engine, &c., will be able to supply the same quantity of water in 10½ hours. The waste of water in the borough is very heavy; and special observations and reports on the subject have been made by the Surveyor, with the result that the Committee have ordered a systematic house-to-house inspection. The reports were presented to the City Council, at their last meeting, by Mr. Haskins, who drew attention to the fact that the powerful engines they now had were capable of raising within 24 hours close upon a million gallons of water, equal to 68½ gallons per head of the population. With reference to the waste of water, he said the service-pipes in the city had been laid down thirty or forty years; the oldest of them being black iron pipes, which were really meant to last only about ten or twelve years. These pipes were now full of holes; and they leaked when the old engine was worked and the pressure was not great, while, directly they attempted greater pressure with the new machinery, the waste was increased to an enormous extent. The Committee recommended a house-to-house inspection, beginning with Winchester Street, where the consumption per head was 85½ gallons, whereas the average for the town was 64½ gallons. The reports were adopted.

Exhibition of Gas Appliances.—Messrs. W. Parkinson and Co. held a gas exhibition from Monday to Wednesday last week in the Crown Hall, South Petherton; Miss Edith Sanderson giving practical demonstrations on cookery twice daily.

Electric v. Incandescent Gas Lighting for the Victoria Embankment.—In our "Electric Lighting Notes" to-day, reference is made to the scheme submitted by the Highways Committee of the London County Council for lighting Victoria Embankment and Waterloo and Westminster Bridges by electricity. The consideration of the scheme has been adjourned; and it seems as though some opposition would be offered to it. Mr. Thornton has given notice of an amendment to the effect that the Committee be instructed to obtain reports from the Engineer and the Chemist upon the question whether the present lighting could be improved by the substitution of incandescent burners for those in use. Mr. E. White has also expressed his intention of moving that the Committee's recommendation be referred back to them, with instructions to ascertain and report what is the cost of the present lighting, and what would be the cost of incandescent gas lighting and of electricity supplied by a company.

Downton Public Lighting.—At a public meeting of the electors of the portion of the parish of Downton, coincident in area with the ecclesiastical parish of St. Lawrence, recently held to consider the advisability of adopting for any part of that area the provisions of the Lighting and Watching Act, a statement was made by the Secretary of the Lighting Committee (Mr. Dunmore) to the effect that there had been 33 lamps in use, two of which were private property, and that the annual cost of lighting had averaged £28. There was, he said, a deficiency of £3 17s. 6d.; and the Committee, thinking the work should properly come under the Parish Council, had decided to discontinue their functions. It was agreed to adopt the Act for lighting purposes; the area to be the ecclesiastical parish of St. Lawrence. It was also decided that the amount to be expended should not exceed £35 for the first year; and the Parish Council will take over the Committee's plant for the sum now representing the deficiency in their account.

The Tradeston Gasholder Tank Dispute.—It may be remembered that a short time ago a dispute arose between the Contractors for the large gasholder tank at the Tradeston Gas-Works (Messrs. J. Paterson and Son, Limited) and the Glasgow Gas Commissioners as to their right to payment for the cartage and stacking of earth removed in the course of the work. The contract price for excavating the tank was 1s. 1d. per cubic yard; but the Contractors claimed 4s. 4d. per cubic yard for all the material they had to deposit temporarily elsewhere, and then bring back to the tank to be used in filling and embanking, owing to there being insufficient space upon the ground. The dispute was submitted to the arbitrament of Mr. W. Robertson Copland, of Glasgow, who decided that the contract does not imply a warranty on the part of the Commissioners to provide sufficient area for laying aside the material to be excavated, until it might be again required for use. The Contractors alleged that the extra cost for ground would amount to £1500 or £2000; but this part of the case did not receive serious consideration from the Arbiter.

The Expenses of the Litigation between the Alliance Gas Company and the Dublin Corporation.—At the meeting of the Dublin Corporation on Monday last week, Mr. Beardwood moved—"That the Law Agent be instructed to furnish to the Council, by the first meeting in September, a statement showing the expenses incurred by the Corporation in law proceedings with the Gas Company, from May 7, 1888, to the present time, both in actions brought by the Company against the Corporation, and by the Corporation against the Company, as well as the costs of the arbitration in connection with the lamps and gas plant." He said his reason for making the motion was that he thought the time had come when the Corporation should arrive at some means of dealing with the Gas Company. They had been engaged in continuous litigation with the Company, and had been always beaten. The Lord Mayor remarked that the Corporation, on the contrary, had succeeded, except in one case, where there was still a question of appealing. Alderman Pile seconded the motion. The Lord Mayor said there would probably be no objection to the information asked for being given; and the public would find that the expenses had not been at all as great as was believed by some people. Sir R. Sexton thought the request of Mr. Beardwood was perfectly reasonable. It was eventually agreed that the information desired should be obtained from the City Accountant; and that the Gas Committee should report to the Council on the matter.

New Workshops for the Liverpool Corporation Water Committee.—The Liverpool Corporation have erected for the Water Department new central workshops and stores in Pall Mall, to take the place of the three establishments which have been used for those purposes, and which are historically of some interest. The Liverpool and Harrington Water Company, which was incorporated at the beginning of the present century, sank several wells in the city, from which they pumped water for the use of the inhabitants. One of these wells was situated in Hotham Street; and adjoining the engine-house, offices and workshops were erected. The Chief Water Engineer continued to occupy these offices until the construction of the Municipal Buildings; and since then, as before, the workshops have remained in use. In addition, the Corporation possess in Bevington Bush and William Henry Street, Soho, two more of the pumping-stations built by the old Company, both of which have, in recent years, been utilized as workshops and for storage purposes. The accommodation at these three places has been found to be totally inadequate, and altogether unsuited to modern requirements. They have therefore been closed; and the stores and workshops all brought to one common centre in Pall Mall. On the upper floor of the new building, there has been provided a standard sample room, wherein standard samples will be deposited of all articles which, under Corporation contracts, are required to be in accordance with an approved sample. To the right of the main entrance is the office for testing water-fittings. The total number of fittings tested annually is about 80,000. Immediately above the fittings testing shop is a standard sample room, in which the public may inspect approved samples of fittings, which have been adopted by the Corporation. A workman's dining-room and hot-water heating system have also been provided.

The Public Lighting of Tunstall.—At last Wednesday's meeting of the Tunstall District Council, it was resolved to renew the contract with the British Gaslight Company for the public lighting, on the same terms as before, for one year.

Oil Gas Enrichment Company, Limited.—The second annual general meeting of this Company is to be held next Monday in Edinburgh. In the report to be presented, it is stated that the balance at the credit of the profit and loss account for the twelve months ending June 30 last is £275, from which £250 has to be deducted to meet the fixed dividend of 5 per cent. on the preference shares—leaving a balance of £25. During the year, expenses to the amount of £547 were incurred in connection with the development of the Peebles process and patents; and the Directors have deemed it advisable to write off the whole of the sum against this year's profits, instead of spreading it over a series of years. They state that the process continues to give satisfactory results; and they record with pleasure that enrichment by oil gas stood most satisfactorily the test it had to undergo in the past severe winter.

The Coal Contracts of the Leeds Corporation.—Some 160 tenders have been sent in for the supply of coal to the Leeds Corporation Gas-Works for the ensuing twelve months. The tenders for ordinary coal averaged from 9d. to 1s. a ton less than was paid last year; and the Committee have decided to buy about 270,000 tons. Cannel coal proportionately was quoted even lower; and of this class the Committee let contracts for the supply of about 30,000 tons. At present the stock of coal at the different gas-works amounts, in round figures, to 20,000 tons; and there is yet upwards of 30,000 tons to be delivered on the old contracts. The annual consumption at the gas-works is about 270,000 tons. Therefore the Committee, when the new quantities have been supplied, will have about 80,000 tons more than will be required. It is the exceptionally low prices quoted that have induced the Committee to stock a supply. It is intimated that, owing to the improvements at present going on at the different works, a reduction in the price of gas to the consumers cannot be expected, at any rate within the next six months.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 175.)

Issue.	Share	When ex-Dividend.	Dividend on Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22 23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15—16	..	4 13 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	+¼	4 6 8
40,000	5	,,	6½	Do. New	4	5—5¼	..	4 14 7
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	255—260	+5	4 8 6
180,000	,,	,,	8½	Do. New	100	205—210	+5	4 0 11
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220—225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	122—125	..	4 0 0
320,000	20	28 Mar.	11¼	British	20	53—55	+½	4 1 10
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7½—8	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	99—102	..	5 17 8
150,000	20	11 July	8½	Cagliari, Limited	20	28—30*	+2½	5 10 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	299—304	+7	4 8 9
165,000	,,	,,	10½	Do. New o.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	260—270	+7½	4 16 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	31 Jan.	11	European, Limited	10	25—26	+½	4 4 7
354,060	10	,,	11	Do. Partly pa d	7½	17—18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	285—290	+3	4 2 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190—195	..	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	130—133	..	3 0 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	198—202	..	2 19 4
3,800,000	Stck.	10 May	12	Imperial Continental	100	250—254	+2	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	+¼	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	16—17	..	5 17 8
150,000	5	24 May	8	Oriental, Limited	5	7—7½	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾—5¼	..	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	9½—10½	+½	6 13 4
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	302—307	..	3 18 2
290,000	,,	,,	13	Do. C do.	100	307—312	..	4 3 4
775,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172—176*	..	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	233—238	−2	3 7 3
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	155—160	..	2 16 3
700,000	50	26 June	7	Grand Junction	50	113—117	..	2 19 10
708,000	Stck.	14 Feb.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—264	+1½	2 16 9
406,200	100	,,	7½	Do. 7½ p. c. max.	100	209—213	+1	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—15	..	2 13 4
500,000	100	14 Feb.	12½	New River, New Shares	100	85—95	+10	4 0
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max	100	157—163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	+5	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	288—293	..	3 8 5

*Ex div.

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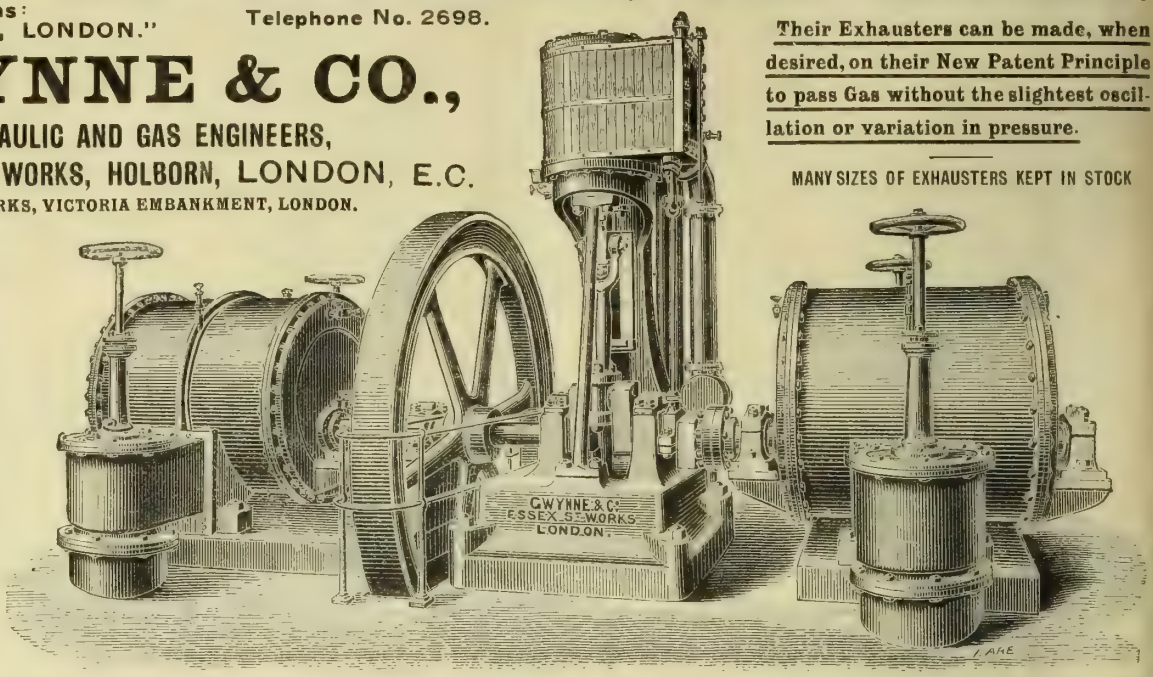

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EDITORIAL NOTES.

The Report and Accounts of The Gaslight and Coke Company.

THE report of the Directors and the statement of accounts relating to the working of The Gaslight and Coke Company for the past half year are in the shareholders' hands; and the general meeting will be held next Friday. The accounts show that, after providing for all fixed charges, there remains a profit balance of £616,771, out of which, as already announced, the Directors recommend payment of a dividend after the statutory rate of 12¾ per cent. per annum—carrying forward the sum of £256,800. At this time last year, there was a net profit of £516,643; and the dividend was at the rate of 12 per cent. per annum—carrying forward the sum of £239,972. It was then explained that this satisfactory result was due to the favourable character of the coal contracts, and also to an advance in residuals. But no explanation is now offered of the still more gratifying results displayed in the present accounts. The second paragraph of the report conveys the very satisfactory and reassuring information that the gas consumption for the half year shows the exceptionally high rate of 6⅔ per cent. increase over that for the June half of 1894. The Directors ascribe this result mainly to "the severely "cold weather experienced in the months of January and "February last." At the same time, a considerable increase in the number of consumers supplied on the automatic meter system is recorded. The Directors report that they have completed their year's coal purchases at prices materially below those of last year; and the only other matter mentioned by them is the result of the inquiry of the Standards of Light Committee.

Turning to the accounts, the capital account shows a net expenditure for the half year of £83,115. In this total, new and additional meters stand for £34,854; and stoves, for £24,736. Twelve months ago new meters only accounted for £619; and stoves, for £3100. There has thus been a marked revival in the Company's trade, upon which everybody concerned is to be warmly congratulated. By the revenue account, it appears that with gas at 2s. 10d. and 2s. 4d. per 1000 cubic feet, as compared with the corresponding period of last year, when the price north of the Thames was 3d. higher, the gas-rental amounted to £1,387,076, which is only £17,155 less. Meter-rents have vanished from the account—representing a sacrifice of about £30,000 for the half year. Coke has improved from £249,408 to £264,391; and tar, from £65,685 to £84,208. But, on the other hand, ammonia has dropped from £98,017 to £66,839. Nor is all the truth respecting the sulphate market revealed in the last figure; for, in the general balance-sheet, the entry for stocks of "tar and "ammoniacal liquor and products" stands at the portentous figure of £204,314. This means something, as everybody in the trade is very well aware. But what it will eventually turn out to mean remains a secret of the future. Coke has also accumulated, which must be taken as a set-off against cheaper coals. Altogether, the Company's half-year's revenue amounted to £1,822,250. On the other side of the account, coals cost £624,366, as against £541,772. Wages have further risen to £168,502. Purification has cost more. And so the total expenses of gas making have risen from £899,176 to £980,136. In distribution charges, the most noticeable increases are for repairs and maintenance, and stoves. Rates and taxes have once again mounted up, and now cost £100,456. In all, the expenditure on revenue account has risen from £1,163,029 to £1,273,362; and the profit balance has fallen from £703,252 to £548,887. But after meeting all charges and the increase of dividend from £338,795 to £359,970, the balance to be carried forward will still be an improvement on that dealt with twelve months ago.

By the manufacturing statements it is shown that 970,015 tons of common coal and 7360 tons of cannel, besides oil and spirit representing 44,715 tons of cannel, were carbonized during the half year, as against 923,469 tons of coal, 7934 tons of cannel, and the oil and spirit equivalents of 37,611 tons of cannel for the corresponding period of last year. These figures show that the use of fluid enrichers is still on the increase in the case of this Company. Indeed, the statement is made in connection with the gas manufacturing account that, of the total output, 738,950,000 cubic feet were "oil gas"—meaning carburetted water gas. With most undertakings, this

would amount to a very respectable "production." It is very nearly as much gas as Bolton requires for all purposes; but in the case of this gigantic concern it is only "enrichment." After what we have remarked on previous occasions respecting the carbonizing expenses of the Company, it is only fair to state that the increase of 6⅔ per cent. in the gas consumption for the past half year has been met by the slight rise of 2·6 per cent. in the carbonizing wages. A fresh entry in the general balance-sheet, which will probably serve the Governor—Colonel Makins—as a "peg" on which to hang some interesting observations on Friday, is a sum of £46,460 for "automatic meter supplies "(fittings account)." The quantity of unaccounted-for gas, which has risen by the not insignificant figure of 52,941,000 cubic feet, will also require some notice on the same occasion. The addition of 406 public lamps for the half year is a sign of the rapidity with which London grows northward and westward.

The North British Association Meeting.

The members of the North British Association of Gas Managers held their annual meeting at Melrose on Thursday, under the presidency of Mr. Alexander Wilson, the Manager of the Dawsholm station of the Glasgow Corporation Gas Department. Taking all circumstances into consideration, the gathering was well attended; and the quality of the technical portion of the proceedings was very good. It must have been no easy task to provide a respectable list of papers for a meeting following so quickly after the Edinburgh meeting of The Gas Institute, which made a strong prior demand upon the allegiance of Scottish gas managers. The North British President for the year is, however, a capable and devoted member of the profession, and he had reserved himself for the Melrose meeting, with the result that his thoughtful address proved worthy of himself and the occasion. The full text will be found in another column. It belongs to that most useful type of such compositions which, being instinct with the author's personality, and setting forth some of the fruits of individual experience, must possess a degree of interest and value commensurate with the power and the attainments of the author. Mr. Wilson began with subjects that naturally came uppermost in his mind—the extraordinary severity of the winter and the effects of the last local colliers' strike. It cannot be a gratifying reflection for the Scotch coal interest that, in consequence of the latter incident, the Glasgow carbonizers made practical acquaintance with the gas-making qualities of 27,000 tons of North of England coal. But the circumstance is not without interest, as it enabled those concerned to enlarge their experience in a direction to which in the ordinary way they would be strangers. Mr. Wilson next proceeded to discuss the discrepancy that usually manifests itself, sometimes with troublesome consequences to innocent parties, between laboratory and works' tests of gas coals. This is an old sore; but it is constantly breaking out in some fresh place. It is generally agreed among gas managers, however, that both laboratory and works' tests are only comparable between themselves, and have but a very elastic connection one with the other. It is a sweeping, but at the same a fairly reliable generalization, that the smaller the retort, the better the coal will show itself off; but since, for good and sufficient reasons, the gas manager cannot carbonize his coal in six-inch tubes, and charge these with selected spoonfuls of the raw material, he must be content to do the best he can with his rougher and larger manufacturing plant. Mr. Wilson's remarks upon the application of machinery to gas making are very much to the point; and he took advantage of his opportunity to present a detailed description of the Dawsholm system of working, which gives this portion of his address the value of a technical paper. The same may be said of his statements on the subject of carburetted water gas, which is used in Glasgow for the purpose of enrichment according to a particular, and so far peculiar, system. It is made here of a much higher illuminating power—28½ to 47 candles—than is thought necessary in other places in the United Kingdom where the same kind of plant is employed; and the question as to which is the most advantageous method of working remains an open one. On the face of the particulars communicated by Mr. Wilson, 40-candle power gas appears to give the best result. But there is nothing said by the President as to the possibility of continuous working up to this high standard; and unless the large proportional quantity of oil required by it can be efficiently dealt with over long periods of time, much waste may occur. The principal paper of the meeting was Mr. William Young's important memoir on the relations between the chemical composition and the illuminating value of lighting gases. This was followed by three papers contributed by Mr. J. N. Myers, Mr. D. Vass, and Mr. A. Waddell respectively; and as all these were more or less discussed, it cannot be said that those who attended the Melrose meeting found themselves without employment congenial to the technical student.

No Complaint against the London Gas Supply.

At the last meeting of the London County Council, the Chairman—Sir Arthur Arnold—delivered his annual address upon the work of the Council; and he had no difficulty in making out a very striking case for this, the largest, and for many reasons most interesting, body of the kind in the kingdom. The Chairman has been twitted in some newspapers with having essayed to put the Council, for the purpose of comparison of efficiency, alongside Parliament, instead of other municipal organizations; and in this respect, no doubt, he fell into the besetting weakness of the party which elected him to office. The Progressives of the London County Council have always tried to pose as legislators rather than as mere administrators; and, at any rate during the last Parliament, they affected to be able to influence the Government instead of being controlled by it. This mood may perhaps pass. Meanwhile, Sir Arthur Arnold devoted a portion of his address to the argument that the Council does its work so very well as to deserve to be entrusted with still greater responsibilities. He claimed to have had "in earlier years a close official connection "with some of the largest of the local authorities in the "North of England," when he "marked the benefits "resulting from their control of the water supply, of "artificial lighting, and other matters." Consequently, he has felt surprised when it has been suggested that "such undertakings by this Council would involve too "great a strain upon our energies." Curiously enough, this was the only reference, direct or indirect, in the whole course of the Chairman's address, to the lighting of London; and the omission of any complaint of the manner in which this service is performed, and of all suggestion for its improvement, may not unreasonably be taken as an acknowledgment that, on the whole, matters are fairly satisfactory in this regard. Thus, for the Metropolitan gas interest, this address is more significant for what it omits than for anything it includes. If there had been any political value in the small gas agitation engineered by Mr. J. Rowlands—now, unfortunately for himself, debarred by a cruel Fate from prosecuting this "cause" from the vantage-ground of a seat in the House of Commons—Sir Arthur Arnold would hardly have let the subject pass unmentioned. The London Gas Companies certainly have no reason to be sorry that their history for the past year, so far as it has come within the official purview of the Chairman of the County Council, is a blank.

An Action against a Trade Union Official.

If the leaders of Trade Union opinion wish to make their organizations stand well with the country, and receive recognition as substantial powers in the industrial community, they will counsel the National Association of Operative Plasterers to submit to the result, whatever it may be, of an action decided in the first instance in the Queen's Bench Division last Friday. This was a case in which a firm of fibrous plaster manufacturers proceeded against the Organizing Secretary of the Trade Union named, for damages for libel, and an injunction to restrain the continued publication of similar libels. It appears that the Trade Union had a quarrel, for the usual reasons, with the plaintiffs; and, also as usual, the defendant tried to interfere with them in their business relations with builders and others. As the Trade Union could not be sued, there was nothing for it but to sue the executive official in his personal capacity. But in the pleadings the defendant stated that the matter complained of was written in the performance of his duty as Secretary of the society. So far as it was possible to do it, therefore, the society were made party to the suit by their own representative. In the event, the jury awarded the plaintiffs £300 damages in respect of the claim for loss of trade, and £500 for the libels. Notice of appeal was at once given; and so the last has not been heard of the matter. Irrespective of the

right or wrong of the verdict, however, it is clear that Trade Unionism has a great opportunity here either for taking the worthy part, or for proclaiming itself mean, shuffling, and cowardly when brought to book. If the Plasterers' Secretary acted for and on behalf of the society, then the society ought to back him up. If this is done, then employers will know what they have to deal with in the event of future trade troubles. If the society leave the Secretary in the lurch, it will be equally apparent that Trade Union officials transgressing the law at the bidding of organizations which cannot be got at, must be made to feel that such conduct is not without its own risks and inconveniences.

An Evil to be Checked.

The circumstance of matters connected with the General Election being just now in everybody's mind, furnishes an opportunity for the mention of something that has been within our knowledge for some time past, but which we have refrained from publishing too soon in order to spare innocent persons. During the present year, we were required to advertise as vacant an appointment in the bestowal of a municipal authority; and there were many applications for the post. In due course, the names and addresses of the candidates comprised in the "short "list" were published in the local newspapers; and thereupon the energetic Secretary of a local political association —which, is immaterial—put himself in communication with the Secretary of the corresponding society in the town where each candidate lived, with the object of ascertaining his "political principles." Now, this is the sort of thing which, unless exposed and put a stop to by force of public opinion, will in time reduce our municipal institutions to the standard of those corporations in the United States where "Tammany" has ruled the roast. We have been repeatedly assured by gas managers in municipal employment that they have sometimes experienced the greatest difficulty, in times of political excitement, in keeping free from party entanglements that have been put in their way by townspeople who should have known better. But once let political considerations operate in connection with the selection of corporation gas managers, and it is easy to predict the result. No town councillor in Great Britain would dare, when a candidate for a municipal appointment came before him in committee, to inquire into the candidate's political views; but if the busybodies who undertake the management of political clubs are encouraged in doing this in an underhand way, the mischief will, in the long run, be as serious as if the Mayor himself undertook the inquiry. We are great admirers of our British municipalities in general, and consequently do not wish to see any of them going the way of New York, where a long period of "Tammany" misrule has just been terminated by sheer despotism. By an Act of the State Legislature, from Feb. 13 to June 30 the Mayor of New York was an autocrat, with power of official life and death. There seemed to be no other way out of the slough of corruption into which the city government had sunk; so, having convinced themselves that their Mayor was an honest man, the people of New York gave him power to clear all the municipal departments of their unworthy heads and subordinates. And he did it—removing 3000 out of 16,000 municipal employees, including 300 of high rank. It was a massacre, not of innocents—necessary, perhaps, but none the less painful to contemplate. Let us hope that nothing of the kind will ever be needed here. But if this wish should unhappily be disappointed, the next best hope will be that the work will be done as thoroughly as seems to have been the case in New York. For the present, the imperative need unquestionably is that the smallest transgression of the "Tammany" order should be denounced and stopped as soon as detected.

Reduction in Price by the South Metropolitan Gas Company.—Our readers will see, by the report in another column of the proceedings at the Bonus Festival of the South Metropolitan Gas Company last Saturday, that the Company have reduced the price of gas 1d. per 1000 cubic feet.

Mr. H. J. Chaney, known to many of our readers as Superintendent of the Standards Department of the Board of Trade, will attend the Sexennial Conference of the International Committee on Weights and Measures in Paris, on Sept. 6 next, as the representative of Her Majesty's Government.

WATER AND SANITARY AFFAIRS.

At last we have the great plan of a new water supply for London. The Water Committee of the County Council have concluded that "the time has arrived" when the report of the Engineer, Mr. Binnie, on the subject of a supply from a distant source, should no longer be regarded as a confidential document, but should be brought into circulation, at least among the members of the Council. A copy of the report now before us, gives us the complete story; and we learn that, by an expenditure of £38,800,000, it will be possible to bring to London, from the region of South Wales, a supply of water at the rate of 415 million gallons per day, so as to "provide for all contingencies "for a period of 50 or 60 years hence." But it is not considered necessary that the whole of this expenditure should be incurred "in the immediate future." It is proposed that, in the first instance, the daily supply should be 182 million gallons, for which the capital outlay would be £17,500,000, or 200 million gallons per day for £18,095,000. The supply is to come from the head waters of the Usk, Wye, and Towy, in Cardigan, Brecon, Radnor, and Montgomery. Large storage reservoirs are to be formed in the valleys of South Wales, at such an altitude as to enable the water to flow naturally into them; the supply proceeding thence by gravitation through masonry conduits and iron or steel pipes, so as to be delivered on the northern and southern outskirts of London at such an elevation as to ensure at all times a gravitation supply under constant pressure. Two aqueducts or conduits will thus be employed, of the relative lengths of 150 and 170 miles, and therefore considerably exceeding the length of the aqueduct connecting Manchester with Thirlmere—the longest structure of the kind now existing. In pursuance of this scheme, the Engineer has been conducting a survey which, when complete, will cover at least 9000 acres, or 14 square miles, in addition to 350 miles of conduit. When the plans are prepared in such a way as to comply with Standing Orders, it is said that the scheme will be one of the largest ever deposited in Parliament. It is not expected that the Council will be in a position to bring it out earlier than the session of 1897; but the Water Committee say that even that date will not give them too much time to mature the project.

But why all this planning and scheming, and the proposal of this enormous outlay? And what is to become of the Water Companies? Assuredly they will have to be dealt with, and, if they are superseded, their interests must be acquired. A double outlay must necessarily ensue, with a redemption fund at the back. The Water Committee argue that the Lea is being overtaxed, and that the Thames cannot be drawn upon for an enlarged supply, without serious damage to the stream. But what said the Royal Commissioners who reported on this subject in 1893? Their statements stand in direct opposition to those of the County Council. They arrived at the conclusion that from the Thames and the Lea, aided by the chalk wells and by extended works, including proper storage reservoirs, a daily supply of 420 million gallons could be obtained, equal to an allowance of 35 gallons per head to a population of 12 millions, or about three-quarters of a million in excess of the total population of Greater London, together with the outlying parts of the water supply area, as estimated for the year 1931, supposing the ratio of increase in the population to be maintained as in the decennial period 1881 to 1891. As for the Thames being damaged, the Commissioners said that, when 300 million gallons per day were taken, there would still be left an average daily quantity of not less than 1000 million gallons. The Water Committee of the Council now assert that the plan approved by the Royal Commissioners would reduce the flow at Teddington Weir, for several months each summer, to only 200 million gallons per day. The Commissioners expressed a view so entirely different from this as to suggest that regulations could be framed under which the 300 million gallons could be taken in such a way as to render the flow of the river, on occasions of exceptional drought, substantially greater than it is under the existing conditions. It is difficult to suppose that the Water Committee of the County Council have a sounder judgment on this matter than the Royal Commissioners. The former have a particular purpose to serve, and are liable to be biassed by their preconceived plans. The Commissioners, on the contrary, were free

and independent, and were bound to give an impartial recommendation. London has now to choose between the two, with the certainty that the County Council plan will prove out of all proportion more costly than the proposals entertained by the Commissioners.

The Water Committee profess to look upon the recent restriction in the water supply of East London as affording proof that the sources at the command of the Company are insufficient. But the reason lies at the door of the Council, if that body will only use its eyes to look at it. In the time of an exceptional drought, the present appliances prove insufficient; and the Directors of the Company knew that this would be the case. Hence the application to Parliament for power to construct additional works, which power was refused by a factious vote in 1893, although distinct warning was given that such refusal might have deplorable consequences. In the County Council debate on this subject last week, much stress was laid upon a statement alleged to have been made by the Company's Engineer before the Royal Commissioners, that the Company had ample means at their command for the supply of their district. Any such evidence, we may rest assured, was based on the assumption that the Company would be allowed to make the best use of their resources, and would not be prevented from extending their works as occasion required. That the Company were right in their application to Parliament is proved by the unfortunate result attendant on the enforced delay. Much has been made of the circumstance that the roads in East London have been freely watered during the recent drought; and it has been contended that the Company have thus sold water at a price *per quantum*, to the detriment of the private consumer, who has been in need of the water sprinkled on the roads. But this laying of the dust has been the act of the local authorities, who thus set at naught the request of the Company that water should be used as economically as possible for road watering and similar purposes. The motive which has instigated the local authorities appears in the case of the Progressive District Board at Poplar, where it was decided the roads should be watered, in order to prevent the contractor from reaping the benefit of a cessation in the work for which he was to be paid a lump sum. The less work he did, the more money he would put in his pocket. Hence the roads were watered, while the District Board passed demonstrative resolutions, in one of which they called on the County Council to press forward "its scheme for another supply of water in the "near future."

Concerning this scheme, we observe that the Water Committee of the Council speak of it as "supplemental." Yet it is proposed, "in the first instance," to bring in a supply equal to that which is already given; and for this purpose a sum is to be spent some two millions in excess of the capital expended by the eight Metropolitan Water Companies on the existing works. The cost of enlarging the supply, on the plan approved by the Commissioners, so as to make it equal to 420 million gallons per day, would undoubtedly raise the total to a sum far short of the £38,800,000 which Mr. Binnie estimates as the outlay for supplying 415 million gallons daily. The market price of the undertakings is another matter, and includes the value imparted by able administration. It is a further consideration that, although the Companies pay dividends, it is altogether out of their province to levy a tax in redemption of capital—a process inevitable with the County Council. London need be on the alert, or the water scheme of the Council will impose a burden which will provoke indignation when it will be too late to provide a remedy. But we perceive reason to apprehend that neither London nor the Legislature will welcome the extravagant scheme which is to be elaborated for the consideration of Parliament in 1897. That Mr. Binnie has displayed much engineering skill in the preparation of his plan we freely acknowledge; but it does not follow that the scheme is either necessary or desirable in the interest of the Metropolis.

The case that collapsed at the Thames Police Court, as reported in the last number of the JOURNAL, should serve to remind the eager litigant that it is desirable to look before he leaps, even where it is sought to mulct a Water Company. A resident in Matlock Street, Stepney, encouraged possibly by the hue-and-cry raised by the daily papers, summoned the East London Water Company for failing to furnish him with a supply of water. It looks as if the complainant had issued the summons first, and sought legal aid afterwards; for it was noticeable that his advocate took the very earliest opportunity of showing that he knew the weak point in his client's case. The complainant had omitted all regard to the condition precedent to any such proceedings. In other words, he had neither paid nor tendered the water-rate. His position, therefore, seemed to suggest the view that he considered himself entitled to require water to be supplied to him on credit, and to punish the Company if they failed to send home the goods. But the Magistrate could hardly be expected to regard the question in the same light. Acts of Parliament are not passed in order that they may be ignored, even where the theories of the water consumer do not square with those of the Legislature, to say nothing of the Water Company whose water he uses, and whose system he abuses. So the case in question promptly collapsed. It is true that an attempt was made to argue that the Company had waived their right to prepayment by appointing collectors to get in the water-rates at their own convenience. But here, too, the Magistrate was against the complainant; and no wonder. It was a bold and ingenious contention that because in practice the Companies save their customers trouble by sending for the money they owe, the right to collect the money in advance is to be treated as abandoned. No simpler or more transparent method of repealing an Act could well be devised. But, the modern agitation against the Water Companies notwithstanding, we have not quite reached that point in the evolution of justice and legality.

The dread of lead-poisoning to which the West Riding County Council have given voice has led to a new departure in the matter of legislation for water supply. In consequence of the action of the Law and Parliamentary Committee of the Council—although *locus standi* was denied to them as opponents of the Bill—the Barnsley Corporation are saddled with a clause requiring all water supplied by the Corporation to be "properly and "thoroughly filtered, so as to remove"—would not "pre-"vent" be a better word?—"its deleterious action on "lead." The Law and Parliamentary Committee are, perhaps naturally, elate with this measure of success, and regard the clause as a great gain in the light of an innovation. But the gain so far only impels them to further action, with the intention of preventing the clause from becoming a dead letter. It is intended, therefore, to carry on the campaign, and procure, if possible, further enactment for the purpose of bringing in some supervising authority. Without this and the power to inflict penalties, the opponents of the Barnsley Bill seem to think they will not be practically better off than they were before.

The Dawsholm Gas-Works.—It is a rather curious coincidence that, concurrently with the holding of the meeting of the North British Association of Gas Managers last week, under the presidency of Mr. A. Wilson, the Manager of the Dawsholm station of the Glasgow Corporation Gas Department, our contemporary *Engineering* contained the first instalment of an illustrated description of these works—the largest of the three gas-producing stations of the Corporation. The article opens with a few historical particulars; and then follows an account of the plant. The general arrangement of the works is shown by a plan; and two full pages are occupied with illustrations of the labour-saving retort-house machinery which, as our readers are aware, is on the Arrol-Foulis system. The effect of its introduction was recounted in the JOURNAL for the 25th ult. (p. 1376). The description of the works comes opportunely at the present juncture, as the meeting of the Institution of Mechanical Engineers opens in Glasgow to-day.

The Gas Interest in the New Parliament, to which reference was made in the JOURNAL last Tuesday, was still further strengthened by the elections which took place in the past week. Sir F. T. Mappin, Bart., the Chairman of the Sheffield Gas Company, will, we are pleased to find, continue to represent the Hallamshire Division of Yorkshire; having obtained 5949 votes, as compared with 5054 polled by his opponent (Mr. S. F. Hatchard). At the previous election, Sir Frederick was returned unopposed. Farther north, the election in South Ayrshire resulted in favour of Sir William Arrol, who is known to the gas fraternity from his association with Mr. W. Foulis in the production of the retort-house machinery bearing their names, but to the world at large from his connection with the Forth and Tower Bridges, and other great engineering works. Sir William, who was unsuccessful at the previous election—his opponent (Mr. E. Wason) securing a majority of 197 votes—goes up with this number increased to 550. In this, as in so many other instances in the present election, preference has been shown for the Unionist candidate.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 252.)

THERE was no improvement effected in the general condition of things on the Stock Exchange last week. Business for the most part was quiet; and prices as a rule drooped. The state of affairs in Eastern Europe is responsible for so much of the downward tendency as proceeded from apprehension of difficulties arising. But, outside political causes, there has been too much "bulling" in the markets lately; and now the reaction has set in. Besides, in view of the holidays ahead, there was a natural desire to close books. The settlement was heavy, but apparently free from difficulties; all the money wanted being forthcoming. Business in Gas securities was about a fair average, considering the season of the year. The prices of undertakings in almost all parts of the world continue to advance; while those of the choicest home Companies have made large strides upward. In Gaslights, the "A" was fairly active, opening at a fair advance, and maintaining the position till the close, with but little variation in the figures at which business was marked. In the debenture, preference, and limited issues, there were very few dealings indeed. South Metropolitans were quiet, and remained uneventful till the closing day, when the "C" jumped up, and changed hands at 313. Commercials were much more active than they have been for some time. Transactions took place in all three issues at top figures; but they did not improve upon them. The Suburbans and Provincials were again conspicuous for making the largest improvements in price, as well as the most numerous. Brentford rose on publication of the accounts, which show good business, an increased dividend, and (better still) the formation of a reserve fund. Brighton has made a large advance, and Alliance and British have made moderate ones; while Bristol has overtopped South Metropolitan "B" as the highest-priced stock in the list. The Continental Companies were strong, though somewhat inactive; and small improvements were effected in several undertakings in more distant parts. The Water Companies showed only moderate business, but at good figures; and a few issues have advanced, while all the rest remain very steady.

The daily operations were: The Gas Market opened strong, at an advance on many of the last prices, and was moderately active. Gaslight "A" and Imperial Continental rose 2 each; British, 1; and San Paulo, ½. Grand Junction Water gained 1. Business was a little more restricted on Tuesday, and prices remained unvaried for Gas stocks; but in Water, New River advanced 5. Things remained at about the same pressure on Wednesday; prices in general being very good, while Gaslight "A" advanced a point. Thursday was a very quiet day; and the only move was an improvement of 5 in Brighton and Hove. Friday was a little busier; and prices were very strong. Bristol advanced 2; and Alliance and Dublin new, ½. Saturday was unusually animated; and many further improvements were effected. South Metropolitan "C" rose 3; Brighton, Bristol, and British, 2 each; and Oriental and Ottoman, ¼ each. East London Water debenture also advanced 2.

ELECTRIC LIGHTING MEMORANDA.

The Lighting of the Victoria Embankment—The Electrical Ventures of St. Pancras—Electrical Advertisements as Parliamentary Notices.

THE scheme of the Highways Committee of the London County Council for the partial lighting of the Thames Embankment by electricity, mentioned in this column last week, has again been considered by the Council, and has once more been referred back. Many members of the Council do not like the scheme; and some of them do not like the electric light. Not a few think incandescent gas lighting preferable to either arc or incandescent electric lamps; and the present result of the conflict of these different opinions is that the Council cannot make up its great collective mind as to what had better be done to improve the lighting of the Embankment. In the meanwhile, the Highways Committee have been instructed to obtain reports from the Engineer and the Chemist "upon the question whether the lighting of the Victoria Embankment and the bridges could be improved by the substitution of incandescent burners for those at present in use." Some other questions arising out of the same matter are also referred to the Committee. But, without anticipating the nature of the reports that will be presented in due course, we may be pardoned for noticing the present attitude of the Council as giving proof that this public body at any rate has outlived the age of infatuation for electric light. It is not so long ago that self-styled "advanced" members of local authorities clamoured for electric lighting at any cost, and of almost any kind or quality, on account of its association with "progress." These perfervid gentlemen had not the slightest patience with old-fashioned people who inclined to the idea that, after all, lights whether new or old should be judged from the point of view of efficiency and economy; and in many parts of the country they succeeded in committing the ratepayers to electrical extravagances of which they now repent. It is something that the London County Council can discuss a question of public lighting without being ridiculed for entertaining the possibility of more than one solution being eventually found for it.

Talking of expenditure upon electric lighting naturally leads one to consider the St. Pancras example. As was reported in the JOURNAL for the 16th inst., the St. Pancras Vestry have decided to cut adrift from the London County Council in the matter of their electric lighting loans, and will borrow the sum of £75,000 from a bank at 3 per cent., spreading the repayment over 42 years—which, as has been repeatedly pointed out, there is no proper justification for doing, because long before this period expires some of the plant upon which the money is to be spent will have to be renewed perhaps twice over. The most significant piece of news in connection with this business is, however, the announcement by the Chairman of the Vestry that before long a further £100,000 will need to be spent upon another electric light installation. It is to be hoped, in the interest of the ratepayers, that some members of the Vestry pricked up their ears at this statement, and at the same instant formed the resolution to have the project explained at the first opportunity. St. Pancras cannot afford to pay additional rates for the purpose of finding employment for electricians; and this has so far been the main result of the electrical venture of the Vestry. Upon a certain occasion, when an application for the adjournment of a long-winded lawsuit was made to the late Vice-Chancellor Bacon, that venerable ornament of the Bench startled the Counsel engaged in the case by observing, in a stage whisper, "Give it another squeeze." Such insight into the playful ways of the Bar was not expected in this quarter. So it is with the electrical advisers of the St. Pancras Vestry, whoever they may be at the present time. They have got a firm hold of an "enterprising" local authority; and they mean to make the best of the happy chance. It is no concern of ours, of course; but, in the interests of justice to the inhabitants of a far from wealthy parish, we trust that, before another sixpence is borrowed for a fresh electric lighting installation, somebody in the Vestry will take steps to have the existing undertaking valued by some reliable assessor. As it is, nobody in the parish knows whether the installation is working at a profit or piling up a heavy loss. The Committee claim a profit; but even the electrical journals have convicted them of cherishing delusions in regard to depreciation and other working expenses, which ought at least to be inquired into before more money goes in the same way.

It is reported that the electrical speculators have again been at their old trick of trying to frighten the local authorities of the United Kingdom by showering down upon them notices of intention to apply for Electric Lighting Orders. One of our electrical contemporaries seems to think that the *ruse* will succeed in some quarters, and that "much will be attempted, either by public or private enterprise, that had better have been left alone, and many a village community may spring at a single bound from the petroleum lamp to the glow lamp." We do not share this apprehension; for the trap has been set too often before in the sight of the birds. Still, of course, some public money may be rashly applied to supplying electric lighting in places where it is not required; and this is a pity. Local authorities should recognize by this time that there is no more money to be had from investors for central station lighting schemes; and that, if they fancy electric lighting on their own account, for the style of the thing, they must be prepared to pay heavily for it. The most prudent course is not to heed the parliamentary notices, which are only designed to serve as a cheap form of advertisement, and one that is almost bound to find its mark.

The World's Petroleum Trade.—According to a telegram despatched from St. Petersburg on Wednesday last through Reuter's agency, several newspapers of that city have announced that the agreement concluded in Paris between the American petroleum firms and the Russian Kerosene Company (the Brothers Nobel) is about to be signed. By this agreement, the kerosene trade in the Mediterranean, as well as in Sweden and Norway, is left exclusively to the Brothers Nobel, representing the Russian kerosene firms; while, for the rest of Europe, Russia will export 35 per cent. and America 65 per cent. of the quantity required for consumption.

Presentations to Mr. James Dougall.—Last Wednesday afternoon, the workmen at the Hull station of the British Gaslight Company, Limited, presented a marble timepiece and side ornaments, accompanied by an illuminated address, to Mr. James Dougall, youngest son of Mr. Andrew Dougall, the Superintendent and Engineer of the station, on the occasion of his leaving Hull to take up the duties of Engineer and Manager of the Hoylake and West Kirby Gas and Water Company, Limited. The ceremony took place in the joiners' shop, which was tastefully decorated for the occasion. The chair was occupied by the storekeeper (Mr. G. Beels); and the presentation was made, on behalf of the workmen, by Messrs. Burn, Smith, and Megson, three of the oldest servants of the Company. Hearty good wishes for his future prosperity and success having been expressed by the workmen and officials, Mr. Dougall suitably acknowledged them, and thanked the donors for their very handsome presents. The remainder of the afternoon was pleasantly spent. Subsequently Mr. Dougall and his friends left for the town office of the Company, where he was presented by the Chief Clerk (Mr. Cox), on behalf of the distribution officials, with a handsome stop-watch, suitably inscribed.

GAS-FLAMES AND LUMINOSITY.

The very suggestive paper of Mr. Wilfred Irwin, read before the Manchester Section of the Society of Chemical Industry, and reproduced in our issue for the 16th inst., calls for special notice. Altogether apart from the author's methods of experiment, and the question of the value of his results raised last week by Mr. Lewis T. Wright, it must be regarded as of great advantage that the problem attacked by Mr. Irwin should be studied in as many different ways as the idiosyncrasies of investigators may suggest. Never before the present day has the phenomenon of the luminosity of hydrocarbon gas-flames been so searchingly investigated by so many workers; and whatever may be the permanent value of the crumbs of information collected in the course of these investigations, the gas industry and the community can but be benefited by the incidental clearing away of misconceptions which must result from these interesting inquiries. It is to be hoped that when the labours of so many investigators are in question, discussion of their contributions may, as the late Professor Huxley remarked of another controversy, never "swerve from the great issue of what is right and what is wrong to the very small question of who is right and who is wrong." The chemist looks at a gas-flame as an arena wherein atoms and molecules act and react upon one another; while the gas manufacturer thinks of it by habit as a light of so many candle power. The common ground on which both orders of observers may most profitably meet is the photometer room; and it must be said of Mr. Irwin that he seems to be quite at home in this apartment.

Mr. Irwin meant the main conclusion from his carburetting experiments to be that for gas to be burnt as in the majority of instances it is burnt by consumers—from the common union-jet burner—benzol is the best enricher. His various experiments with gas that had been previously disillumined were interesting and instructive in their degree; but, as Mr. Banbury Ball pertinently observed in the course of the discussion on the paper, the practical gas manager has to start with gas which is endowed with a certain degree of luminosity, which he sometimes wishes to increase. Mr. Irwin admits that naphthalene is the cheapest and greatest of all enrichers of common coal gas; but the difficulty is in getting it to the burner. It is not volatile; and it has an embarrassing tendency to drop out of the gas containing it in undesirable situations. Benzene, on the other hand, can be depended upon to go wherever the gas goes, and do its appointed duty in connection with the most ordinary burner. There is nothing particularly novel in these deductions. All gas managers know that benzene is a capable enricher, though there is still some uncertainty regarding its standard of utility in this regard. Its desirability for the gas manager depends largely upon its cost; and it is only of late years that this has been brought low enough to render it available in gas-works.

It is a distinct advantage of Mr. Irwin's paper that it brings into such prominence the low illuminating value of Manchester gas when burnt from a No. 4 union-jet burner, presumably (although the author does not specify the fact) used at its best rate of consumption and the correct pressure. Mr. Wright makes a distinct point against the author for employing "such a method of photometry as would make Manchester gas to be of 12·6 candles." But the figure is not disputed. The only true inference that can be drawn from it is that it must be idle to tell the public that they are being supplied with gas of 20-candle power, when in reality all they get is 12-candle light. Here is another argument against the supply of nominally high-power gas of which the advocates of the lower-grade and lower-priced article are at liberty to make effective use. The people of Manchester are paying many thousands of pounds yearly for something which a small fraction of their number, including the official gas examiner, are enabled to recognize as being actually supplied. And it is not possible to say with truth that though the high quality of the gas is not recognized by the people, yet it is there, and doing good service in ways unknown to fame; for Mr. Irwin claims to have quite disposed of the "theory advanced by some, that a good heating gas and a good lighting gas are practically synonymous terms." There is a capital opportunity now presented for Mr. Newbigging to prove to the satisfaction of the ratepayers of Manchester that they are taxing themselves unnecessarily to fill the pockets of the dealers in cannel coal and other superfluous enrichers. The money spent upon these materials might as well be literally poured into the Ship Canal—in the figurative sense, it had better be so applied.

It is impossible to avoid the reflection, when reading what Mr. Irwin has to say about carburetting gas for public lighting by a sort of "albo-carbon" device, that the time for this kind of thing has gone by. There is no market now for those local carburetting arrangements that have had a certain vogue for many years with consumers who fancy a specially brilliant light. We have always admired the albo-carbon light, particularly as adapted to shop illumination, not only on account of its brilliant effect with proper management, but almost equally for the ingenuity and taste displayed in the arrangement of the clustered burners and their appurtenances. Some care and attention are requisite, however, to obtain the best results from this system of burning gas; and newer systems, involving no more attention and care, are capable of producing an even better effect. The era of locally carburetted gas has passed away; and can it not be said with equal truth that the days of gas carburetted at the works with an eye to satisfying an artificial standard of illuminating power, are numbered? "Notice the extraordinary effect the burner has upon the results," observes Mr. Irwin. This is just what gas engineers have always noticed, and what many of them think it is high time the Legislature and the public also regarded from the common-sense standpoint. Before passing on to comment upon other points of Mr. Irwin's paper, we desire to remark, in connection with his explanation of the nature of the difference between Paris gas and Manchester gas, that, as Mr. Wright has pointed out, he has not supplied the necessary data from which such a conclusion as he proposes could be safely drawn. He may be right or wrong in his contention; but there is an easier way of explaining the fact that Paris is very much better lit by its low-quality gas than are our northern towns with their nominally high-power gas. This explanation has been given too often in our columns to need repeating now, especially as it is a rather long story.

Mr. Wright, whose interest in the washing of gas in the process of manufacture has been abundantly manifested, has done well to call attention to Mr. Irwin's statement about his having been able to wash all but 2 candles of luminosity out of Manchester gas by agitating it with water in a bottle. This assertion, which must be taken upon Mr. Irwin's authority, has the gravest practical bearings. Nothing like such a result is produced by the very thorough libations through which crude gas passes in order to free it from its ammonia and a proportion of its other impurities; but then the gas is warm. If cold purified gas cannot stand a washing such as the author describes, then the sooner wet meters are done away with the better. While referring to this matter, it may be asked what is the present state of expert opinion in regard to the use of a skin of oil upon the surface of the water in gasholder tanks? It has been reported that, where carburetted water gas is put into holders, this deposit forms of itself; but it has also been recommended as a cure for the fouling of gas under storage. Special processes for drying coal gas have been tried and abandoned as too troublesome, or even useless; but this observation of Mr. Irwin's will revive interest in the subject.

It is worthy of note that the paper upholds what is termed "the solid particle theory of combustion"—the word "luminous" should have been inserted before the last word of this passage. It is found also that the hypothesis is erroneous which supposes that in a hydrocarbon flame the hydrogen separates out and burns first, so raising to incandescence the liberated carbon particles. This once popular, and plausible, interpretation of the phenomena of the luminous hydrocarbon flame should now be relegated to the limbo of exploded *pseudo*-scientific guesses at truth. Not the least interesting part of the paper is that portion of it which deals with the question of the actual proportion of the carbon of a flame that is utilized in the production of light. "Even in naphthalene," says Mr. Irwin, "not more than 44 per cent. of the weight added to the gas is really utilized in emitting light; and since the addition of 0·002 gramme per litre raises the illuminating power of the gas by one candle, the amount of solid carbon engaged in emitting this quantity of light would be 0·00088 gramme. In other words, a gas burning for one hour, and giving a light equal to 20 candles, does not employ more than the extraordinarily small amount of 2·58 grammes ($\frac{1}{11}$ oz.) of solid carbon actually engaged in emitting light." If one were to divide this period of time by that—say one-half of a minute—during which an ordinary observer might be supposed to be attentively looking at such a flame for the purpose of noting the distribution of the different zones, and marking how these shade off into one another, there would remain but a very small fraction to express the weight of the carbon consumed in the production of all this brilliancy for the time being. How infinitesimal, then, must be the bulk and weight of those separate and distinct carbon particles which we are told are the light-giving elements of the luminous flame; and what a striking additional exemplification is here given of the importance of the "next to nothing!" It is one of the most marvellous features of the Welsbach burner that it has been found possible by this device to present to a heating flame matter in such fine state of division that it actually becomes more brightly incandescent than these evanescent particles of precipitated carbon, and, unlike the latter, can be used in the same way over and over again.

Is it possible to increase the luminous efficiency of the carbon particles of an ordinary hydrocarbon gas-flame, burning freely in the air? So far, nothing in the researches or observations of the experimenters who have worked so ardently of late years to ascertain the causes of the luminosity of such flames, encourages the hope that an affirmative answer may at some time or other be found for this question. No answer at all can be given to it now; but it is certain that, while such flames are responsible for the consumption of about 80 per cent. of the whole quantity of coal gas burnt for lighting purposes in the United Kingdom, they waste most of the costly carbon that it is the task of the gas manufacturer to put into them. And the more of this carbon there is, the more they waste. Reverting again to the consideration of the Paris gas mentioned in the paper, while it may be an over-statement of the fact to say that the consumer of gas of this quality always gets from it what

he is supposed to receive in the way of illuminating effect, he is not so greatly mocked as is the consumer of Manchester or other coal gas of 20-candle power nominal and upwards. Besides, by the adoption of appliances ready to his hand, as Mr. John West has recently stated, the consumer who pays for what is called 14 or 15 candle gas can get as much light from it as if the illuminating power of the gas were officially certified to be 20 candles or more, and charged for accordingly. All these pieces of evidence, "line upon line, precept upon precept," are bound to tell some day. It is not the nominal illuminating power of coal gas, as the examiner knows the term, that is of practical moment for the consumer; but the actual lighting effect that he can realize for his expenditure. He wants his gas cheap; and the purified, undoctored article made from the best available coal supply is the cheapest, as well as the best, he can obtain. Then, if he needs a small or a rough-and-ready light, he can get it from a simple, open, flat-flame burner; while if he requires a brilliant light, he can obtain it with equal facility by other means. If the gas burnt under the first-named condition is only of 12-candle power, it may be of 50-candle power under the second; and it is difficult to see why it has not as good a right to the one rating as to the other.

DIPS INTO THE PAST.—PROJECTS THAT FAILED.

(*Concluded from p.* 177.)

A CHAPTER might well be written on failures in connection with attempts to develop a higher illuminating duty from coal gas. The success of the Welsbach lamp has been built upon the failure of the Clamond, the Lewis, and others, their predecessors; and it was left to comparatively late years to bring to perfection the regenerative lamp, which had been attempted, with insufficient success, by Chaussenot, in 1835, and others after him. In this connection may be mentioned the scheme—first mooted fifty or sixty years ago—for supplying oxygen to gas lights in order to intensify combustion and increase the illuminating power developed. In 1867, it was revived in Paris, where something like a panic was created among gas shareholders. Why such a result should have been produced—even had the process given more promise of success—seems strange to us who see, at the present day, the incandescent gas-lamp (which aims at producing the same result—more light from less gas) received with gladness as an aid to the gas industry. The oxygen scheme was unsuccessful chiefly owing to the excessive cost and imperfect quality of the oxygen then obtainable, which was said to cost 17s. per 1000 cubic feet, or more than four times as much as it is reputed to cost now; while the process of manufacture was at that day so defective, that the finished product contained 30 per cent. of nitrogen. The strong objections which were raised to the proposal, founded on the supposed difficulty and danger of distributing a powerful supporter of combustion, like oxygen, in addition to coal gas (of course, in separate mains), were never put to the test.

A number of projects, for effecting considerable changes in the general features of gas making, may be mentioned in conclusion, which, though brought forward from time to time, and backed in some instances by very eminent men, have never been put to the test in any large way, but at their introduction were unhesitatingly condemned, by competent authorities, as unpractical and doomed to failure. To this class belongs the proposal to cut short the period of carbonization after a portion only (from one-third to one-half) of the illuminating gas has been evolved, so as to obtain a gas of better quality and, at the same time, produce a fuel for domestic consumption, less smoky than coal, and more generally applicable than coke. This project was brought forward in the interests of smoke prevention. It was not, however, difficult to show that, not only would its adoption be fatal to economy in carbonization, but the coke produced would not, in reality, be so serviceable as the ordinary article, while the object aimed at—namely, the diminution of the smoke evil—would be far better served by encouraging the more extended use of gas as fuel, towards which its cheaper production was a predominant factor. That this view has been justified by the result is evidenced by the enormously extended use in late years of gas cookers and fires, coincident with the cheapening of gas and the provision of greater facilities for their adoption.

A more visionary scheme was the proposal to erect enormous works for converting coal into gas at the different centres of the great coal-fields, instead of at the place where it was to be consumed; large mains being laid to convey the gas to the cities and towns to be lighted. Then there was the proposal, which has been so often resuscitated, to supply two qualities of gas through separate sets of mains—a high quality for illuminating purposes, and a lower and proportionately cheaper quality for heating purposes. This dual-supply scheme has, at different times, taken different forms. In one, the surplus coke from the manufacture of ordinary gas was to be converted, in huge producers, at the gas-works, into cheap fuel gas, which it was supposed might supplant coal for the firing of steam-boilers. But the scheme which found most favour with the general public, and received the largest share of attention, was that originally proposed and strongly advocated by the late Sir W. Siemens. Two-thirds or other proportion of the gas yielded by the coal carbonized was to be first taken off as lighting gas; and the remainder, containing the less valuable illuminating constituents, was to be collected separately, and distributed for heating purposes. On a cursory view of the subject, such as would be taken by an outsider, there is something very attractive in this scheme; as, of course, there was nothing really impossible in its working details. But when examined by experts, the weaknesses of the project were at once revealed. It was shown that the cost of distributing such a low quality of gas would be fatal to its financial success; and, moreover, if there were sufficient demand for such a gas, and the difficulty last mentioned were overcome, a cheaper source of supply might be found in another direction. Still some service was rendered by the discussion which arose on the proposal, if only in recalling attention more forcibly to the fact that the gas evolved from the coal deteriorates very rapidly in quality as the termination of the charge is neared. Probably owing in some degree to this consideration, there has been a greater tendency, of late years, to reduce the length of charge, or, in other words, to obtain quicker evolution of the gas.

There is one suggestion arising from the above consideration, which we do not remember to have seen made before. It has been shown, by more than one experimenter, that the illuminating power of gas evolved during the concluding period of the charge—say the last hour of a six-hour charge—is either very low or is *nil;* the gas consisting chiefly of hydrogen with some marsh gas and carbonic oxide, and containing hardly any or absolutely no condensable hydrocarbons. In any case, it undoubtedly tends to reduce the average illuminating power of the total yield of gas from the coal. As to quantity, this portion of the yield does not amount, on the average, to more than 5 per cent. of the whole; so that if it be not recovered, the loss is really very small. This sixth hour cannot, however, be annulled, and a five-hour charge substituted, *under the same conditions of heating*, as it is required to enable the retort to store a reserve of heat, in preparation for the introductiou of another charge of coal. And, of course, there is, with shorter charges, a similar but briefer period, which is chiefly occupied in allowing the retort to regain the heat expended in driving off the volatile products. Our suggestion, then, is this: Connect the mouthpiece of the retort, by means of (say) a 2-inch or 3-inch tube, provided with a cock, with the interior of the setting, and divert the gas yielded during the last hour of the six-hour charge, so that it may assist in heating the retorts. By this means, it would seem that the quality of the gas, sent forward to the gasholder, would be considerably improved—at any rate, in greater proportion than would compensate for the slightly smaller yield; while the heat of the retort would not suffer, but rather be improved. A collateral advantage, which we should expect to find, is the reduced risk of explosion occurring when the lid of the retort is slackened to open it, through the open connection to the furnace gases.

North of Ireland Association of Gas Managers.—The annual meeting of this Association is to be held in the Mayoralty Rooms, Drogheda, on the 13th prox., under the presidency of Mr. P. J. Salmon, of Galway. We learn from the programme issued by the Hon. Secretary (Mr. J. Whimster, of Armagh) that, in addition to the President's address, there will be three papers and a lecture. Mr. E. Stears, of Lisburn, will give an account of four months' working by him with Hislop's regenerative furnaces; Mr. M. Martin, of Drogheda, will deal with successful methods of doing ordinary work; and Mr. C. B. Tully, of Sligo, will emphasize the advantages of Provisional Orders for gas companies. Professor W. Ivison Macadam, F.R.S.E., &c., will give the lecture, the subject of which will be "The Illuminating Value of the Various Constituents of Coal and Oil Gas, and the Conditions necessary to Produce Incandescence." It will be illustrated by experiments and lantern views. In the afternoon, the members will dine together; and on the following day, they have a pic-nic excursion, joined by their lady friends, through the beautiful valley of the Boyne; visiting the scene of the famous battle.

The Examinations in "Gas Manufacture," &c.—In the JOURNAL for the 2nd inst. (p. 44), we published a list of the candidates who passed at the last examinations in "Gas Manufacture" at the City and Guilds of London Institute. We are now able, through the courtesy of the Superintendent of Technological Examinations (Sir Philip Magnus), to supplement it by giving the names of those to whom prizes have been awarded. The first prize in the Ordinary Grade (£1 given by the Salters' Company and the Institute's silver medal) was secured by Mr. A. E. Brooks, junior assistant to Mr. J. Eldridge, of Oxford. The second prize (£1 and a bronze medal) was gained by Mr. F. P. Tarratt; and the third (a bronze medal), by Mr. J. P. Hallaway. As being allied to gas manufacture, we may mention that the following succeeded in gaining prizes in the examinations in "Coal Tar and Coal Tar Products." In the Honours Grade, Mr. A. Turner took the first prize (£2 given by the Salters' Company and the Institute's silver medal); while in the Ordinary Grade, the first prize (£1 and a silver medal) was gained by Mr. C. H. Desch; and the second (£1 and a bronze medal), by Mr. H. W. Younger.

NOTES.

A Brushless Painter.

Another mechanical painting device has been introduced to the British public, the invention of a Mr. Cleaver, who calls it the "Brushless Painter." It works by pneumatic power; and, like other appliances of the kind mentioned on previous occasions in this column, consists essentially of an arrangement whereby paint, tar, or other medium is sprayed over the surface to be covered. The paint is contained in a closed vessel, from which it flows into a tube, and at the nozzle of the tube it meets a supply of air under pressure which atomizes it. The air-pump is, of course, situated on the ground or floor, and serves several nozzles, according to its working capacity. It is claimed that the force with which the paint is blown upon the surfaces intended to receive it ensures better work than can be relied upon in the case of hand painting. On the occasion of a recent demonstration of the qualities of the Cleaver apparatus, at Cardiff, nine square yards of the iron hull of a ship were painted in about seven minutes. A special quick-drying anti-fouling composition, hardly to be applied by hand, was also successfully dealt with. On the same occasion, a railway waggon, which it takes a man two hours to paint with one coat by hand, was efficiently covered in 16 minutes. Carved and undercut work can be more reliably painted by this machine than by hand.

The Distribution of Energy in Flames.

A study has been made by Professor König, of Berlin, in conjunction with Dr. Rubens, as to the distribution of energy in the spectrum of a triplex burner. The apparatus and methods employed made it possible to measure the energy in different regions of the spectrum by means of a bolometer, while at the same time the intensity of the light of the same part of the spectrum was ascertained by means of the Limmer photometer. Professor König, who has communicated to the Berlin Physical Society the results of the labours of himself and his colleague, so far as these have gone, states that after correcting the bolometrical indications for the effect of diffused light, the energy of the extreme red was found to be over a thousand times more than that of the blue. By comparing the relative intensities of the rays of a normal amyl-acetate lamp flame with those of the larger burner, the distribution of energy in the amyl-acetate flame was deduced by calculation; and in this case also the energy of the red end was found to be 300 times that of the blue end. With diffused daylight from a cloud, the curve of energy was merely horizontal; while in the case of the cloudless sky, the curve ascended from the red towards the blue end, thus reversing the conditions of the artificial lights.

The Evaporative Duty of Rubbish Destructors.

At the recent annual meeting at Halifax of the Incorporated Association of Municipal and County Engineers, a joint paper on the Royton sewage works was contributed by Messrs. T. S. M'Callum and W. Naylor. A portion of the paper dwelt with the subject of the economy of refuse destruction. It was stated that on the occasion of a trial at the works, the destructors returned as ash and clinker 46 per cent. of the material consumed; while the evaporative power of the fuel was equal to 0·40 lb. of water per pound of refuse. The steam generated in this way was used for pressing sludge; the indicated horse power obtainable being 3·4 per cell per hour. To do this work, the steam consumption per minute was 5·48 lbs. If, the authors remarked, these results showed anything at all, it was that the idea that town refuse could be burnt at any sort of profit was erroneous. It could not be imagined that refuse which gives an evaporative duty of less than 2 or 3 lbs. of water per pound would pay for cartage. Mr. Boulnois, of Liverpool, thought the authors' figures of the evaporative duty of refuse were low; and other speakers in the discussion upon the paper considered the percentage of clinker high. The authors' statements and the facts that came out in the course of the discussion throw a strong light upon the pretences of those electricians who, from time to time, attempt to inveigle municipalities into electric lighting ventures by holding out the promise that town's refuse destroyers are quite capable of supplying all the steam required for power.

The Permeability of Iron to Argon.

Writing to *Nature*, Professor W. Ramsay narrates the experiments he has recently carried out, or suggested, with the object of testing meteoric iron for argon and helium. The investigation has yielded an affirmative result. The question then arose as to whether common metallic iron has the power of occluding argon, since certain experiments seemed to indicate the probability that red-hot iron is actually permeable by argon. If permeable, then the argon might be permanently absorbed. A crucial experiment was therefore undertaken by Mr. Kellas, to ascertain whether finely-divided iron, obtained by the reduction of ferric oxide in hydrogen, would occlude argon. The nature of the experiment need not be detailed, especially as it went to show that, whether or not iron at a red heat is permeable by argon, it does not permanently retain the gas. The discovery is only one more addition to the proofs already given as to the inertness of the new component of the atmosphere. There is already much information collected to show what argon will not do; and almost the only thing it is known to do is to give a characteristic yellow line in the spectrum. In consequence of the discovery of argon, however, Professor Ramsay declares that a great deal of spectroscopic investigation of gases, the air, and other matters, will need to be gone over again. He thinks, however, that little reliance is to be placed on the evidence of the spectroscope as to the presence of any one gas in a gaseous mixture; and he suggests that in future much attention should be paid to the relative conductivity of gases. The characteristic spectrum of argon is almost completely masked by the presence of a few parts per cent. of nitrogen or of hydrogen.

Punches and Punching.

M. Charles Fremont has recently communicated to the *Comptes Rendus* the fruits of an experimental inquiry into the conditions affecting the amount of clearance necessary to be left between a punch and its bed. He concludes, from a large number of experiments, that the maximum effort in punching metals is independent, in the ordinary way, of the amount of clearance. This latter allowance is a function of the thickness of the metal to be punched, and not of the diameter of the punch. It is also a function of the elongation of the metal, but in a less proportion than of its thickness. Finally, M. Fremont finds that the amount of clearance space, or play of the punch, ought to be about one-fifth of the thickness of the metal punched. M. Fremont's attention has also been directed to the form of punch best adapted for piercing perfect holes—a matter that has often exercised the study of metal workers. Now, however, when the punch is rarely used for good heavy ironwork, having been so largely superseded by the drill, and is principally used for light tank and gasholder sheets, the form and other elements of the tool are not of such pressing importance as they would have assumed if the development of ironwork construction had lain in a different direction.

COMMUNICATED ARTICLE.

NOTES ON CURRENT TOPICS.

By "Veritas."

Perhaps it is too much to expect average humanity to take more than a transient interest in current topics; and yet it has always seemed strange, to one who ponders somewhat deeply, that more keenness and discrimination do not come to the surface occasionally when some key-note is struck which is not merely a vibration of the time, but which, duly appreciated, is a chord destined to have lasting effect on the progress of science, and correspondingly far-reaching consequences. These philosophical remarks are the outcome of some years of observation; but it is useless to "point a moral" without completing the quotation by "adorning a tale."

One or two subjects have recently appeared in the JOURNAL which are of more than transient interest, and others which, though not so important, are worthy of careful consideration. In the foremost category must be placed Professor Lewes's papers on "The Combustion of Coal Gas for Fuel Purposes" and "Acetylene and the Part it Plays in the Luminosity of Flame;" in the latter, notably the paper by Mr. Lewis T. Wright on "Matters of Interest in Connection with the Washing of Crude Coal Gas." The classification may be disputed as somewhat empirical; but it may be justified by the tenor of subsequent remarks. Of the papers mentioned, the first is undoubtedly of the most practical importance, as indicating for the first time the immense improvement in efficiency, and consequently in economy, of the application of the regenerative principle to gas-stoves. It seems curious that this principle has been so long adapted to the increase in the development of the illuminating power of coal gas, but that the extension to heating purposes has been so long in abeyance. It is also curious to a reflective mind that all the improvements in the development of light from gas by regenerative action should have been entirely eclipsed by the most modern application of heat to light, in which light *ab initio* from the luminous hydrocarbons in gas is destroyed, and the light re-developed to an unsurpassed extent simply by heat. In the (so-called) incandescent burner, we have, in the burner itself, a flame with an air supply whereof the pure function is the development of heat. We have, in fact, a modified Bunsen burner similar to that in daily use for laboratory work, and where the functions are simply those of heat. This hot flame surrounded by the so-called "mantle," instantly affords a light eclipsing all the results obtained by that system of regeneration which sought to obtain increase of light by utilizing the heat from the combustion of the gas to raise the temperature of the gas consumed and that of the air necessary for its combustion. The advent of the Welsbach light is indeed the inauguration of a new era in gas lighting. As it stands, a comparatively inexpensive appliance—inexpensive, at least, compared with the price of regenerative burners—gives a light which is the best development, per cubic foot of gas, of any previously on the market.

How much more light will be developed per unit of gas when the Welsbach burner is made on a regenerative principle, future history has yet to record; but this much has at least been shown in Professor Lewes's paper—that, by the more

perfect admixture of gas and air in a Bunsen burner, with corresponding heat-development, a light equivalent to 27 candles per cubic foot was obtained with ordinary London gas, and "without the use of a chimney." This means that the 5 feet gas consumption which the heterogeneous admixture of Acts of Parliament and Gas Referees, modified by that liberal-minded and impartial body the London County Council, stigmatize as 16-candle gas, would, if tested by the latest development of modern science, be recorded as 135-candle power. Of course, the means to produce this tremendous and unprecedented effect are not at present available to the average individual.

The increased heat from the Bunsen flame was only obtainable by the use of mechanical means for the admixture of air and gas by a small fan actuated by an electric motor. But surely such a simple thing as the perfect admixture of gas and air before combustion could be accomplished automatically, without extraneous means, if sufficient inventive genius were brought to bear on the question, stimulated, as it should be, by the immediate prospect of large pecuniary gain, which, after all is said, is one of the chief motives in matters mundane. There is, however, with regard to this special question, one other matter to consider—one upon which Professor Lewes was unable to offer an opinion—and that is the durability of the mantles under the increased temperature which developed 27 candles per cubic foot of gas consumed, as against about 12·5 candles with the ordinary Bunsen appliance. This is a question which will have to be determined; and it is one well worthy of careful experiment.

Turning to the application of the regenerative principle to gas-stoves, we have a most important advance in heating by gas which merits the attention of gas companies. It has sometimes seemed as if the flourishing condition of most gas industries has not conduced to progression, but largely to secure the maximum amount of "staff" brains with the minimum amount of remuneration and the maximum amount of dividend to the shareholders. Possibly a time may come when a wiser policy will intervene, and some universally adopted bonus scheme will give an additional impetus to the general prosperity of a large industry.

Some criticism has appeared about Professor Lewes's results; but those who know him best will acknowledge that he would not proclaim statements that he was not in a position to verify. As a matter of plain common sense, it is obvious that the application of the regenerative principle to heating purposes with regard to the use of gas should be accompanied by efficient results. What has already been accomplished in the use of solid fuel should be possible in the use of gas. It is a well-known fact that, in ordinary gas-stoves, a large amount of heat evades useful effect by escaping up the chimney. It is, of course, necessary that the products of combustion should leave the stove at a temperature necessary to maintain a sufficient draught. But the ordinary gas-stove far exceeds this limit; and a large amount of heat is wasted as in the ordinary coal fire—viz., up the chimney. It is more easy, for many reasons, to utilize the waste heat from gaseous than from solid fuel; and therefore it seems the more curious that the application of the regenerative principle to gas-stoves has not received earlier attention. Reverting to Professor Lewes's results, he states: "Having obtained a large and small stove of this construction, I tested them under identically the same conditions as the English stoves. To my surprise, I found that the efficiency was nearly two-and-a-half times as great." Further, he states: "Coal gas is substantially cheaper than coal burnt in the ordinary form of grate, where regenerative gas-stoves are employed." Professor Lewes also gives a brief description of the construction of the special form of stove by which these results are obtained. From this it does not appear that the cost of construction of this particular kind of stove should be prohibitive of its general introduction. Of course it takes some time to induce the public to receive any novelty; but, in the end, efficiency wins the day. There is a further point; and it is that, whether in the domain of heating or lighting, anything which conduces to economy in the use of gas, and is therefore in favour of the consumer, is, in the abstract, against the interest of gas companies. This view is, properly considered, a false one, as anything which makes the use of gas more popular must not only tend to additional consumption, but also to increased commercial stability of the general gas industry.

Turning from this subject to Professor Lewes's paper on "Acetylene," there is little to be said, except with regard to the scientific interest which attaches to the researches that have shown the important part this compound plays in the luminosity of flames. As a source of light *per se* as developed from calcium carbide, the cost would be prohibitive; and as an enricher, acetylene appears to suffer from the disadvantage of giving a lower luminosity when diluted with ordinary gas than when burnt undiluted. In this respect, it distinctly differs from the usual hydrocarbons employed for the enrichment of ordinary low-grade coal gas.

Although of less scientific interest, Mr. Lewis T. Wright's paper on "Matters of Interest in Connection with the Washing of Crude Coal Gas" is of practical value, and is suggestive of some comments, also practical. There is no doubt that *in all works*, whether gas liquor is sold or used on the premises for the manufacture of sulphate of ammonia, it pays to produce strong liquor. Where the product is sold, it is obvious that one freight of 14 oz. liquor must be worth two freights of 7 oz.; whereas the cost of carriage, dealing purely with weight and bulk, is identical in the two cases. Further, there is no doubt that the water used in scrubbing has a distinctly deteriorative action on illuminating power. Many of the leading hydrocarbons to which the luminosity of ordinary gas is due, are by no means insoluble in water; and water performs an important function in general gas purification. The contact of it with gas in the large masses of lime and oxide used for purification purposes cannot be helped; but its use for removing ammonia is a question within the domain of practical politics. The chief difficulty is *not* the removal of the main quantity of ammonia in the crude gas, but the eventual reduction to the maximum of 4 grains per 100 cubic feet prescribed as the penalty-point by the London Gas Referees. The limit is reasonable; but the means to attain it are expensive, and possibly not understood by the existing staff of the body which has a conspicuous absence of what was at one time rightly insisted upon—viz., that one member should have a practical knowledge of gas manufacture. Reverting to the question of the best means of dealing with the purification of gas from ammonia, there is no doubt that the main difficulty is the elimination of the small amount left after the usual processes of washing and initial scrubbing.

Mr. Wright has laid down an axiom which must only be accepted as true under the conditions stated—that at a temperature of 60° Fahr. "liquor of 14-oz. strength cannot reduce the ammonia in the gas it is in contact with to a lower amount than 54 grains per 100 cubic feet." The strength of liquor obtainable cannot be empirically laid down as a pure function of temperature and composition of gas, but must necessarily vary with the mechanical appliances used for ammonia purification. As a broad practical question there is more than one means which might be adopted for limiting the amount of clean water used for purposes of ammonia purification where sulphate is made on the premises. One suggestion, and the chief one, is that instead of a large proportion of water being used for eliminating the small and final amount of ammonia, a lead-lined scrubber supplied with weak sulphuric acid should be used as the final vessel. Two ordinary scrubbers would then produce the usual strong liquor; and one acid scribber would complete the purification—the latter being of comparatively small area, as its efficiency would be independent of questions of vapour-tension and temperature, and be purely one of chemical action. This would render the complete purification of gas from ammonia in the washing and scrubbing plant automatic in winter and summer. The liquid produced would be a weak solution of ammonium sulphate, which would be utilized by being pumped into the saturators in place of the ordinary water generally employed; so that there would be no loss. Another suggestion is that, instead of continuously liming the liquor, as in ordinary sulphate manufacture, the spent liquor from the still columns should be cooled down, and used in the scubbers instead of clean water for (say) some eight or ten times. The liquor could then be limed in the ordinary course, with the production of a correspondingly increased yield of ammonia, and a proportionately decreased loss in treatment.

There are other points in Mr. Wright's paper which may be reserved for future discussion.

Mr. Boverton Redwood on the Petroleum Industry.—In our review of Mr. Boverton Redwood's account of the petroleum industry in Groves and Thorp's "Chemical Technology" (see *ante*, p. 137), reference was made to the author's mention of Dr. Dvorkovitz's patented process as a digression. It has been pointed out that this is not so, inasmuch as it is only the Dvorkovitz process for obtaining gas oil from crude petroleum, or petroleum distillate, and not the oil-gas process of the same inventor, that is in question here.

The End of the Wenham Company.—On Thursday, the 18th inst., the premises in Upper Ogle Street, Fitzroy Square, formerly occupied by the Wenham Company, were put up to auction by Messrs. Farebrother, Ellis, Clark, and Co., under an order of the Court in the Chancery action commenced some time ago to wind up the Company. The premises were originally built by Messrs. Jackson and Graham for their own occupation as a cabinet factory, at a cost, it is stated, of £24,000; and they were purchased by the Company in 1885 for £9400. There was no bid for the property; and it was "passed" as unsold. On the following Monday, the goodwill of the business and the patent rights were disposed of for £200. The initiation, growth, and decay of this undertaking, in the course of about a dozen years, forms a not uninteresting chapter in the history of gas supply. The Company started in Rathbone Place with a small capital; and their operations were so successful that soon afterwards the concern was reconstituted with £250,000 at its back. For a year or two, 10 per cent. was paid to the shareholders; then troubles came. Lawsuits had to be undertaken; expensive provincial and foreign branches proved unremunerative; and, moreover, competitors were in the field. Another reconstitution of the Company took place; the capital being reduced to less than £60,000. But dividends dwindled, and eventually ceased. After running a downward course for a few years, the whole concern has been sold to meet the claims—amounting to something less than £18,000—of the debenture-holders.

TECHNICAL RECORD.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

Review of the Proceedings at the Annual Meeting.

For their thirty-fourth annual gathering, the North British Association of Gas Managers selected the sleepy, but historically interesting, little town of Melrose as their meeting-place. It was not an ideal one, on account of its geographical situation, being too much on one side of the country. To take distances, it is 37 miles from Edinburgh, and more than 70 miles from Glasgow, more than 80 from Perth or Dundee, more than 150 from Aberdeen, quite 220 from Inverness, and upwards of 70 from Dumfries. These were drawbacks which were not easily overcome; and, as a matter of fact, none of the principal officials of the gas undertakings in any of the towns enumerated found themselves able to attend the meeting. Besides this, there was, of course, the very obvious reason why so many should have stayed away, that most of the gentlemen from these towns attended the meeting of The Gas Institute in Edinburgh in June. There was a further reason to be found possibly in the fact that, during the month now closing, the country has been given over to parliamentary election work, in which, doubtless, many gas managers engaged, and thereby misspent (from the Association point of view) their time, and could not afford it for another meeting. This was the first occasion on which the Association strayed, as it were, beyond the central district of Scotland; and if weight is to be given to the long roll of absentees, as well as to the expressed opinions of those who attended, it is highly probable that the members will not soon repeat the experiment. It is not that the meeting at Melrose was not a success; for, in spite of the drawbacks above mentioned, it was, both in point of the members attending and of the quality of the papers and discussions. But a place which is so distant that it cannot be reached on the morning of the first day, nor from which it is possible to get home on the evening of the second—thereby necessitating three nights from home—is manifestly one entailing too much outlay for the rank and file of the members to be able to afford.

Having spoken of the drawbacks to Melrose as a meeting-place, it must be admitted that it possesses advantages which last week helped the attendance considerably. It is a beautiful spot in itself; it was new ground to many of the members (one was heard to say that he never was so far from home in Scotland before); and through its being in the vicinity of Abbotsford, where Sir Walter Scott—Scotland's premier author—spent the evening of his life, it is a veritable Mecca of tourists, particularly foreign ones. Closely associated with the work of Sir Walter may be mentioned the venerable Abbey building, which is known everywhere through the famous couplet in the "Lay of the Last Minstrel," but which, unfortunately, on account of the cloudy nature of the weather, the members had not the opportunity of visiting, as recommended by the poet, by moonlight. These were all reasons which went to swell the attendance; but there was also considerable attraction in the programme of business. There was, first of all, Mr. A. Wilson in the chair, out of regard for whom a considerable number of managers from the western portion of Scotland put in an appearance. Then, head and shoulders above all, there was the paper by Mr. W. Young, of Peebles, one of the honorary members of the Association. There were also three papers by working members, on subjects which appealed to their colleagues more forcibly than purely scientific contributions. Having regard to all this, it is not surprising that, when Mr. Wilson took the chair, the attendance was not much below what it was at Glasgow last year, and was much about the same in number as faced Mr. Hall at Dundee two years ago.

Of the attendance, it may be said, with safety, that no meeting of the North British Association would be complete without the presence of Mr. J. M'Gilchrist, of Dumbarton, Mr. MacPherson, of Kirkcaldy, or the Secretary, Mr. R. S. Carlow, of Arbroath, all of whom were there, and in their best form. There were also Mr. Yuill, of Alloa, the new President, who has had a rapid advance since, a few years ago, he began to take part in the affairs of the Association; Mr. Vass, of Portobello, another of the younger members whom all are delighted to see coming forward; Mr. A. Bell, of Dalkeith, a veteran in the service, but still active as a youth; his son, Mr. Bell, of Peebles, who is at present overworked in looking after his Company's interests in connection with an extensive town improvement, and who, in consequence, did not feel fitted to lend his voice to the proceedings; and Mr. Ballantyne, of Rothesay, whom everyone would have been glad to hear putting in his word more than he did. There were also Mr. J. Hall, of St. Andrews, one of the fathers of the Association, who showed that "age cannot wither, nor custom stale," his zest in tackling current problems; and his son, Mr. Douglas Hall, of Montrose, one of the most prominent and useful members of the Association. Of the absentees, it may be said that Mr. W. Foulis, of Glasgow, expected to be present, but was unable to get to the meeting; Mr. Mitchell, of Edinburgh, is on holiday; Mr. Linton, of Leith, is not in such robust health as would make it advisable for him to travel; Mr. Whimster, of Perth, it was scarcely expected, would undertake the journey; Mr. John M'Crae, of Dundee, sent an apology; and Mr. Alex. Smith, of Aberdeen, and Mr. Thomson, of Inverness, were too far away. Mr. Wilson, of Coatbridge, was also in the absent roll.

Turning to the proceedings, there comes first the President's address, regarding which the opinion may be given that it was a "gritty" document. Mr. Wilson spoke of having accepted the position of President with fear and trembling. It is not likely that he looks back upon his tenure of office in the same spirit. He gave an address which was highly appreciated, and which will stand reading and consideration at the hands of the members. No questions arose during the meeting which required his intervention; and he may now look back with complacency upon well-accomplished duties.

The paper by Mr. Young was a long one—occupying nearly an hour in delivery. It was of such a nature that, though too deep for the immediate understanding of the hearers, they seemed to feel that it contained, as it did, something which was new, and which would prove to be valuable in the elucidation of flame problems by the leading minds in the industry. No one was wearied. Generally, it may be said, the expectation had been that it would pass with little discussion; and it was consequently somewhat of a revelation to find, when Mr. MacPherson rose, that there was in the Association one who, to speak metaphorically, could hold a candle to Mr. Young. The short debate which took place will serve a useful purpose as regards those who walk in the ordinary courses of the gas industry; but the paper itself will be of more value in consequence of the light it throws upon the laws which ought to be obeyed in the synthetic treatment of illuminating gases. The speakers on the paper were Messrs. MacPherson, Bell, Yuill, and M'Gilchrist.

Mr. J. N. Myers, of Saltcoats, made out an unanswerable case, from the gas manager's point of view, for the standardizing of meter unions. The subject has been heard of before; but it has now taken a step forward in the remit which has been made to the Research Committee to deal with it. The Committee should feel encouraged to prosecute the remit by the fact that the proposals of Mr. Myers received the cordial support of Mr. Hepworth and Mr. Macfie, who represent two of the largest firms of meter makers in Scotland. Besides these, Messrs. Bell, sen., Hall, jun., Yuill, Ballantyne, Renfrew, and D. M. Nelson also took part in the discussion.

Mr. Vass's paper on "The Heating Value of Coal Gas" raised an interesting discussion upon the relative merits, as heating or motive power agents, of high and low grade gas. But nothing conclusive was reached; there being as yet no sufficient data upon the subject to enable an authoritative opinion to be formed. Practically the same speakers took part in the discussion.

The paper by Mr. A. Waddell, of Broughty Ferry, was a record of the author's results in the working of the Peebles oil-gas process. Mr. Waddell brought out the most favourable results, which could not be gainsaid in discussion; and consequently the remarks of the speakers were necessarily not a criticism of the main feature of the paper, but rather a seeking for information to clear up some of the side questions that arise in connection with such a disturbance of ordinary working conditions as is involved in the introduction of a new process into a gas-works. It is not disputable that Mr. Waddell, after working the Peebles process, and carrying out other improvements, such as regenerative settings, has been able to reduce the price of gas 10d. per 1000 cubic feet; and in the criticisms that were offered, chiefly by Mr. M'Gilchrist, Mr. MacPherson, Mr. Yuill, and Mr. J. Hall, the object was rather to ascertain how the economies which made the reduction possible were to be proportioned between the working of the oil-gas plant and the other improvements. Treated in this way, the subject was more fitted for a Committee than for a public meeting; and therefore, though the paper was valuable, the discussion did not produce much that will be of use.

The business was then expeditiously got through—the adjournment for dinner being reached before five o'clock, which is unusual. Almost as soon as the meeting ended, rain showers began to fall, which during the succeeding night developed into a continuous downpour, lasting for nearly thirty-six hours—one of the greatest rain storms of recent years. On Friday forenoon, about fifty drove to Abbotsford; the proprietor of the George and Abbotsford Hotel kindly furnishing closed conveyances for the journey. The visit to Melrose Abbey, which was another item on the programme for Friday, was paid by a few in a short period during which the rain fell less heavily. The others whiled away the time in the hotel—an improvised concert in the drawing-room being one of the expedients adopted by the storm-stayed company; and it met with a good deal of success. The bad weather on the Friday was the only element of weakness in the meeting.

Report of Proceedings.

The Thirty-fourth Annual General Meeting of the North British Association of Gas Managers was held in the Corn Exchange, Melrose, last Thursday—the PRESIDENT (Mr. Alex. Wilson, the Manager of the Dawsholm station of the Glasgow Corporation gas undertaking) in the chair. Considering the somewhat out-of-the-way locality in which the meeting was

held, the attendance was more than up to expectation, though a number of the leaders in the gas industry were absent. The proceedings began shortly after eleven o'clock.

WELCOME TO MELROSE.

Mr. J. CURLE, jun., Solicitor, a Director of the Melrose Gas Company, extended a welcome to the town to the members of the Association; saying it gave him very much pleasure to do so. They were always very glad to see visitors at Melrose, especially when they combined a scientific purpose with that of pleasure. He was afraid the town was too small, and the consumption of gas not large enough, to offer very much of interest in gas processes; the town being noted rather for its historical associations and the beauty of its surroundings. The valley in which it lay had been inhabited for a very long time; and various phases of civilization had left their traces behind. He trusted the members would derive both pleasure and profit from their visit to Melrose.

The PRESIDENT, in acknowledging the welcome, said that Melrose was rather out of the way for the bulk of the members of the Association; but he was very pleased to see such a good turn-out of them.

THE REPORT OF THE COMMITTEE.

The SECRETARY (Mr. R. S. Carlow, of Arbroath) read the annual report of the Committee, which contained the following remarks:—

No question of any great importance, or of any special interest, either in regard to the manufacture or distribution of gas, has been brought under the notice of the Committee for consideration. The Committee's duties, therefore, have, in this respect, been of a very light nature during the past year; and they have now no special point to lay before you for your approval.

The Benevolent Fund in connection with our Association has been drawn upon largely this past year; £35 having been paid to three deserving cases.

The Annual Report of the Proceedings, 1894, was published, and sent to each member of the Association, according to the rules. The Statistical Report for the year ending July 31, 1894, was compiled and bound together with the Annual Report of the Proceedings, and issued to all members of the Association, as well as to those who gave the necessary information.

The Committee, at a meeting held in Glasgow on Nov. 14, 1894, took into consideration the suggestion made by Mr. D. Vass, of Portobello, that the Committee give instructions to have the annual report of the Committee, balance-sheets, &c., printed and distributed among the members of the Association, before the annual meeting in each year. The Committee fully discussed the matter, and unanimously agreed, for several reasons, not to entertain the above suggestion.

The Committee regret to state that they have been under the necessity of deleting a number of names from the roll of membership, owing to deaths, members resigning, and being in arrears with their subscriptions. Still it is gratifying that there are always a large number of parties applying for admission as new members; thus showing that the Association is accomplishing the ends for which it was originated.

The SECRETARY then stated, with reference to the membership, that last year there were on the roll 159 ordinary, 59 extraordinary, 15 associate, and 6 honorary members—a total of 229; but that, after deducting the names of those resigning, there remained 134 ordinary, 58 extraordinary, 13 associate, and 6 honorary members. There were added at the present meeting (as below) 11 ordinary, 5 extraordinary, and 1 associate member; making, in all, 228 on the roll.

NEW MEMBERS.

The following were admitted to the Association:—

Ordinary Members.—Bell, L., Innerleithen; Carlow, F., Lasswade; Chalmers, P., Coupar Angus; Dow, A. C. R., Strathmiglo; Mitchell, W., Dalry; Muir, R., Galston; M'Lennan, A., Lennoxtown; Smith, J., Annan; Speed, T., West Wemyss; Stewart, G., Dunkeld; Wilson, J., Glasgow.

Extraordinary Members.—Callander, J., Dalkeith; Gibb, D. M'Callum, Glasgow; Hepworth, J., Edinburgh; Macphie, N., Edinburgh; and Penman, D. A., New Cumnock.

Associate.—Keillor, G., jun., Hamilton.

THE MURDOCH MEMORIAL FUND.

Mr. J. M'GILCHRIST (Dumbarton), the Secretary and Treasurer of the Murdoch Memorial Fund, reported that the fund now amounted to £207 9s. 11d. He said that during the year, the Committee purchased from the widow of the late Mr. Murdoch, who wrote "Light Without a Wick," about 1240 copies of that excellent work. They were unbound; and it was the intention of the Committee to (possibly next year) issue subscription-sheets, accompanied by these copies; and perhaps many people who knew nothing of Murdoch on the last occasion that the Committee asked for subscriptions, would, by reading the book, get an idea of his great ability. Possibly next year they might be able to raise a sufficient sum to place a bursary in the Glasgow University, the name of which was given by their esteemed friend Lord Kelvin, who was so kind as to unveil the bust of Murdoch in the Wallace Monument at Stirling three years ago. Some people thought that perhaps they might have been doing some work this year; but really there were so many subscriptions in connection with Gas Associations of late years, that possibly they were doing the right thing in delaying. There was an old Scotch saying that "There's luck in leisure;" and he trusted they would be able to raise £500 by next year.

The report was approved o; and on the motion of Mr. CARLOW, who said they could not do better than continue the Committee, seconded by Mr. T. D. HALL (Montrose), the following were re-appointed: Mr. J. M'Crae, Mr. A. MacPherson, and Mr. J. M'Gilchrist—the latter to be, as before, Secretary and Treasurer.

Mr. M'GILCHRIST said they all had pleasure in accepting office; and he might say, on behalf of the Committee, that they were willing workers.

THE AUDITOR'S FINANCIAL STATEMENT.

Mr. R. B. MAIN (Glasgow), the Auditor, then submitted the annual financial statement, from which it appeared that the sum of the General Fund was £135 8s. 10d. with £35 5s. 3d. in hand; that the Benevolent Fund stood at £256 1s. 3d. with £211 10s. 6d. in hand; and that the total of the research fund was £78 12s. 8d. with £76 10s. 8d. in hand. He said that in the year 1893-4 they only paid £10 from the benevolent fund to one case; while in the past year they paid £35 to several cases. The fund was consequently in a much better position than it was previously. He had great pleasure in bearing testimony to the excellent way in which the accounts were kept by Mr. Carlow. The annual balances of the fund showed the wisdom of Mr. Carlow's suggestion last year, of augmenting the subscriptions. The funds of the Association were now in a thoroughly healthy and satisfactory condition; and he was sure that, as long as Mr. Carlow discharged his duties in the way he had done in the past, they certainly wished, to use an election phrase, that he might long retain his seat.

The report was approved of.

A vote of thanks was accorded to Mr. Main for his services; and he briefly acknowledged it.

APOLOGIES FOR ABSENCE.

The PRESIDENT intimated that apologies for absence had been received from Messrs. R. Mitchell, J. M'Crae, and A. Gillespie, who all wished success to the meeting.

THE PRESIDENT'S ADDRESS.

The PRESIDENT then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—My first duty is to thank you most heartily for the honour you have conferred upon me in electing me as your President for the year. Having received that honour, I trust I may also have your indulgence and assistance to help me in making this year's meeting at least equal to the previous very successful meetings of the Association.

Since we met last year, many things have occurred to try our capabilities and enlarge our experience. The excessively severe weather of last winter, while it gave us a great deal more business, also gave us many trials. In the works, extra attention had to be paid to all the plant that was likely to be affected by the frost; and even with the best supervision, the extreme cold was always getting at some unprotected place, the damage to which was generally only found out when that particular pipe or vessel had to be put to work. In many districts, the damage to the mains and services was very great; and it required the utmost exertions of all connected with the outdoor department to keep pace with the complaints, escapes, stoppages, &c. But now the winter is past; and, with brighter days, we look back with other feelings on the damage that was done—thinking that after all the frost was only like an immense testing-machine, enabling us to find out many weak places in our plant, which would otherwise have remained undiscovered for some time. Also it will lead us to increase the minimum depth of cover on our mains and services wherever we can, if we wish to keep them out of harm's way in the future.

The coal strike, which lasted for seventeen weeks, must have done incalculable injury to the trade of the country generally, as well as to the miners themselves. It says little for our advancement in these matters, that such disputes cannot be settled in some way other than by cessation of work, which on the one hand takes away the earnings that are the support of many families, and really often makes the length of the dispute depend on the amount of privation and suffering these families are able to endure, and on the other hand affects in a depressing way not only the trade in which the dispute arises, but every industry allied to it. The strike in question, affecting as it did one might almost say the foundation of our business, tried our stocks of coal to a very alarming extent; and when these were deficient—as in many cases they were bound to be—or where it was not thought advisable to let the stocks run down, the worry and expense of getting coals from new fields must have been great. Added to this, there were the difficulties that are generally to be met with when a different and strange class of material has to be used. In all, 27,000 tons of coal from the North of England were supplied to the works in Glasgow during the strike. These coals are generally supposed to take a longer time to carbonize than our Scotch coals. The time taken to burn off charges in the South is four, five, or six hours; while here three-hour charges are the rule. But, with the good quality of coke got from the English coal, we were able to keep to the usual method of charging. There may be a few stopped pipes; but those who have sufficient means for enrichment ought,

with care, to be able to deal with coals of this class in their ordinary way, when from any cause the usual supplies are not available. At the same time, a strike of such magnitude shows us the imperative necessity for having as large stocks as possible, although such storing entails a certain amount of loss and inconvenience. Still it will have to be borne, in view of the generally unsettled state of the mining industry.

It is a regular recurring source of trouble to all concerned, that the results obtained in carbonizing coals in ordinary every-day working do not more closely approach the values obtained when tests are made on small quantities. Managers who take every care, and use the best known means to get the full results, are disappointed in finding that they are far short of what may be called the ideal value of the coals they use. Those to whom the managers have to give an account, are also often inclined to think there must be a "screw loose" somewhere, when they compare the working results with the values given when the coals were bought, and find that it takes so many more tons than they expected to produce the quantity of gas that is required.

Several times it has been my duty to explain to members of gas committees or directors of some of the smaller works, who came to me for advice on this matter, that their manager, instead of being either lax or ignorant, was in reality getting very fair working results from the coals that were supplied to him; and this is mainly my reason for speaking on the subject. At the same time, the question must often arise, "Why do we not get the same results out of the coal in the retort-house that we do in the laboratory?" I do not think I am far out in saying that, in a great many cases, coals tested in a small apparatus seem to give from 15 to 20 per cent. more value in gas than is obtained from what is supplied as the same coals carbonized on a large scale.

Granting that the analysis taken on a small quantity shows the actual results obtained—and I for one do not in the least doubt this—and also that every care is taken to get what seems to be a fair sample, by taking a section of the seam or otherwise, why are we not able to get approximately the same results in daily working? It appears to me there are several reasons for the discrepancy: The heats in a small apparatus can be judged to a nicety, and altered to suit every class of coal; the whole of the gas is taken off and accounted for; no leaky lids; no cracks or holes in the retorts; no stopped ascension-pipes; no purifiers to clean out; not even testing the gas for purity, and all the other causes of loss, which must be present in a greater or less degree in every-day work, and which, taken in the aggregate, help to make up a considerable percentage of loss per ton. In addition to this, the small sample is perfectly clean; while, with coal in bulk, there is usually a certain amount of gum or dirt adhering to the coals, although they seem to look well, and have had a fair amount of screening at the pits. This may easily be shown to be the case if the coals are tested in bulk as received, and also after being rescreened. What seems to be a fairly good sample of coal will give an increase of value on rescreening of about 5 per cent.; while if the coal has a wet and dirty appearance, careful rescreening will make a difference of sometimes 10 per cent. in the value. A point that may be noticed here is that it makes a considerable difference in results if the large coal is carefully broken, and not merely smashed. In the later case, the amount of small being increased, the coal is more difficult to carbonize; and the results are sure to be lower.

Taking these circumstances into consideration, it seems to me that, although it is quite right to have laboratory tests made of the pure coal under the best conditions, the tests that buyers should take for their guidance are those which have been made in a full-sized apparatus; and the quantity taken should give a fair average of the usual quality as sent from the pits.

In connection with this subject of testing, all those interested in the exact measurement of illuminating power will be pleased that the Board of Trade Committee on Standards of Light have concluded their investigations, and have given their opinion that Mr. A. Vernon Harcourt's one-candle pentane standard is the best available unvarying standard of light, and also that Mr. Dibdin's ten-candle pentane Argand is the best standard available for practical use. All those who have had the opportunity of using these standards will, I think, agree with the finding of the Committee. It is to be hoped that very soon we shall also have a standard photometer, with plain instructions as to the method of using it.

When a universal system of standard testing for illuminating power comes to take the place of the present too elastic methods, we may hope to see even the coal tests giving us more regular results, and we shall obtain fairer and more reliable returns for the gas made in our daily working.

I do not intend to say anything about the faults and irregularities of the standard candle, as it has served us to the best of its ability for a long time, and perhaps it had to bear blame often when the fault lay elsewhere. It has been a good old servant, although I am afraid it has generally received more kicks than thanks. When the day of the new standard arrives, it will be of no use for us then to say, when the quality seems to be on the low side: "Oh, try another pair of candles; these do not seem to be burning right."

As most of my experience has been gained in large works, the great advantage of machinery in dealing with quantities of material has always been brought prominently before me. There can be no doubt that, since the cost of manual labour from various causes was materially increased, machinery in gas-works has made more rapid headway. Certainly much has been done to lower the cost of working in many places; but it is still the exception, rather than the rule, to find the bulk of the hard work done by machinery. Indeed one cannot help thinking that, if our dividends or surpluses depended more on the cost of working than they really do, a great many more new methods of doing, at least, our routine work would have been in vogue, and machinery would have been more general in all our departments. Of course, in the adoption of machinery there are difficulties to be met; and whenever a manager makes up his mind to leave the old and well-worn ways of manual labour, and adopt instead steam, hydraulic, or other power, with all the various plant required to make such power useful for his purpose, he must be prepared to face not only a certain amount of opposition, but also be ready to give a much more personal and unceasing amount of attention to the new way of working for a considerable time, if he intends it to be a complete success, than was absolutely necessary under the old deeply-rooted system. Foremen who under the old *régime* were to be thoroughly relied on, both for experience and for getting the work done in good style, have to be educated in the best methods of handling the plant, and keeping it in good order, so as to have a proper supervision of the men under them. Suitable men have to be selected and broken in to the work; and, be the installation large or small, it will certainly take a little time before the best results from the new venture can be obtained. But once got into thorough working order, the time and trouble that have been expended will be lost sight of in the satisfaction that is felt at the substantial benefits that are achieved.

In connection with this subject, a short description of some of the improvements introduced into the Dawsholm works by Mr. Foulis, our Engineer, and the saving effected thereby, may be of interest. In the retort-house our method of working is as follows: The coal to be used for carbonizing is emptied direct from the railway waggons into hoppers, which each contains, when full, about 100 tons. The different varieties of coal are brought to the hoppers in due proportions, so as to obtain an average mixture; separate hoppers being kept for shale when used, so as to prevent the shale refuse from getting mixed with the good coke. From the bottom of each hopper, a shoot conducts the coal to the breaker, where the large pieces are broken to a proper size for carbonizing, and the small is bye-passed through a screen direct to the elevator-boot, to prevent breaking where it is not required.

Each breaker is capable of dealing with 15 tons per hour, and can crack up the hardest cannels or shales. Elevators, geared from the engine which drives the breakers, raise the broken coal to overhead storage tanks, from which the charging-machines draw their supply. Each charging-machine can carry about 6 tons of coal. This is sufficient for an hour's work; the usual number of retorts charged per hour by each machine being forty, although, when required, more can be overtaken, as the actual time the machine is at work charging forty retorts is only 30 or 35 minutes. In this system of charging, the coal is pushed into the retorts in six strokes; the successive strokes being automatically shortened. The coal is dropped, in measured quantities, in front of the pusher-head when full back; and the weight of the charge can be regulated according to the heat of the retorts as well as to any part of each retort—a point that will be appreciated by good carbonizers.

The machine is actuated by hydraulic power, and is made to travel along the floor by a motor. It is worked by one man, with an attendant for closing the lids when the retorts are charged. The machines for drawing the coke are also actuated by hydraulic power, and do their work in good style; but they are made to travel along the floor by the lads who work them, as the machines are comparatively light and easily moved.

The retort-lids are opened by the firemen, who also arrange the shoots so that, when the coke is not required for the producers, it falls down into small side tipping waggons, which run on a two-feet gauge railway, laid on the producer floor. When loaded, the waggons are drawn out to the coke-yard by small locomotives, and run on to an elevated bank, where they are tipped, the coke drenched, and thrown back ready to be loaded into carts or waggons.

Parallel to each of the tipping banks is a gantry made of cast-iron columns and wrought-iron joists, carrying an eight-feet gauge railway about 15 feet above the ground level. On this railway runs a steam-crane, working a single-chain dredger bucket, taking up about 10 cwt. of coke each lift. The coke, on being lifted, is either put into the waggons direct, or is put into the hoppers of the rotary screens, of which there are two on each gantry. These screens are each driven by a small steam-engine; and they separate the coke into three sizes—large coke; small coke, suitable for blacksmiths, bolt and rivet making, &c.; and breeze, which is mostly used under the works' boilers, by the aid of forced draught. The crane on each gantry is capable of dealing with the coke from 500 retorts.

Practically, the whole of the heavy work in the carbonizing department is done by machinery; and, besides the money saving, there are many advantages. In comparing the cost of machinery with manual labour, in each case the work done is

the same, and the whole of the wages are included, from the coal-store to the time the coke is trimmed up in the coke-yard ready for loading again. In all, 240 retorts are taken, worked with three-hour charges. Each charge weighs, in our case, about 2½ cwt.; giving a total quantity of coals carbonized in the 24 hours of 240 tons. The men work on eight-hour shifts; and the number required for the 240 retorts for the 24 hours is as follows:—

Manual Labour.

60 stokers, at 5s. per shift	£15	0	0
15 fire men, at 5s. per shift	3	15	0
15 ash men, at 4s. 6d. per shift	3	7	6
30 coal breakers, at 3s. 6d. per shift	5	5	0
10 bogie drivers, at 3s. 4d. per shift	1	13	4
10 coke men, at 3s. 6d. per shift	1	15	0
3 water boys, at 2s. 6d. per shift	0	7	6
3 fore men, at 5s. 6d. per shift	0	16	6
Total	£31	19	10

Note.—In addition to the above, seven horses were required for drawing out the coke.

£31 19s. 10d. ÷ 240 tons = 31·95d. per ton.

Machine Work.

6 charging-machine men, at 4s. 9d. per shift	£1	8	6
6 drawing-machine men, at 4s. 9d. per shift	1	8	6
15 fire men, at 5s. per shift	3	15	0
15 ash men, at 4s. 6d. per shift	3	7	6
10 coke men, at 3s. 6d. per shift	1	15	0
6 pipe cleaners, at 5s. per shift	1	10	0
1 lid cleaner, at 4s. 6d. per shift	0	4	6
6 lid men, at 4s. 3d. per shift	1	5	6
3 coal-breaker men, at 3s. 8d. per shift	0	11	0
3 loco. boys, at 2s. 10d. per shift	0	8	6
3 shunters, at 3s. 4d. per shift	0	10	0
3 fore men, at 6s. per shift	0	18	0
Total	£17	2	0

£17 2s. ÷ 240 tons = 17·1d. per ton.

This gives a saving on each day's work of the 240 retorts of £14 17s. 10d.; or a saving of wages on each ton of coals carbonized, equal to 14·84d. As the cost of labour in the retort-house other than stoking varies for many reasons, the saving due to the stoking machinery is best shown by taking the stoking alone. With the same amount of work as before—viz., 240 retorts—the comparison is as follows:—

Manual Labour.

60 stokers, at 5s. per shift	£15	0	0
30 coal breakers, at 3s. 6d. per shift	5	5	0
Total	£20	5	0

£20 5s. 0d. ÷ 240 tons = 20·25d. per ton for stoking alone.

Machine Work.

12 machine men, at 4s. 9d. per shift	£2	17	0
6 pipe cleaners, at 5s. per shift	1	10	0
1 lid cleaner, at 4s. 6d. per shift	0	4	6
6 lidmen, at 4s. 3d. per shift	1	5	6
3 coal-breaker men, at 3s. 8d. per shift	0	11	0
Total	£6	8	0

£6 8s. ÷ 240 tons = 6·4d. per ton for stoking alone.

Giving a saving in favour of the machines of 13·85d. per ton. From this must be deducted the charges due to capital and depreciation, also the up-keep of the machinery, and fuel. But the wear and tear is not heavy; and deducting the cost of tools used in manual labour, 2·5d. per ton ought to cover all these charges.

It may here be pointed out that if our retorts could work off heavier charges, the saving would be greater, while making practically no difference to the men. Taking say a 3-cwt. charge (the average charge in the South), the cost would be £6 8s. ÷ 288 tons = 5·33d. per ton for stoking alone. The saving effected by the cranes and rotary screens in loading the coke is: For unscreened coke about 1¼d. per ton, and for screened coke, including the breeze, about 4d. per ton loaded into waggons.

Referring again to the stoking machinery, in addition to the saving in wages some of the advantages are: The charging by this system can be kept practically regular; or, if necessary, varied to suit the heat of each retort. The retorts are open a shorter time for drawing and charging. There is no loss of coal in charging; and the work goes on with greater regularity. Less dependence on men, as only about half the number are required, and new men are easily trained. Also, in making this alteration from manual labour to machinery, we have entirely done away with the old stoker and his heavy laborious work, which had to be performed close to the open retorts. We have instead the heavy work done by the machinery; the labour of the men being comparatively light, and done much farther away from the heat of the retorts. This being the case, a different class of men offer themselves for the work—of lighter physique, active, and intelligent. They are more suitable to deal with in every way than the lower class of labourers who were generally the only available men under the old conditions.

Apart from the carbonizing department, there are other opportunities for using machinery in a gas-works, as, for instance, the moving of the materials used for purification. In some works this is done with great advantage; but I think enough has been said to prove that the use of machinery in gas-works is entitled to great consideration, and will well repay those who adopt it.

Although a manager may be no advocate for gas of a high illuminating power, still the question of enrichment by oil is sure to be of interest to him. The matter has been brought before several of our meetings lately, with the result, I think, that the Peebles system of enrichment has been proved to have given almost universal satisfaction wherever adopted; also that the system seems to give the highest illuminating value for the quantity of oil used. In small or medium-sized works, the Peebles system of retorting the oil takes a first place; and it may be proved as well that it is also the best and most economical method of enrichment for a large works. But the feeling is abroad that something on a larger scale is required—a plant that will turn out the enriching agent wholesale, and not merely an extension of retorts with all the multiplicity of connections and details, and taking up considerable ground space.

The second system brought before us by Mr. Young seems to go in the right direction; but it has yet to be tried on a practical working scale before the same success can be claimed for it as for the retorting method. Of the Peebles system, I have no practical knowledge beyond the published results, and visiting some of the works where it has been adopted. Still I am deeply impressed by the completeness of the system. Compared with what may be called the rough-and-ready method of carbonizing coal, the Peebles system stands out as a scientific operation; and it thoroughly deserves all the success it has achieved.

The method of enrichment which has come most under my notice is that by carburetted water gas. As the plant used for making this gas may not be familiar to all here, before giving you some details as to its working, a short description of it will not be out of place. The apparatus consists mainly of three cylindrical wrought-iron vessels, about 6 feet outside diameter, lined with fire-bricks. The first vessel in the series is called the generator. It contains the fuel bed where the water gas is made. The second vessel is the carburettor, where the oil is added, through a spraying arrangement, to the water gas. The third vessel is the superheater, where the oil vapours are thoroughly gasified and fixed. Both the carburettor and superheater are filled with checkerwork of fire-bricks to give heating surface. The generator and carburettor stand about 18 feet high; the superheater being 7 feet higher. This, besides giving more heating surface, enables it to act as a chimney, to draw away any gas that may be in the apparatus when the doors are opened. At the top and bottom of the generator are connections for steam.

The primary air goes in at the bottom of the generator, with secondary air connections to the top of the carburettor and bottom of the superheater. The gases pass either up or down the generator, by a simple reversing arrangement of valves—down the carburettor, and up the superheater. When blowing, the waste gases pass away through a stack-valve on the top of the superheater; and when making water gas, the stack-valve is closed, and the gas passes through an hydraulic seal in the washer, through the scrubber to the condensers.

In addition, there are two steam-boilers of the locomotive type, giving a pressure of 80 lbs. per square inch; a small steam-pump for forcing the oil into the carburettor; a meter, for measuring the oil as it is used; and a small engine and blower, for supplying the air-blast.

The method of working is as follows: The stack-valve is opened, and air forced through the fuel (which in our case is hot coke, direct from the coal retorts). The oxygen of the air, combining with the carbon of the coke, forms carbonic acid, the bulk of which, passing through the deep fuel bed, gets reduced to carbonic oxide. This fuel gas flows from the generator to the carburetter, where a limited supply of secondary air is admitted, causing partial combustion of the carbonic oxide. This raises the temperature of the checkerwork and brick lining. At the bottom of the superheater, a further supply of secondary air is admitted; causing further combustion, and heating up of the checkerwork and lining of that vessel.

When the temperatures are sufficiently high—this can be ascertained by looking through the spycocks—the air-blast is shut off, and steam is admitted under or on top of the fuel; and as soon as the waste gases are driven out by the water gas now being made, the stack-valve is closed.

The water gas is formed by the oxygen of the water or steam combining with the carbon of the coke, and setting free the hydrogen; water gas being composed of about equal quantities of hydrogen and carbonic oxide, with a small quantity of carbonic acid, varying from 1½ to 4 per cent.

As the water gas flows into the carburettor, it meets the oil, the temperature of which has been raised by passing through a heater in the gas outlet pipe. The oil is in the form of a fine spray; and as it passes through the checkerwork of the carburettor and superheater, it is first vaporized, and then gasified into a permanent gas, with the exception of a small percentage, which is thrown down as tar in the condensers. Gas making continues for from six to eight minutes—until the temperatures are too low for proper work, when the oil and steam are shut off; the stack-valve opened; and the apparatus heated up again, as previously described.

The whole apparatus is easily worked, and is under perfect control, both as to heats and the quality of gas to be produced. The cost of gas of different qualities varies according to the value of the coke and oil used. But it must be borne in

mind, in making comparisons, that the amount charged for labour could as easily produce three or four times the quantity of gas if a larger plant was employed; also no credit is taken for the tar produced. All the illuminating values to be given are as tested direct by the photometer; and the length of the trials extends from four days to several weeks—the average being taken over the time included. The oil used in the first five experiments was Broxburn blue oil, with a specific gravity of about 840; and in the last experiment given, the oil was Broxburn once-run oil, with a specific gravity varying from 808 to 830. The coke and breeze used in the boilers are included in the figures given—

Manufacturing Charges per 1000 *Cubic Feet of Carburetted Water Gas.*

Average illuminating power	Candles. 28·53		Candles. 33·09		Candles. 36·37		Candles. 40·80		Candles. 47·13		Candles. 33·07	
	lbs.	d.	lbs.	d.	lbs.	d.	lbs.	d.	lbs.	d.	lbs.	d.
Coke, at 5s. per ton	46·40	1·240	47·90	1·280	47·90	1·280	52·30	1·400	52·90	1·412	45·30	1·210
Breeze, at 1s. per ton	3·00	0·016	5·80	0·031	5·60	0·030	7·20	0·033	8·50	0·041	15·20	0·081
	Galls.		Galls.		Galls.		Galls.		Galls.		Galls.	
Oil, at 2¼d. per gallon	4·47	10·057	5·35	12·037	6·09	13·702	6·89	15·502	9·36	21·060	5·57	12·532
Labour	..	1·600	..	1·510	..	1·630	..	1·760	..	2·202	..	1·740
Purification, estimated	..	0·570	..	0·570	..	0·570	..	0·285	..	0·285	..	0·570
Sundries	..	0·250	..	0·250	..	0·250	..	0·250	..	0·250	..	0·250
Cost per 1000 cubic feet		13·733		15·678		17·462		19·230		25·250		16·383
„ pound of sperm.		0·140		0·138		0·140		0·137		0·156		0·144
„ candle per 1000 cubic feet		0·481		0·474		0·480		0·471		0·535		0·495
	Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.		Per Cent.	
Average carbonic acid in crude gas.	3·9		3·7		2·46		1·94		1·66		4·4	
	Cubic Feet.		Cubic Feet.		Cubic Feet.		Cubic Feet.		Cubic Feet.		Cubic Feet.	
„ make of gas for 24 hours	358,500		380,500		352,200		327,000		261,500		331,000	

Although all the items are here given for 28, 33, 36, 40, and 47 candle power water gas, it will perhaps be sufficient to give you the details of (say) the 40-candle gas; and to say that the average cost per candle per 1000 cubic feet for the qualities from 28 to 40 candles works out to 0·476d. per candle; and for the gas made at 47 candles, the cost is 0·535d. per candle.

Tests were also made of the gas at different parts of the apparatus, to find out the work done by each of the vessels. It was found that, even at the bottom of the caburettor, the oil was merely vaporized. This was shown by allowing the gas to stand after being collected. On testing this gas, there was practically no illuminating power; and the oil condensed from the sample had almost the same specific gravity as the oil going into the apparatus. At different levels of the superheater, it was found that the oil vapours were being gradually broken up into gas—the lighter oils first—until at the top all the oil was gasified, and the gas had its full illuminating value.

In using the carburetted water gas for enriching the ordinary coal gas, it was found, on testing the mixtures, that the enriching value of the 33-candle gas was from 6 to 8 per cent. higher, and the 47-candle gas was at least 10 per cent. higher than the values given to them by the photometer when tested alone.

One of the chief objections to the use of water gas is the poisonous nature of the carbonic oxide which forms half its bulk. Some people seem to think that, when made use of as an enriching agent, water gas still has all its deadly qualities. That this is not the case can easily be shown. To enrich 1000 cubic feet of 18-candle coal gas (say) 3 candles, requires 158 cubic feet of 40-candle carburetted water gas. This quantity of enriching agent contains at most only 36 cubic feet of carbonic oxide; the remainder being hydrogen and oil gas. So that, in the 1158 cubic feet of enriched gas, there is at most 36 cubic feet of carbonic oxide, or 2·2 per cent. to be added to the 6 to 8 per cent. already in the coal gas, which really can make very little difference in its composition. The fatalities which occurred in Glasgow from gas escapes during the past winter were sometimes attributed to the water gas; but as some of these were in districts supplied by the stations where no water gas was used—and in the gas sent out from Dawsholm at the time, the carbonic oxide in the coal gas was only increased by the water gas made about 0·7 per cent.—there was very little foundation for any of these reports.

I have already said that the apparatus is very easily worked. Indeed, it takes but few men to produce a large quantity of gas. Also it gives an outlet for surplus coke, which is often a trouble to get rid of at a fair price. If the apparatus was used for enriching purposes, it could also, when required, turn out a larger quantity of lower quality gas, if for any reason the ordinary gas supply should run short. The wear and tear account is extremely low; and the apparatus can be let down, heated up in a short time, or kept on a slow fire with no damage to any of its parts. It takes up very little floor area; and the capital account for the gas produced is low.

When the apparatus is being employed in making gases of high illuminating power, a considerable amount of tar is produced; and though this can be sold or used for fuel, to get the proper illuminating value out of the oil, this tar ought to be returned to the apparatus and broken up into coke and gas. The difficulty that prevents this being done at present is that the tar is mixed with about an equal bulk of water; and it is very difficult to separate them. From experiments made, there is no doubt that a considerable amount of illuminating value is left in this tar or heavy oil; and the system will never be complete until this illuminating value is completely utilized.

There are some other matters I might have brought before you; but our time is very limited, and we have some excellent papers to hear and discuss. So I will close by thanking you for the patient hearing you have accorded me.

Mr. Adam MacPherson (Kirkcaldy) said he had very great pleasure in moving a vote of thanks to the President for his highly instructive address. They had all highly appreciated it; and when they had had time to read and digest it, he was sure they would appreciate it all the more. He hoped Mr. Wilson would consent to his address being incorporated in their report of the proceedings.

The President said he had very great pleasure in handing his manuscript to the Secretary for the use of the Association.

Papers and Discussions.

Mr. W. Young (Peebles) then read the following paper:—

NOTES ON THE CHEMICAL CONSTITUTION OF ILLUMINATING GAS IN RELATION TO ITS ILLUMINATING VALUE, AND ON SOME OF THE PHYSICO-CHEMICAL CONDITIONS WHICH INFLUENCE THE LUMINOSITY OF GAS-FLAMES.

The subject of my notes was first introduced to the notice of this Association some twenty years ago by our worthy member Mr. MacPherson, of Kirkcaldy, in a most interesting paper upon "The Relations which Exist between the Durability and Bromine Tests and the Illuminating Power of Gas as Expressed in Standard Candles;" * and again at our meeting at St. Andrews in 1878, in a paper on "How Should the Value of Gas be Determined?" † In these papers, it was shown that there appeared to be a proportionate relation between the hydrocarbons absorbed by bromine, the durability of a 5-inch flame, and the illuminating power; and that the illuminating power and the durability bore a fixed relation to the percentage of carbon present in the gas.

In the discussion which followed the reading of the latter paper, while admitting that, in the majority of cases, there was an approximate relation in all coal gases, as ordinarily manufactured, between the condensation by bromine, the durability of a 5-inch flame, and the illuminating power, such as to provide a ready method of approximately arriving at the probable illuminating power of a gas, I yet questioned the correctness of the inference that there was necessarily a fixed relation in those respects, or that the illuminating power bore a fixed relation to the percentage of carbon present in the gas. I pointed out that the illuminating power was far more dependent upon the mode in which the carbon was combined than upon the actual percentage present in a gas, and that the state of combination of the carbon also similarly influenced both the durability and the condensation by bromine.

At our next annual meeting, held in Edinburgh in 1879, I had the honour of reading a paper before you in further elucidation of the same subject, having for its title "The Proportion of Carbon Present in Gas in Relation to its Illuminating Power." ‡ In order to illustrate, in a striking way, the different effects, due to the structure of a gas in relation to its constituents, upon the relation between the condensation by bromine, the durability, and the illuminating power, I brought under your notice five different samples of gases, which, though all containing exactly the same quantities of carbon and hydrogen, yet possessed different volumes, and consequently differed in specific gravity and in durability, and also presented different degrees of condensation by bromine, and also differed largely in illuminating power.

The first sample consisted of methane or marsh gas (CH_4), which occupied a vessel containing 1200 cubic inches, and, when consumed in a flat-flame burner, was shown to give practically little or no light.

* See Journal, Vol. XXVI., p. 189. † *Ibid.*, Vol. XXXII., p. 164.
‡ *Ibid.*, Vol. XXXIV., p. 220.

The second sample consisted of the same quantities of carbon and hydrogen as were present in the 1200 cubic inches of methane, but arranged or grouped to form a more complex paraffin (C_6H_{14}) and free hydrogen. This, although it occupied the same volume, was shown to give, when consumed, a considerable amount of light; but it gave no condensation by bromine.

The third sample consisted of a like quantity of carbon and hydrogen arranged as ethylene or olefiant gas (C_2H_4) and free hydrogen. This, when so arranged, was shown to possess a larger volume—viz., 1800 cubic inches. But although larger in volume, yet, on account of the different arrangement of the carbon with the hydrogen, the mixed gases, when consumed, gave a highly luminous flame; and there was a very large condensation by bromine—a condensation far in excess of what would be proportional to the illuminating power.

The fourth sample consisted of the equivalent of the elements present in the 1200 cubic inches of marsh gas, arranged to form acetylene (C_2H_2) and free hydrogen. When so arranged, the volume was doubled, becoming 2400 cubic inches. Yet, although doubled in volume, and consequently having only one-half the specific gravity, and only half the durability through a given sized orifice, yet the mixed gas, when consumed, was shown to give a still larger amount of light.

The fifth sample consisted of the equivalent quantity of acetylene (C_2H_2) polymerized into benzol, and diffused in the form of vapour through free hydrogen. The carbon and the hydrogen equivalent to the 1200 cubic inches of marsh gas, when so arranged, occupied 2000 cubic inches. But, although occupying this much larger volume, it was shown, on being consumed, to give an intensely smoky flame; and, owing to the high vapour density of the benzol, the condensation by bromine would be small compared with the very high illuminating power.

Attention was then directed to the reason why carbon, in these different forms of combination, should give such discordant results; and why, when combined with hydrogen as methane or marsh gas, it should give little or no light, while the same carbon, when combined as acetylene (C_2H_2), should give a flame having an intense luminosity.

The explanation then given was that the difference was due to potential in the form of heat-energy stored up in the different hydrocarbon compounds; that carbon, when burned in, or combined with, hydrogen, gives out heat just as when combining with oxygen, but to a much smaller degree; and that while the union of carbon, even with one atom of oxygen to form carbonic oxide, develops sufficient energy to gasify the carbon from the solid form, and leave a considerable surplus of heat, the union of carbon with hydrogen in the lower forms of combination does not yield sufficient energy even to gasify the carbon. Therefore, in such forms of hydrogen and carbon compounds, energy must be supplied from some external source to bring about the union; and it is only when the carbon is combined with its full complement of hydrogen—as in marsh gas—that sufficient energy is developed to gasify the solid carbon, and leave a surplus of heat-energy.

It was also pointed out that Favre and Silbermann had found the energy of the combination of carbon with hydrogen to form the saturated hydrocarbon marsh gas (CH_4) to be not only sufficient to gasify the carbon and to effect the union, but to leave a *plus* or surplus heat of 20,420 heat-units; and that, on the other hand, when the carbon was combined with a smaller percentage of hydrogen to form the unsaturated hydrocarbon olefiant gas (C_2H_4), there was no *plus* or surplus heat produced; that in the latter case the energy was not even sufficient to gasify the carbon, but that 10,880 heat-units must be supplied from some outside source in order to effect the combination. Again, when carbon combined with hydrogen to form the still less saturated hydrocarbon acetylene (C_2H_2), there was required from some outside source no less than 55,000 heat-units. That therefore the carbon, in combining with hydrogen to form olefiant gas and acetylene, had conferred upon it a higher potential or amount of locked-up heat-energy as compared with the carbon forming the marsh gas, of 31,300 and 75,430 heat-units respectively; and that when these gases were burned, the extra amount of stored-up energy in them would be developed as light and heat. It was further stated that these hydrocarbons (C_2H_4 and C_2H_2) were not so stable compounds as the marsh gas; and they were therefore more easily decomposed by heat into dense hydrocarbons and free carbon.

At the date at which that paper was read, I was fully under the impression that these, together with the influence of the different diluents present in the gas, were the main factors influencing the illuminating power resulting from the carbon in coal gas; and, under such an impression, I thought myself fully warranted in asserting that, while there was admittedly a relation between the physical and the chemical composition of coal gas, as ordinarily manufactured, on the one hand, and the illuminating power on the other, as shown by Mr. MacPherson, yet I considered that this was accidental, and that "if at any time the conditions which make a system of manufacturing gas successful in one district of country, from its locality, or it might be the nature of the coal or other material to be dealt with, rendered it not so successful as another, and called for an altered system of manufacture, this would, in a great measure, change the nature of the constituents of the gas, and consequently all the relations which experience has shown to exist between illuminating gas and the conditions referred to in this paper."

The conditions forecast in that statement have now, to a considerable extent, come about. Our supplies of cannel are becoming rapidly exhausted, while the supplies of liquid hydrocarbons are as rapidly expanding. The change in the supply of crude materials has developed new methods of producing and enriching illuminating gas. We have the water-gas process, where the diluents carbonic oxide and hydrogen are mainly produced from the residual coke from our coal, and the illuminating power is conferred upon the gas by decomposing the liquid hydrocarbons. Such gas gives a small flame and a lower durability than ordinary coal gas. We have the carburetting of ordinary coal gas by diffusing through it the vapours of the highly-volatile hydrocarbons, both from the natural petroleum and from the artificially-prepared tars. By the former (petroleum enrichment), the flame is enlarged in proportion to its illuminating power, and the durability is increased. But bromine would scarcely effect any extra condensation, since the volatile petroleums are largely composed of paraffins. On the other hand, the benzol vapours would be entirely removed by bromine, and a small flame of lower durability would be produced. We have also the method of enriching coal gas by means of oils cracked up in various ways into gaseous compounds; and, lastly, we have had lately brought under our notice pure acetylene as a possible enriching agent.

The introduction of these new processes and the materials for the production and enrichment of illuminating gas, has brought prominently under observation various chemical and physical conditions influencing the development of light from the flame of hydrocarbons, which conditions had either previously escaped observation, or had seemed of so little practical importance as to receive little attention. My connection with the process of enriching coal gas by means of oil gas, fractionally decomposed at low temperatures, has caused me to take special note of those physico-chemical conditions; and these notes, bearing as they do upon previous communications, I propose to lay before you to-day.

In my former paper, it was shown that those hydrocarbon gases which yielded flames having the highest luminosity were those having the highest stored-up potential or heat-energy. Professor Lewes, in a recent most interesting communication to the Royal Society,* has shown that the illuminating value of a hydrocarbon gas, when consumed alone, may be approximately calculated from the heat of formation or stored-up potential energy of the elements present in each hydrocarbon.

The following table, taken from Professor Lewes's paper, shows the relative calculated and found illuminating values from the two equivalents of carbon present in the following hydrocarbon compounds:—

	Illuminating Value.		
	Calculated.		Found.
Methane	8·4	..	5·2
Ethane	35·0	..	35·0
Ethylene	60·9	..	68·5
Acetylene	202·2	..	240·0

These figures fully confirm the inferences contained in my former paper; and, if taken alone, would indicate that, in manufacturing gas, we should, as far as possible, aim at the direct production from the crude material of those gases which possess the highest potential energy.

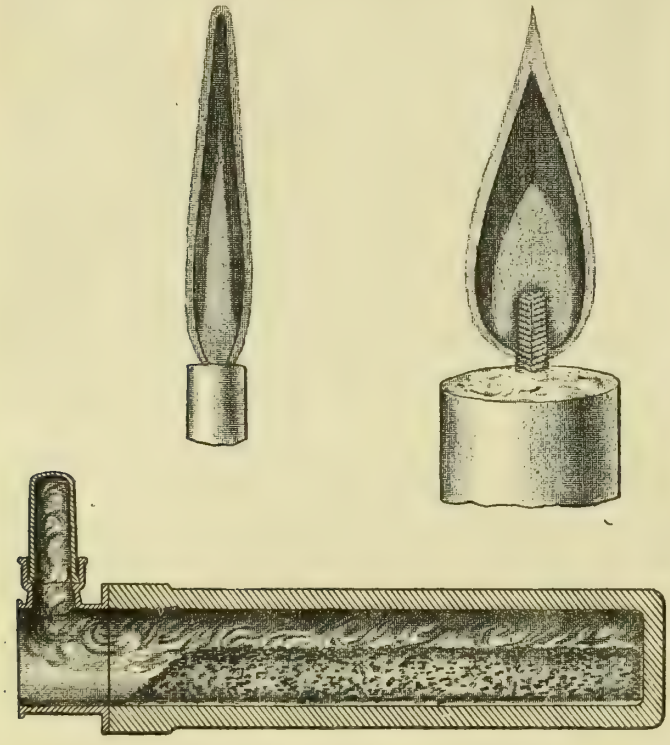
Although it is true, however, that hydrocarbon gases of high potential energy give the greatest luminous effect when consumed alone, and although, as shown by Professor Lewes, acetylene—one of those gases—plays a most important part in the ultimate luminosity of all hydrocarbon flames, it does not necessarily follow that, even were it possible to convert the whole of the volatilable carbon of our crude material into acetylene, that acetylene would be the best hydrocarbon to form part of an illuminating gas, necessarily consisting, as it does in large measure, of non-luminous diluent gases; for recent experience with enrichment processes has shown that, under such circumstances, there are brought into operation a great many conditions which influence the light obtainable from a mixture of hydrocarbon and non-luminous gases.

The flame of a candle has frequently, in the past, been taken to illustrate and explain the method by which the luminosity of a hydrocarbon flame is produced. It has been pointed out how, in the flame of a lighted candle, we have all the conditions obtaining in the production of a coal-gas flame, including both the cracking-up of the hydrocarbon and the subsequent changes which occur during the combustion of the resulting gas.

With your permission, we shall revert to the subject. I have here a diagram of a candle showing, as is generally done, three well-marked zones. Around the lower part of the wick, the melted hydrocarbon, or the fatty acid or tallow, is drawn up from the cup of the candle by capillary action, is volatilized, and a portion is consumed in forming a wall of flame which surrounds the higher parts of the wick, and supplies the heat necessary to volatilize the ascending hydrocarbons. The resulting vapours drive back the surrounding wall of flame, and, being subjected to the heat radiated from that wall of flame, are in part decomposed. The more diffusible portions of the products of decomposition pass to, and aid in forming, the outer flame-

* See JOURNAL, Vol. LXV., p. 796.

wall. So far little or no light is produced, the heat generated having been consumed in the preliminary volatilization and partial decomposition of the hydrocarbon of the candle. The temperature of the flame now rapidly increases; and the volatilized and partially-decomposed hydrocarbons continue to spread and ascend within the outer flame-wall of complete combustion. They are then subjected to the heat radiated therefrom, and undergo further chemical changes, the chief of which, as shown to demonstration by Professor Lewes, is the conversion of the original hydrocarbon into acetylene, methane, and free hydrogen. The methane, and more particularly the free hydrogen, from their greater rate of diffusion, pass out to the outer walls, and are burned; thereby still further raising the temperature of the flame. This leads to the decomposition of the hydrocarbon of high potential, and thus light is produced; for the liberated carbon particles, heated by the liberated hydrogen, remain incandescent till finally consumed in the upper part of the flame.



Let us now apply this train of reasoning to our ordinary gas plant. We have here a diagram of a retort charged with coal as the source of the hydrocarbon supply. As this hydrocarbon contains a large excess of carbon over what can be volatilized, we take and burn a portion of this excess of carbon externally to the walls of the retort till these are heated to the temperature found best suited to bring about the desired amount of decomposition. The coal resting upon the lower part of the retort has its hydrocarbonaceous portion volatilized. The vapours pass upwards into the vacant space over the coal, where they are exposed to the radiant heat of the arched walls, and cracked up, as far as possible, into compounds which will remain gaseous. These gaseous compounds, after being cooled and freed from accompanying impurities, are passed to the burner to be consumed. The flame from such a burner is shown in the second flame diagram, which represents the cross section of an ordinary flat flame. As in the case of the candle, it consists of three separate parts—an inner cone of unconsumed gas, an outer complete-combustion flame shell or wall, and an intervening cone in which the hydrocarbon gases are being acted upon by the heat radiated from the outer flame-walls. Although, however, the gas-flame appears to consist of three separate parts, the conditions obtaining within the inner parts are much less complex than those in the candle. The hydrocarbons are already in the gaseous form, having had the potential or heat energy of a part of the carbon burned outside the retort conferred upon them; and they are thus diffused through a large volume of diluent gas. This diluent gas would, in the case of the candle, be to a large extent consumed in the outer shell of the candle-flame in doing the work of volatilizing and chemically changing the hydrocarbons preparatory to final rupture into their elements. In fact, the candle may be looked upon as a retort within a retort; the inner one consists of a wick supplying a continuous stream of hydrocarbon, which is volatilized by the combustion of a part of the hydrocarbon, supplemented by the radiant heat from the walls of the second retort. These second retort walls are composed of the transparent gases undergoing complete combustion. The intervening space is filled with the vapours from the wick; and these vapours are there subjected to chemical changes which set hydrogen free, which confer upon the altered hydrocarbons a higher potential of energy, and which finally bring about the decomposition of these hydrocarbons and their rupture into their elements.

We thus see one of Nature's ways of doing the carbonizing or retorting of a hydrocarbon when her object is to produce light by the combustion of that hydrocarbon in the form of a gaseous flame. On former occasions, I have had the honour of drawing your attention to the important part radiant heat plays in the economical carbonizing of coal in the retort. I think the flame of a candle bears strong testimony to the soundness of that opinion. On the other hand, when Nature's object was to supply man with liquid hydrocarbons in the shape of petroleum, her retorting or carbonizing was done in a retort with no empty space in which radiant heat could effect the gasification of the hydrocarbons produced; and when man came to imitate Nature, in obtaining liquid hydrocarbons from solid coal and shale, he was not long in discovering the gasifying effect of radiant heat in empty space inside the retort, and in devising a retort which had no empty space. That retort was then equivalent to the wick of the candle, surrounded by walls close to it heated externally; the volatilized products being prevented from escaping into space by being drawn off at the top of the wick, and passed to the condensers. In like manner, we may take a lesson as to how coal should be carbonized; that while contact-heating may be economically employed to volatilize the hydrocarbon of the gas-making material, the actual decomposition of the hydrocarbons should, as far as possible, be effected by radiant heat.

It will be observed that the essential difference between the production of light from a hydrocarbon by a wick-fed flame and that produced by the pre-carbonizing of a hydrocarbon in retorts, together with a gas-fed flame, consists in the fact that such carbon as is present in the hydrocarbon in excess of what can be gasified, is very differently utilized in the two cases. In the wick-fed flame, the decomposition of the hydrocarbon is largely effected—first by the complete combustion of a portion of the hydrocarbon in the lower part of the flame, and thereafter by the combustion of the hydrogen and marsh gas, as produced during the different stages of decomposition in the outer flame-wall of the flame. The carbon set free takes a comparatively feeble part in the work of decomposition, for it is burned away only when it reaches the upper part of the flame, where most of the work, preparatory to the final decomposition has been already effected. The carbon thus mainly contributes to the luminosity of the flame through the incandescence due to its own combustion.

Where the hydrocarbon is first carbonized, the carbon in excess of what can be gasified is isolated, and burned outside the walls of the retort, and is therefore applied to the volatilizing and gasifying the volatilizable part of the hydrocarbon, and conferring upon it a part of its heat energy of combustion in the form of stored-up potential energy. Then the liberated hydrogen and marsh gas, not being consumed as produced, are left to form a part of the gas, and still further to raise the potential energy of the gasified hydrocarbon before final dissociation takes place in the flame. The stored-up or potential energy is instantly liberated when the hydrocarbons are decomposed into their elements, carbon and hydrogen; the result being, as we have already explained, the production of increased luminosity.

It will thus be seen that the method of obtaining light from a hydrocarbon, by pre-carbonizing in retorts and combustion in a gas-fed flame, possesses advantages over that of a wick-fed flame in so far as it enables better control to be maintained over the changes, chemical and physical, which ultimately result in producing light. In order, however, to get the full advantage of the, so to speak, double-retorting system with a gas-fed flame, it is necessary to adjust the relations between the potential energy conferred upon the volatile hydrocarbons while these are undergoing gasification within the heated walls of the retort, and the potential energy subsequently to be further conferred upon them by the chemical and physical changes which take place inside the flame-walls during the second retorting process. The object is that at the final rupture or dissociation there shall be present in a flame as large a percentage of hydrocarbon of high potential energy (acetylene) as possible.

Different hydrocarbons require different temperatures in order to bring about that adjustment between the changes which it is desirable to effect in the prior retorting process, and those which it is desirable should be subsequently brought about in the flame by the heat of the non-luminous gases unavoidably produced in the prior retorting process. Should the temperature of the prior retorting process be too high, changes are brought about within the retort which should only take place within the flame; carbon being precipitated there instead of being left as volatile carbon to be precipitated in the flame, and an excess of non-luminous heating gases is produced which cannot be devoted to bringing about beneficial changes in the accompanying hydrocarbons.

If, on the other hand, the hydrocarbons to be rendered gaseous by the prior retorting have to be used diffused through coal gas in order to increase its illuminating power, recent experience with oil-gas enrichment processes has shown that, in consequence of the coal gas possessing a large surplus of potential or heat energy in its non-luminous or feebly-luminous constituents which can be economically employed in raising the potential energy of the hydrocarbons, the lower the temperature at which the hydrocarbon can be pre-retorted or cracked-up, the greater is the percentage of carbon that can be permanently

gasified and rendered available for carburetting. And although the hydrocarbon so gasified has less heat potential, the difference is nevertheless far more than counterbalanced by the utilization of the surplus heat energy of the non-luminous portion of the coal gas in effecting chemical changes in the flame, and also by other physical conditions influencing the luminosity obtained from a given hydrocarbon. The surplus heat energy of a gas-flame is similarly advantageously employed when the coal gas is carburetted by means of the vapours of very volatile hydrocarbons.

It has long been known that different non-luminous and feebly-luminous diluents—such as carbonic oxide, hydrogen, and marsh gas—had very different effects upon the illuminating power of highly luminous hydrocarbons when diffused through them and burned; and that carbonic oxide had a greater diluting effect than hydrogen, and hydrogen a greater effect than marsh gas, even after making allowance for the original feeble luminosity of marsh gas. It is only, however, since the introduction of the various carburetting processes that it has been observed that not only had the various diluents that difference of effect, but that different hydrocarbons were also very differently influenced in their luminosity by being diluted with the various diluents referred to, including coal gas; that while oil gas, produced at low temperatures, when commingled with certain percentages of diluents, gave an aggregate luminosity largely in excess of what could be obtained from the undiluted gas—or, in other words, was benefited by dilution—oil gas produced at high temperatures, as also acetylene gas, when diluted to a like degree, were not benefited to the like extent; or, as in the case of acetylene gas, gave a luminosity very much less than could be obtained by the combustion of the pure gas.

It has also been observed that hydrocarbons having the same percentage of carbon and hydrogen in their composition, but differing in density, are very differently affected by diluents; and that the denser the compound, the greater is the enriching value per unit of carbon present. Thus the six atoms of carbon associated with six atoms of hydrogen in the three molecules of acetylene had not the same enriching value as the same number of carbon and hydrogen atoms, equivalent to three molecules of acetylene, but polymerized into one molecule of benzol.

To enable us to follow the manner in which the various forces operate during the combustion of a hydrocarbon so as to bring about those observed results, we must again refer to the structure of the gas-fed flame, the action of which I shall again ask you to look upon as a carbonizing or retorting process. The walls of the retort are composed of the products of complete combustion of the constituents of the hydrocarbon, and are practically transparent to the ethereal waves of light generated by the chemical changes which occur within the flame. These chemical changes are brought about by the radiant heat from the intensely heated gaseous walls of the flame-retort.

On a former occasion, at a meeting of the kindred Association now merged in this, I drew attention to the influence of the force of diffusion of gases during the carbonizing of coal inside a clay retort, and showed how the porous walls of the clay retort allowed an exchange of the gases inside the retort and those outside it, at rates proportional to the square root of their respective densities. Now, although the wall of our combustible retort is composed only of highly-heated gases, yet that gaseous wall will nevertheless exercise a similar effect, though a modified one, to that exercised by the porous walls of the clay retort; and the more perfectly this outer flame-wall is maintained by a careful regulation of the pressure of the gas at the point of ignition, so as to prevent induced currents of air or gas, the more perfectly will this outer flame-wall take upon itself the function of a previous diaphragm in influencing the action between the combustible gases inside and the supporters of combustion outside; and the more perfectly will it also act in other respects as the wall of a retort, in the manner to be immediately brought under your notice.

The relative affinities for oxygen of the various constituents of the illuminating gas have also to be taken into account; for although the outer flame-wall of the retort may, by carefully regulating the pressure of the gas at the burner, be made to act fairly effectively, yet some oxygen will always be carried into the interior of the flame, and those constituents of the compound gas which have the greatest affinity for oxygen, under the conditions obtaining within the flame, will be the first to seize upon such intruded oxygen.

Professor Clowes recently communicated to the Federated Institute of Mining Engineers the results of a series of experiments in which flames were burned in an enclosed volume of air, maintained at atmospheric pressure, till each flame was extinguished by the products of its own combustion, and the atmosphere that had extinguished each flame was then analyzed.* The results showed that a paraffin flame was extinguished when the oxygen fell to 16·6 per cent.; a candle flame, 15·7 per cent.; a methane flame, 15·6 per cent.; a carbonic oxide flame, 13·35 per cent.; and a coal-gas flame, 11·35 per cent.; while a hydrogen flame was not extinguished till the oxygen present fell to 5·5 per cent. The conditions under which these tests were made, being very much those obtaining in a gas-fed flame, will in all probability indicate the relative affinities for oxygen of the substances named.

* See JOURNAL, Vol. LXV., p. 1313.

As the heat which effects the work of altering the chemical constituents of the hydrocarbon gas is necessarily largely radiant heat, from the outside highly-heated gaseous wall of the flame, the power of the constituents of the gas to respond to, or take up, this radiant heat will, of necessity, considerably influence the resulting changes which occur within the flame. I have already explained to you my views in regard to the selective action of radiant heat upon the hydrocarbon vapours evolved from the coal inside a gas-retort; how the radiant heat from the walls of the retort passes freely through the simple gases, but is more and more freely absorbed as the hydrocarbons become more complex in their constitution. Although, however, the simple gases cannot readily respond to, and be heated by, radiant heat, they have the power, when commingled with complex hydrocarbons, of largely modifying the effect of radiant heat upon these, by taking up the molecular motion or heat absorbed by the complex hydrocarbons, and becoming themselves heated by contact.

There is no doubt that the heat radiated from the gaseous highly-heated flame-wall acts upon the constituents of the gas in the interior of the flame in a very similar manner. The power which the hydrocarbons possess of taking up the radiant heat enables the long heat waves from the flame-wall to effect changes which confer potential energy upon the hydrocarbons; and this results, at the moment of ultimate decomposition, in the production of short waves of light.

The interactions between the hydrocarbons in the gaseous flame have, no doubt, also a considerable influence upon the luminosity of a flame. These interactions are not well understood; but Professor Lewes has shown that whatever the original hydrocarbons may be, they are very largely converted into acetylene before undergoing final dissociation into their elements. There is little doubt, however, that, both in the process of cracking a hydrocarbon inside a retort, and also during the cracking up and changing the hydrocarbons into acetylene in the interior of a gas-flame, both hydrogen and carbon are partially set free without passing through the acetylene stage; and it has occurred to me that this free carbon is itself largely conducive to the formation of acetylene and other hydrocarbons of high potential energy, and that even the carbon set free from the dissociation of the acetylene may take part in the subsequent changing of the methane produced at the time of the formation of the acetylene from the other hydrocarbons. For instance, methane and ethane have a low potential of stored-up energy; and they produce, when burned, a small amount of light in proportion to the carbon which they contain. Both these gases, especially the former, may be passed through a length of empty tube heated to a high temperature. In that case only a very small portion undergoes decomposition, and that principally at the surface of the tube. This is due to the fact that the radiant heat from the walls of the tube is only feebly absorbed by such gases, and cannot therefore readily effect any decomposition. If, however, the tube be filled with a solid substance, such as graphite or pounded retort carbon, presenting a large surface which can take up the heat and be raised to a high temperature, the gases, on being passed through, are then largely decomposed—the carbon of their constitution being left behind on the highly-heated solid surface. Contact heat has thus effected what radiant heat had failed to accomplish.

The conditions obtained when methane is burned alone are exactly analogous to those of methane passed through the highly-heated tube. The outer highly-heated walls of the methane flame radiate heat through the methane contained in the interior of the flame. Methane, however, is but feebly acted upon by radiant heat; and only a very small portion is brought into the condition necessary for the production of light.

If the methane has diffused through it someother hdyrocarbon which possesses, in a high degree, the power of absorbing radiant heat, and is therefore readily decomposed, conditions are brought about exactly analogous to those in the highly-heated tube filled with solid material, for the radiant heat from the hot flame-walls, falling upon the carburetting hydrocarbon, is absorbed by it, and causes it to undergo changes which ultimately lead to its dissociation into its elements. The solid carbon particles thus set free, being also good absorbers of radiant heat, become highly heated; and the methane in contact with these highly-heated particles is acted upon by the contact heat, which thus brings about those conditions in the flame which lead to increased luminosity.

It will thus be seen that, while the action of contact heat by surface is highly advantageous in the flame (setting free carbon to produce luminosity), the same action inside a gas-retort would be highly objectionable, as it would rob the hydrocarbon gases of carbon which should only be set free in the flame.

The chemical changes which are brought about in different hydrocarbons by contact heat are no better understood than the changes induced by radiant heat. As already stated, Professor Lewes has shown that, in whatever way the changes are brought about, most of the hydrocarbons contained in a flame are converted into acetylene before final dissociation into their elements; and that, if the changes are arrested after the change into acetylene has taken place, the acetylene polymerizes mostly into hydrocarbons belonging to the benzol group. Dr. Dvorkovitz has also shown that a potent factor in changing

hydrocarbons belonging to the paraffin and olefine groups into the benzol group, by heat, is surface contact. These two facts, taken together, would point to the solid particles present in a flame playing an important part in bringing about the chemical changes therein which lead up to luminosity, and would at least partly explain why the commingling with hydrocarbons of low potential—such as methane—of hydrocarbons which have a high power of absorbing radiant heat, and are easily decomposed, with the liberation of free carbon particles, leads to the apparent high enriching value of the latter when diffused through the former.

There are two theories as to how the luminosity of a hydrocarbon flame is brought about. One is that of Sir Humphry Davy, that the luminosity of a hydrocarbon flame is solely due to the solid particles set free from the decomposition of the hydrocarbon in the flame, and heated to incandescence; the other, that of Dr. Frankland, who challenged the solid-particle theory, and showed that flames of some substances, which could not possibly contain solid particles of any kind at the temperature of the flame, but whose vapours were very dense, produced highly luminous flames. Dr. Frankland further showed that substances yielding flames that were non-luminous, or feebly luminous, under ordinary atmospheric pressures, became highly luminous when burned under high pressure; and he inferred therefrom that the luminosity of the flames of hydrocarbons was due to the incandescence of extremely dense hydrocarbons in the flame.

While satisfied that the luminosity of hydrocarbon flame may be partially brought about in accordance with both theories, neither of these fully accounts for some of the observed results previously referred to; and it has occurred to me that an explanation may be found in supposing that, at the moment of decomposition or dissociation of the molecule within the flame, the decomposition or dissociation enables the molecule to shake the surrounding ether into waves of light, and that this power can be conferred upon molecules either by stored-up energy, as in the case of hydrocarbons like acetylene, or still further by densifying such hydrocarbons by polymerization, or even by mechanical condensation or pressure, as is the case when non-luminous gases are burned under high pressure with the evolution of light.

In other words, just as, by raising the temperature of solid substances by means of non-luminous heat, a power is developed in them of transmuting the long heat-waves into short light-waves, so the hydrocarbons in a flame can be so changed in their physical and chemical condition, by the stirring up of the non-luminous heat-energy in the molecules of the hydrocarbon or in densifying the molecules, so that, when they come to be decomposed or dissociated into their elements, they can convert the stored-up energy of the long heat-waves into light-waves; and, again, by burning non-luminous gases under great pressure, the mechanical energy expended upon the densification of the gas confers upon the molecules the power of emitting light at the instant of dissociation in the flames.

The energy of the high-temperature heat, when expended upon heating up carbon, enables the vibrating carbon to transmute the long heat-waves into short waves of light. The carbon so heated communicates its heat to whatever may be brought in contact with it; and therefore a flame which owes its luminosity to solid particles will emit light dependent upon its temperature —such temperature being measurable by thermometric instruments.

The energy of the radiant heat, when expended upon effecting chemical changes in the hydrocarbons, is converted into stored-up molecular energy in the hydrocarbon compounds of high potential energy. Such stored-up energy becomes latent, and is not sensible to thermometric instruments; and it does not necessarily assume the form of heat of high temperature in order to produce light. According to the latter supposition or theory, it does not do so, but is largely converted directly into light at the instant of dissociation, and never becomes measurable by thermometric instruments.

It so happens that, in the case of hydrocarbons, the stored-up molecular energy, liberated at the instant of dissociation, is necessarily accompanied by the liberation of solid carbon. That solid carbon may take part in the conversion of the stored-up energy into light. But the fact, demonstrated by Frankland, that flames may be highly luminous in the absence of solid particles, makes it highly probable that the stored-up energy of the hydrocarbon is transferred to the ether by the carbon while still in the state of vapour, and that the action of the solid carbon particles is largely confined to the part of taking up the non-luminous heat-radiations, and transmuting their energy into that of light. The fact that the luminosity of the flame from the combustion of hydrocarbons can be calculated, as shown by Professor Lewes, from their heat of formation or stored-up energy, also points in a like direction.

Professor Lewes has carefully tested, with very delicately-constructed instruments, the temperatures of the various portions of the flames of acetylene, ethylene, and coal gas, with the following results:—

Portion of Flame.	Acetylene.	Ethylene.	Coal Gas.
Non-luminous zone	459° C.	952° C.	1023° C.
Commencement of luminosity .	1411	1340	1658
Near top of luminous zone . .	1517	1865	2116

These gases, when consumed in the burner best suited for their combustion, give the following illuminating values:—

Acetylene	240·0 candles.
Ethylene	68·5 „
Coal gas	16·8 „

It will be observed that, when tested by thermometrical instruments, the gases, as they rise in stored-up molecular energy, which can largely be directly converted into light at the instant of dissociation, give flames of lower and lower temperatures; but, when tested by the photometer, the emitted light rises as the molecular energy rises.

In the case of coal gas largely composed of non-luminous or feebly-luminous gases, with only a small quantity of hydrocarbons upon which the heat-energy of the non-luminous gases can act in conferring the power of transmuting their heat-energy into radiant heat and light, the flame retains its high temperature, and heats up the part of the thermometric instrument inserted in it to a temperature approximately equal to its own.

By carburetting the coal gas, or by supplying the coal gas with a Welsbach mantle, we should enormously increase the light, through giving the non-luminous gases something upon which their heat-energy can be expended in transmuting the heat of the flame into radiant heat and light. But in both cases the temperature of the flame would fall.

As we have seen, ethylene possesses a certain amount of stored-up potential energy in excess of that of its separate elements. But, as shown by Professor Lewes, before undergoing final decomposition into its elements in a flame, it has to undergo a change into acetylene; and this involves the work of splitting off so much hydrogen. The heat resulting from the combustion of this free hydrogen will be partly expended in bringing about the chemical changes into acetylene, the dissociation of which produces light, and in heating up the liberated carbon, and conferring upon it the power of radiating light and heat. Thus the temperature of the flame is kept lower than that of the coal-gas flame.

Acetylene possessing a high potential energy, on undergoing decomposition or dissociation into its elements in the flame has that stored-up energy largely converted directly into light; and since the liberated hydrogen is small in quantity, the energy developed by its combustion can be, in proportion, more fully expended upon the carbon in endowing it with the power of radiating light and heat. The temperature of the flame is thus kept comparatively low, while the flame itself emits much light.

It would therefore appear that, if it is desirable to develop the energy evolved by the combustion of a hydrocarbon or compound gas (of which the constituents are decomposable or dissociable by heat) so as to produce a flame of high temperature, it is necessary, in order to prevent that inter-molecular work being done, that the supporter of combustion should be intimately commingled with the decomposable gas, so as to prevent decomposition or dissociation of the hydrocarbons into their elementary condition prior to their complete combustion, and also that the combustion should be as rapid as possible.

With regard to the observed difference in colour between the various hydrocarbon flames—as, for instance, between the white light from the low-temperature flame of acetylene, and the comparatively yellow flame of ethylene—it has occurred to me that the difference may be due to the relative proportions of light coming from the several sources in the flame; that the stored-up energy in the hydrocarbon is directly evolved at the instant of dissociation as white light, while the light subsequently emitted by the liberated carbon varies in colour according to the temperature of the flame; and that, further, as carbon is one of the elements that can assume various allotropic forms, and has also the power of holding in association with itself small quantities of hydrogen at extremely high temperatures, the carbon liberated from the various hydrocarbons may be under different conditions or forms, and may also hold in association varying proportions of hydrogen, which will confer upon it different powers of taking up non-luminous heat at a high temperature, and transmuting it into light. The aggregate light produced would then have different colours, much in the same way that incandescent mantles give different coloured light, dependent upon their constituent elements.

The deductions to be drawn from these notes are—

1.—That, when a solid or a liquid hydrocarbon has to be converted into illuminating gas, the cracking-up or carbonizing process inside the retort should be done at such a temperature, and under such conditions, as will produce the largest percentage of gaseous hydrocarbons suitable for the purpose of taking up the heat of the non-luminous gaseous part of the flame, and utilizing that heat in the production of changes which enable that non-luminous heat to be transmuted into light; and that radiant heat plays an important part in bringing about those changes, both in the retort and in the flame.

2.—That non-luminous gases act in two ways: (1) While in contact with the hydrocarbons in the body of the flame, they withdraw heat from the hydrocarbons which have the power of absorbing the non-luminous radiant heat from the flame-walls. They thus retard or prevent those changes which lead to the storing up of the radiant non-luminous heat in the hydrocarbons; and they also tend to prevent the final dissociation of those hydrocarbons into their elements, and thus tend to cause loss of luminosity. The power of diluents to retard chemical change in

the flame appears also to be influenced by the specific gravity or density of the diluting gas; the diluent of greatest density having the greatest retarding influence. (2) On reaching the outside of the flame, the combustible diluent gases evolve heat, which is capable of bringing about those changes conducing to luminosity which they retard or tend to prevent while in the body of the flame.

It is the balance of these two effects which decides whether the luminosity of a hydrocarbon will be increased or diminished by dilution with non-luminous combustible gases. When the hydrocarbons possess the power of absorbing non-luminous radiant heat, and of being thereby converted into hydrocarbons of high potential energy, they are capable of being largely benefited by combustible dilution, especially with hydrogen or methane. On the other hand, with hydrocarbons such as acetylene, which cannot, in the gaseous state, have a higher potential conferred upon them by radiant non-luminous heat, diluents reduce the illuminating power of the hydrocarbon.

3.—That the non-luminous flame-wall of a luminous flame performs the functions of the hot wall of a gas-retort, in so far as it acts as a pervious separator between the carburetted gases inside the flame and the external air; and that radiant heat from the flame-walls brings about similar changes inside the flame to those inside the retort—the essential difference being that, as the flame-walls are transparent, they allow of the resultant luminosity being seen, and the evolution of light.

4.—That the effect of diluents upon hydrocarbons is considerably modified by their specific gravity or rate of diffusion, and by their affinity for oxygen. Thus hydrogen, although volume for volume it produces about the same amount of heat at nearly the same temperature as carbonic oxide, is by far the better diluent, owing to the fact that, from its high rate of diffusion, it rapidly finds its way from among the hydrocarbons to the outside of the flame; and thus its injurious action inside the flame is greatly lessened, while the useful heating effect is brought more effectively into action. The high affinity of the hydrogen for oxygen also enables it to take hold of any oxygen which may have found its way into the flame, and thus to prevent the premature destruction of the hydrocarbon. The specific gravity of hydrocarbons has a similar influence. Thus acetylene, having a specific gravity approaching that of carbonic oxide, will, by diffusion, pass to the outside of the flame even more quickly than that diluent; while benzol vapour, having three times the gravity, will diffuse much more slowly, and will therefore remain longer within the body of the flame under the influence of the heated flame-walls, and so will produce a greater amount of light.

5.—That the free carbon present in a luminous flame, being heated by radiant heat from the outside walls, acts by surface contact in bringing about changes of the hydrocarbons, especially of those which have a low absorptive power for radiant heat, such as marsh gas. This leads to increased luminosity of the flame.

6.—That the stored-up energy in hydrocarbons such as acetylene, and still more in polymerized acetylene in condensed molecules, such as benzol, &c., is liberated or given out, at the instant of their decomposition or dissociation, largely as light, and in great part never takes the form of heat; and that while the energy, radiated away in the form of light, can be measured by the photometer, the temperature of the flame, as measured by thermometric instruments, is low.

7.—That the differences observed between the colours of hydrocarbon flames may arise from three causes: (1) The stored-up energy in the molecules of hydrocarbon is directly emitted as white light; (2) the light emitted by incandescent carbon varies in colour according to the temperature to which it is raised; and (3) the last is probably modified by the allotropic state the carbon may assume at the instant of dissociation from the hydrogen, and also by the small quantity of hydrogen held in union with it, either chemically or physically.

The subject of these notes is at present receiving a large amount of attention, and, had time permitted, I should have liked to go more fully into details on several points referred to, and necessarily omitted, more particularly into the influence of the different forms of burners, and of the pre-heating of the air supply upon the conditions which affect the production of light from illuminating gas. The paper has, however, already assumed dimensions which, I am afraid, have taxed your patience to the utmost. Besides, my main object in recurring to the subject of my notes was to explain why hydrocarbon gases and vapours, having the same illuminating power when consumed alone, should have such different enriching values; and why oil gas produced at low temperatures should have a higher enriching value than a gas from the same oil cracked up at a high temperature, more particularly when commingled with water gas; and I trust that what I have been able to communicate has not only satisfied you upon that point, but also added somewhat to our general knowledge of the conditions influencing the luminosity of hydrocarbon flames.

Discussion.

The President said they had had a most interesting and instructive paper from Mr. Young; and he thought the best way they could do honour to it would be to have as good a discussion upon it as possible.

Mr. A. MacPherson (Kirkcaldy) said he thought the first duty they had to perform was to acknowledge their very deep debt of gratitude to Mr. Young for the labour he had bestowed in preparing such an elaborate and instructive paper, and for the exceedingly lucid and interesting manner in which he had placed the subject before the members. It was a paper which one could not deal with right off, as it required a great amount of consideration. There was such a vast amount of important information conveyed in such a small space, that really it was impossible, in any discussion which could take place there upon it, to do anything like justice to it—in fact, they could only touch the outer fringe, and even then in a very feeble way. At the outset, he might say that it was certainly very gratifying to him, if any feeble effort of his own, put forth some twenty years ago, had been the means of bringing out the communication which had been placed before them that day. It seemed to him it was evident, from the various communications they had recently had, from Professor Lewes and Mr. Lewis T. Wright, that Mr. Young and himself had been twenty years or so before their time. It was, he thought, about twenty years since Mr. Young and he first had controversies over this subject; and the gentlemen he had named were now investigating what was really the part that hydrocarbons played in the luminosity of flame, which he and Mr. Young then took up. Though at that time they disagreed, and each held strongly and stubbornly to his own cause, it was gratifying to see that further investigation had proved that their different positions were quite reconcilable, and that each was, in his respective position, right, and that each of their positions was necessary to arrive at the complete elucidation of the subject. He hoped Mr. Young would bear him out in the statement that they each took up a certain position, which further investigation on the part of Mr. Young had proved to be correct. What he (Mr. MacPherson) then maintained, and what, he believed, Mr. Young was prepared to admit, was that the carbon found in a gas was what should regulate its illuminating value; and that, as coal gas was manufactured in Scotland, they might say that, if they found a certain amount of carbon in gas—the light-giving hydrocarbons being chiefly the olefiant series—they might depend upon receiving a certain amount of luminosity from the gas. Of course, this was always premising that the gas was properly burned. They had had the whole of this illustrated in a very practical and very simple manner; and Mr. Young had brought his theories before them in a way that they could quite comprehend, as he had selected as the method of illustration the working of their retorts, and had shown them that the destructive distillation which really took place within them very nearly resembled the changes which occurred in a gas-flame. He (Mr. MacPherson) thought they might gather from the paper that while it was of the greatest importance that they should carefully guard against the destruction of the light-giving hydrocarbons in the retort, they should also carefully see that gas was consumed in such a way as to give the utmost luminosity. Mr. Young, he thought, had plainly shown that it was possible to destroy the illuminating power of the gas in the retort; and he thought he had shown that it was equally possible to destroy the best possible gas by burning it under conditions not at all fitted for developing the luminosity contained in it. He had told them that different hydrocarbons required different temperatures. Well, they all knew that every coal had its own temperature, at which it ought to be carbonized if they wished to obtain the best possible results both in quantity and quality. Mr. Young had shown them that different hydrocarbons also required different temperatures in the flame, and the very important part which these different temperatures played in developing the luminosity from the different hydrocarbons which might be contained in the gas. He (the speaker) thought that Mr. Young had fully proved his claim to what he stated some sixteen years ago in the Society of Arts Hall in Edinburgh—that it was entirely dependent upon the form in which the carbon was in the gas that they would obtain the luminous effect from it. He showed them that the same amount of carbon, burned in different compounds, gave very different results; and he thought that Professor Lewes and Mr. Lewis T. Wright (who were still working upon this subject) might have taken the trouble and have looked back, and they would have found that Mr. Young long ago discovered it, and brought it before the Association. He had, since then, considerably advanced, and been enabled to further strengthen the position he took up at that time; and he was sure they would all agree that it could be in no better or abler hands than Mr. Young's. They certainly all hoped he might be able to continue his investigations until he arrived at what they must regard as a full and perfect knowledge regarding the combustion of a gas-flame. There could be no doubt that the surplus energy in the diluents in ordinary gas-flames were taken advantage of by Mr. Young in his oil-gas process. It could be brought home to them very easily, if they only considered that there was a great amount of energy wasted in an ordinary gas-flame. If they brought into the flame certain material on which the energy could be expended, they would get a much greater amount of light from a smaller proportion of enriching material suitable for developing the light, than they otherwise could expect; and they obtained it almost, he might say, for nothing at all, because, while the hydrocarbons were passed through, they also lowered the temperature of the flame. This lowering of the temperature, he would say, had a double advantage—it enabled

them to realize the value of the hydrocarbons which were brought there, and which were dissociated by the amount of heat they absorbed, and converted the otherwise wasted heat into light. Also they must remember that the lower the temperature of the flame, the lower would be the temperature of the rooms; and they all knew that a very great amount of complaint was often made of the over-heating of rooms by ordinary coal-gas flames. Therefore, he would say that oil-gas enrichment would be a double benefit. Mr. Young had also very beautifully illustrated to them the manner in which the various forces operated to bring about decompositions which he had observed in the flame, and the interchanges which took place therein, in a manner also familiar to them—choosing a process which took place in their retorts to illustrate the changes which occurred in the flame. He had also shown them what the influence of pressure was on the development of light. They all knew now the great benefit that was derived from the use of governors. Mr. Young had told them that the outer wall of flame must be carefully preserved intact, so that no intruder might get inside to spoil the chemical actions which were going on there, and consequently reduce the amount of luminosity which they would otherwise get. This showed them that, while they previously thought that a governor was merely of use in retarding the flow of the gas, and thereby suspending the solid particles of the flame for a greater period—and no doubt that was part of its service—they were shown that there was a far more valuable use for a governor, which was in preserving the outer wall of the flame, as Mr. Young had pointed out, than in the mere suspension of the solid particles of the flame for a longer or shorter period. He had also touched upon high temperatures in the cracking-up of oil. Well, that might account for the number of very variable reports which they had seen given by different persons who used oil. Some of them, perhaps, cracked-up the oil at too high a temperature; while Mr. Young told them that if they wanted to get the greatest amount of illuminating material out of oil gas, the oil must be cracked-up at a low temperature. They knew that if they distilled coal at too high a temperature the same thing took place—they deposited the carbon which went to make light, inside the retorts, and impoverished the gas. As he said before, it was impossible to do anything like justice to Mr. Young's paper there; but these were a few of the points which he had noted. The paper reflected the very highest credit on Mr. Young. He had put himself to very much trouble to carry out his investigations; and he (Mr. MacPherson) was most happy to say that, while of old they crossed swords freely, their friendship never on any account wavered. It only served to strengthen it; and he hoped that now, when their courses were in a sense met, their friendship would increase the more.

Mr. A. Bell, sen. (Dalkeith), expressed the pleasure with which he had listened to the paper. They knew that Mr. Young had been in poor health for some time; but however he might have suffered physically, he was sure they would all agree that mentally Mr. Young was pretty sound. There was one point which Mr. Young had cleared up to him, and which he was very much pleased at. He had the pleasure of hearing Professor Lewes's paper, which was very lucid and clear; but on one point to him it was obscure—that was where the acetylene would not act as an enricher if a diluent were present. It struck him then that perhaps acetylene was one of those "bloated aristocrats" who would have nothing to do with a poorer neighbour. But Mr. Young had given them the reason—that it was not a completed compound. It was ready to fall down, it was in an unstable condition; and therefore (at least that was his view) the diluents simply separated the molecules of acetylene and kept them asunder. Thus the more the diluents were added, the less the illuminating power of the gas. Other gases—such as their oil gas—were more in a condition to be baked, and put into a condition for flame by the outer heat of the walls. Acetylene was already in that condition; and therefore it could not stand the heat. He must thank Mr. Young for at all events clearing up that point.

Mr. A. Yuill (Alloa) did not think he could add much to what Mr. Young had given them, because he felt that, before they could understand the real value of the paper, they would require a little time to study and digest it. One thought struck him on hearing Mr. Young—that was about the temperature of flame; and it was brought more particularly home to him after he heard Mr. MacPherson speak. In one of the tables before them, it was noticeable that, as the illuminating power of the gas fell, the heat-units rose; and the reverse—as the temperature rose, the illuminating power fell. In his experience with oil gas, he had found a higher calorimetric value both for gas cooking and heating stoves, also in gas-engines. This appeared to him to be the opposite to what Mr. Young had found; and he would like Mr. Young to explain it. Mr. Young said he was afraid he was trying their patience; but what he (Mr. Yuill) felt was that he was rather trying their power of absorption. They could hardly take the paper in at that moment; but he had no doubt when they had read it, it would add much to their experience and knowledge on the subject. He had much pleasure in thanking Mr. Young for the paper he had read.

Mr. J. M'Gilchrist (Dumbarton) said that, having regard to the three papers that were to follow, he had not proposed to discuss Mr. Young's paper at all; but he must thank him very kindly for the further instalment he had given them with reference to the illuminating value of gas. He would like to ask Mr. Young a question which was brought out in his paper, with regard to the observed difference in colour between the various hydrocarbon flames. They had heard a lot of "rot" about illuminating power and illuminating value; and he would like Mr. Young to give them some further information upon the subject.

The President said they owed Mr. Young their very best thanks for the labour and the research he had undertaken so as to instruct them, not only on the way that gases were decomposed in flame, but also by his opening up of a new line of thought as to the care which should be exercised in making gas so as to get the best combination of gases and the greatest value out of the coal. The time that Mr. Young must have taken to prepare the paper must have been immense; and, as they had heard, he was not in a good condition of health. They were therefore all the more indebted to him for giving them such a grand paper.

Mr. Young said that, when he commenced to read his paper, he did not anticipate that it would be received in the way it had been. He had been very much afraid, from its highly technical character, that it would prove to be rather a dry subject; but he was agreeably surprised to find that it had met with such a warm and kind reception, and led to such an amount of discussion. Mr. MacPherson had made some very pertinent remarks bearing upon the paper; and he had no idea that, just from hearing the paper read, he would have been able to take up the subject in the way he had done. He had referred to their past agreements and disagreements. He was happy to say they had "agreed to disagree" many times before; and he thought they were still in the same happy position. Though he candidly admitted that, while in the case of coal gases as ordinarily manufactured, there was undoubtedly a relation between the various chemical and physical conditions referred to by Mr. MacPherson, yet, with altered modes of manufacture and materials, there were undoubtedly brought about differences which also altered, to a certain extent, those relations. And while admitting that the percentage of carbon, as found in ordinary coal gas, bore, as a rule, a fair relation to its illuminating power, yet he questioned if there was a fixed relation. There were, undoubtedly, gases—such as water-gas, for instance—where these relations did not obtain; and more particularly was this the case in gases that were enriched. For example, to take enrichment by (say) hexane, which was a paraffin, C_6H_{14}, and benzole, C_6H_6. They had exactly the same quantity of carbon present in the molecule of both of these hydrocarbons; but, volume for volume, the illuminating power resulting from enrichment was just about four times as great (admitted by nearly all authorities) from the carbon present in the flame of the benzol-enriched gas as from the carbon in the hexane when associated with the same gas. Therefore, gases carburetted with these two agents must necessarily give very different illuminating values for the same percentages of carbon present in them. While this was true with coal gas carburetted with these hydrocarbons, yet—as remarked by Mr. MacPherson—the case was different in all coal gases as ordinarily manufactured; for, under the conditions of manufacture, they never added one particular hydrocarbon. The nature of the operation necessarily involved the simultaneous production of hydrocarbons of very varied composition; and Mr. Lewis T. Wright, in a recently published letter, put it very clearly that it was the overlapping of these hydrocarbons which led to the modifying of the carbon value in the various hydrocarbons. As shown in his (Mr. Young's) paper, the hydrocarbons in overlapping or commingling with each other, had an influence in modifying the illuminating power obtainable from them; so that, while (for instance) acetylene and similar hydrocarbons lost enormously by being diluted, the olefines and similar hydrocarbons on the other hand were just as much benefited by dilution. Seeing therefore that they had both classes of hydrocarbons present in all their ordinary coal gases, the enhanced value of the one series was counterbalanced by the decreased value of the other; and hence the reason why they had in the generality of coal gases a definite relation between the percentage of carbon present in such gases and its illuminating power. He referred more particularly to enrichment by hexane and benzol, because in actual practice this was being done. In some works, they were enriching purely by benzol; and that gas would have a very much higher illuminating value per unit of carbon present than a gas enriched by American petroleum would have, owing to the fact that the carbon in the benzol gas was of higher enriching value than the carbon present in the paraffin. Only under such circumstances would the physical conditions be differentiated. It would require to be the addition of a particular hydrocarbon that would prevent the overlapping which would otherwise take place. Then, with regard to the other point Mr. MacPherson took up—the effect that the changes taking place within the flame had upon its temperature. In replying to this point, he might include the remarks made by Mr. Yuill with reference to the low temperature of the flame of a highly luminous gas and its high heating value when used in gas-stoves or as motive power. The illuminating power, the temperature of the flame, and the total heat obtained from a gas were very different things. They might have a flame of comparatively low temperature emitting a great amount of light, merely because the heat, which in a Bunsen flame would be emitted

as sensible heat, had become latent in conferring upon the hydrocarbons present in the flame a higher potential (or stored-up) energy. It had for a time assumed another form, and become latent; and at the instant when the hydrocarbon with the latent potential underwent decomposition, instead of being emitted as non-luminous heat, it became emitted as light, and therefore never assumed the form of high temperature sensible heat. They would thus observe that, if it were desired to get the benefit of a high temperature heat from a highly luminous gas, the supporter of combustion must be commingled with the hydrocarbon gas so as to prevent this intermolecular action within the flame, and thus secure that the energy of the flame was emitted as high temperature heat. In a gas-engine—as referred to by Mr. Yuill—and for use in cooking and heating stoves, they mixed the supporter of combustion with the gas prior to combustion; and they thus prevented the heat doing any molecular work upon the hydrocarbons. Instead of the energy of the gas being partially emitted as light, it was converted into heat-energy, as in the gas-stove, or partially into mechanical energy, as in the case of the gas-engine. Mr. Bell referred to the diluting effect of hydrogen and carbonic oxide upon hydrocarbons. He referred more particularly to acetylene as being a hydrocarbon possessing a very high potential, subject to a very high strain, and ready to rupture with explosive violence into its elements. It occurred to him while Mr. Bell was speaking that Mr. Bell looked upon acetylene very much as, when boys, they looked upon gunpowder—that if they used it pure and dry, and applied a light, it went off with explosive violence, producing a flash of light. But if they wanted to fire it slowly, they mixed sand with it; and they found when so mixed, that it no longer flashed, but the flame would travel slowly along a train laid on the ground, and its explosive energy was much reduced. There was no doubt that, in the same way, when they put a diluent into a hydrocarbon of high potential—like acetylene, that was ready to burst or rupture—that the diluent acted upon the hydrocarbon by taking up the stored-up energy. It acted as a sort of cushion, and prevented the rupturing effect. So that undoubtedly, the diluents acted much in the same way that the sand did in gunpowder, in separating and taking up the energy developed by the combustion of the gunpowder. He thought these were all the points that had been touched upon; and he had only to thank the members for the very kind remarks which had been made regarding himself personally.

On a reminder from Mr. M'Gilchrist,

Mr. Young said he might almost admit that he had purposely avoided Mr. M'Gilchrist's point. It was one which he would just as soon that he would be allowed to shirk. It was a question bristling in many ways with difficulties, which made it desirable to keep away from it. It was somewhat of a "hedge-hog" in its character; and he was afraid it would take up too much of the time of the meeting to go into it. Of course, Mr. M'Gilchrist must be aware that he (Mr. Young) was not a believer in the difference between illuminating power and illuminating effect from ordinary illuminating gas-flames; but, of course, if they had a very large flame, they must necessarily have a larger diffusive light than from a smaller flame. They might also have a flame differing in colour. They knew that ladies objected very much to the electric arc light, because of the ghastly appearance it gave them. In this case, they had the illuminating power, but they did not get the desired illuminating effect. On the other hand, if they had a soft light—such as from an olefiant gas—they would not only have the quantity of light, but they would also have the desired effect—that was, the ladies' countenances would have a much better appearance, and matters would look warmer and better altogether. With regard to the amount of light measured by the photometer, there was no doubt whatever that they must have some standard method of ascertaining the amount of light; and he thought that it could not be ascertained in any other way than by the photometer.

The meeting then adjourned for luncheon.

On re-assembling after the adjournment, the remaining papers—viz., "A Plea for Standardizing Meter Unions," by Mr. J. Napier Myers, of Saltcoats, "Notes on the Heating Value of Coal Gas," by Mr. D. Vass, of Portobello, and "Gas Making from Splint and Shale and from Splint and Oil," by Mr. A. Waddell, of Broughty Ferry—were taken. These, with a report of the discussions thereon, will be given in subsequent issues of the Journal.

Election of Office-Bearers.

The President intimated that the following had been elected office-bearers for the current year:—

President.—A. Yuill, Alloa.
Vice-Presidents.—A. Bell, Dalkeith; T. Wilson, Coatbridge.
Secretary and Treasurer.—R. S. Carlow, Arbroath.
Members of Committee.—A. Bell, jun., Peebles; J. M'Gilchrist, Dumbarton; H. Pooley, Dunfermline.
Auditor.—R. B. Main, Glasgow.

Mr. Yuill said he had much pleasure in thanking the members for the honourable position in which they had placed him. He could only say that he would do everything in his power for the interests of the Association.

Place of Next Meeting.

The President announced that the desire of the members was that the meeting next year should be held in Edinburgh.

Votes of Thanks.

The President then proposed a very hearty vote of thanks to the readers of the papers, which had, he said, been varied, and well up in quality. They had had both theory and practice put before them; and this was what was required. They did not want too much of the one thing. The meeting had pleasantly disappointed some of them. They scarcely expected to have such a good gathering, seeing that there had been the meeting of The Gas Institute in Edinburgh so recently. But they were very pleased to see so many present. They were also just a little afraid that they were not going to have papers. The Secretary, however, always said the papers would come; and the members would see that he had been right.

The President's Medal.

Mr. M'Gilchrist said the duty imposed upon him was a very pleasing one—the presentation to their esteemed President of the Presidential Medal for the year. While they might differ about oil gas and coal gas, with regard to the price and the quality, there was one thing they could not have any difference upon—viz., that Mr. Wilson was the right man in the right place as President of the Association. Had it not been for Mr. Wilson's energy, they never could have had such an excellent meeting in Melrose.

The President, in returning thanks, said he took up the position of President with fear and trembling, as it was out of his line altogether. If he had pleased the members, as President of the Association, he was entirely satisfied. He might say that a President of the Association had his work made very easy for him by their friend the Secretary.

Mr. MacPherson proposed a vote of thanks to Mr. Carlow for his services, and said he could speak from experience, as a Past-President, of the great amount of work Mr. Carlow did for the Association, and of the ability with which he performed it.

Mr. Carlow acknowledged the vote, and the proceedings closed.

The members and their friends, including ladies, afterwards dined together in the George and Abbotsford Hotel—the President in the chair, and Mr. A. Yuill, the President-Elect, in the vice-chair.

On Friday, heavy rain fell almost incessantly, which had the effect as well of accelerating the return home of some of the members as of preventing others from going to participate in the excursion. Only a comparatively small number—perhaps a little more than fifty—consequently took part in the trip. Rain fell the whole time, so that, at Abbotsford, the visitors could only apply themselves to what was to be seen indoors. This was soon accomplished, and the party were set down at the hotel door in Melrose exactly two hours from the time they had left it. After luncheon, in a partial cessation of the rain, a number of the members visited the Abbey; while others had to content themselves with music in the drawing-room of the hotel.

Westphalian Gas Coal.—According to Herr Hegener, the great development which has taken place in the mining of gas coal in Westphalia dates back about forty years; only an exceedingly small quantity being produced before then. The whole district comprises a tray-shaped enclosure of large quantities of fossil coal. New shafts have from time to time been sunk—old anthracite coal being principally found, though newer deposits are met with above. He thinks that further deposits may reasonably be expected to be struck in the northern districts of Westphalia. The total production of coal in 1863 was 4,600,000 tons; whereas in 1893 it was 38,000,000 tons.

An Incandescent Gas-Light Combination in America.—Under the title of the Welsbach Commercial Company, an undertaking has been started, with a capital equal to £1,400,000, to exploit the incandescent system of gas lighting in the United States. The "combine" is composed of the Welsbach Light Company, the American and Manhattan Incandescent Gas-Light Companies, and the United Gas Improvement Company; and Mr. Emerson M'Millin is on the Board. Particulars of the scheme are contained in *Progressive Age* for the 15th inst. Our contemporary considers that the alliance will be productive of advantage all round, and especially to the Welsbach Light Company, who will secure, in the new Company, "an already capitalized selling agent, with unlimited financial resources, which guarantees all accounts on the favourable basis of 5 per cent. on present prices," and will thus avoid the necessity of undertaking the work themselves. We learn that the sales are guaranteed to the extent of 25 per cent. increase the first year, with a rising schedule afterwards. It is pointed out that the several Welsbach and Lungren patents are much more powerful when united than in opposition; and a virtual monopoly is claimed against possible future competition. The higher rate at which the lights will probably be sold to agents in future will, it is believed, afford them protection against unauthorized invaders. A closer connection is to be formed with gas companies, for the common good; and the scheme is confidently looked forward to to benefit them and the incandescent light business generally.

REGISTER OF PATENTS.

Prepayment Gas-Meters.—Tourtel, J., of West Kensington. No. 14,132; July 23, 1894.

This invention is designed to permit of prepayment gas-meters being so arranged that, by a very slight re-adjustment, they can be adapted to take various coins. The meter-case is also so arranged that the register is separately enclosed; and the Government seals need not be disturbed when the coin-freed portion of the apparatus requires to be exposed for re-adjustment or repair.

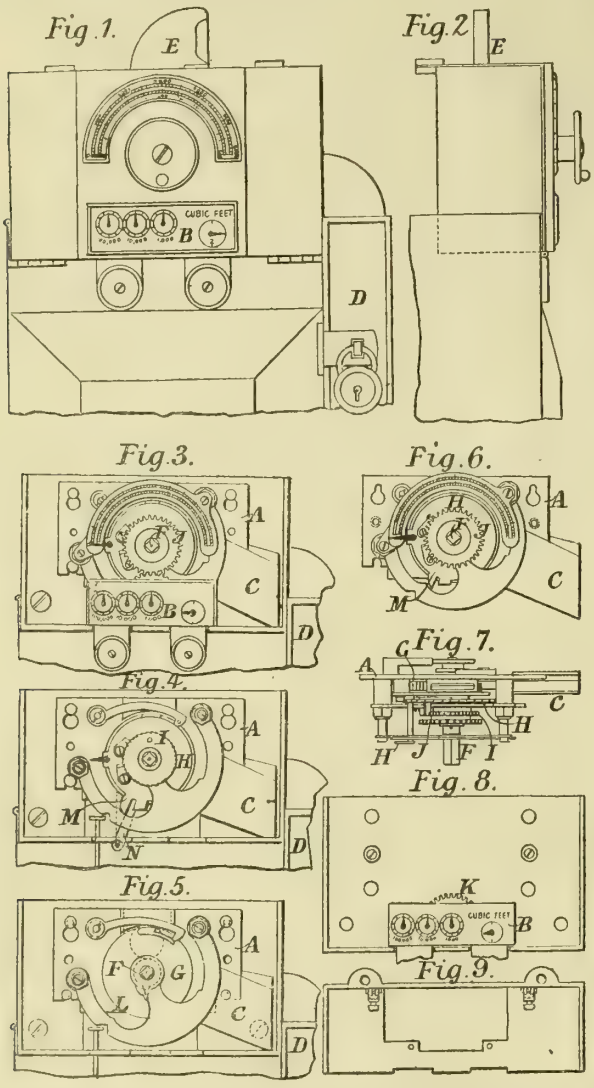


Fig. 1 is a front view, and fig. 2 an end view, of the upper part of the meter. Figs. 3, 4, and 5 are front views of the coin-freed mechanism on different planes. Fig. 6 is a front view, and fig. 7 a plan, of the mechanism removed from the fixed casing. Fig. 8 is a front view, and fig. 9 a plan, of the casing, with the mechanism removed from it. The other figures show separate details of the mechanism.

The coin-freed mechanism is all carried on a plate A and front frame, supported from A by two studs. The plate is held against the back plate of the casing by headed studs, which engage in slots and key-holes of the plate in such a manner that the plate, and the mechanism attached to it, can be raised to clear the heads of the studs and be removed from the casing, leaving undisturbed the ordinary counter and dials B. To the plate A is attached a shoot C for conducting the liberated coins to a locked receptacle D attached to the side of the meter. On the top of the casing is fixed a hood E, in which is formed the slot for introducing the coin.

F is a central spindle, with its outwardly projecting end squared to receive a handle, which is usually held on the spindle by a screw. By removing the screw, however, the handle can be drawn off; and then the front of the casing can be folded down on hinges, so as to give access to the mechanism within. Immediately under the hood E, there is fixed on the spindle F the coin-wheel G. The coin lodges in the slot in such a position that a part of it (according to its size) projects beyond the circumference of the wheel. The normal position of the wheel presents its coin-slot upwards; and for each coin introduced, it has to be turned once round. Should it be turned not quite to the normal position, however, it is brought to that position by a spring roller entering a recess formed on the lower edge of the middle part of the wheel, or by a spring entering a V-shaped notch in a disc fixed on the spindle F. A pawl engaging with a ratchet-wheel on the spindle prevents it being turned backwards.

When there is no coin in the wheel G, it is prevented from turning by a stop upon it meeting a pawl; but when there is a coin in the wheel, its projecting part, acting on a pin projecting from the side of the pawl, lifts the pawl, and allows the stop to pass it, and so permit the wheel to be turned quite round until the stop again meets the pawl. During the revolution of the wheel, the coin drops from it into the shoot C, and descends to the receptacle D. Free on the spindle F is mounted a disc H, on the face of which are pivoted two pawls. These have pins passing through slots of the disc, and are urged inwards, towards the centre, by springs on the other side of the disc bearing on the pins. In front of the disc, free on the spindle F, is mounted a ratchet-wheel I, the teeth of which are engaged by pawls on the disc H. The ratchet-wheel is driven by one of the wheels of the counter. The ratchet-wheel is fixed on the boss of a toothed wheel J, which gears with a wheel K on the spindle of the counter-index, and registers up to 1000 cubic feet. This gearing and the ratchet-wheel I are arranged for the introduction of pence into the slot. When shillings are to be introduced, the gearing is altered so that a pinion on the counter-spindle gears with a large wheel attached to the ratchet I. The number of teeth on the ratchet-wheel, and the proportions of the gearing by which it is connected to the counter, have obviously to be determined so as to suit the price of the gas and the value of the coins used.

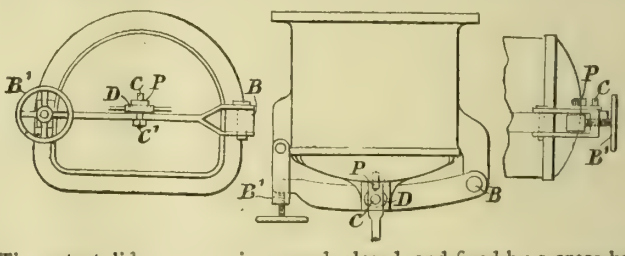
The coin-wheel G has on its side a cam L, which, when the wheel is caused to revolve, acts upon the pawls of the disc H, causing them to engage successively with the teeth of the ratchet-wheel I, in such a manner as to turn the disc to the extent of one tooth of the ratchet for each revolution of the coin-wheel. An index carried by the disc points to the number of cubic feet corresponding to the extent through which the disc is turned on a scale graduated with two sets of divisions—the outer set indicating the quantities when shillings are used, the inner set when pence are used, as the actuating coins. As the disc H is turned step by step as described from its initial position shown in fig. 4, a notch M of the disc, which has engaged in it a pin of a lever N, moves this lever aside, as indicated by the dotted line in fig. 4, and thus opens a valve in the gas-pipe to which the lever is connected. Gas being thus admitted to the meter, the spindles of the counter B revolve, and the ratchet-wheel I, which is geared to one of them, is caused to revolve in the direction of the arrow, and turning back the disc H, until the notch M again engages the lever N, and moves it back, closing the gas-valve, and so stopping the further movement of the meter until coins are again introduced and the handle once more turned.

Lighting and Extinguishing Street Gas-Lamps.—Hunter, W. A., of Plumpton, near Penrith. No. 17,586; Sept. 15, 1894.

This apparatus for automatically lighting and extinguishing street and other gas-lamps, consists of an air cylinder placed in close proximity to each lamp; the cylinders being connected with a main-pipe arranged preferably underground, and communicating with an air-pumping apparatus. In this way, when pressure is applied, the piston of each cylinder (with its piston-rod) is operated in such a manner as to first turn on the gas, and immediately afterwards to light it by putting the lighting agent in action; and on sufficient removal of pressure from each cylinder, to shut off the gas. Thus any number of lamps may be lighted or extinguished in rapid succession, or almost simultaneously. The details of the arrangement are not describable apart from a series of drawings accompanying the specifications, which together occupy eighteen closely printed pages.

Retort-Lid Fastenings.—Henderson, J., of Osmaston. No. 23,662; Dec. 5, 1894.

This invention has for its object to provide means of ensuring tight jointing between retorts and their lids or covers while in use, under pressure or otherwise, and without interfering with their operation, by "arranging the lid or cover in such manner as to be capable, when securely fixed, of a parallel rubbing motion in horizontal, vertical, or angular directions, upon the mouthpiece or bearing surface, whereby any foreign substance intervening between the two can be removed by attrition, and a true and complete face surface on both parts, and hence a tight joint, secured."



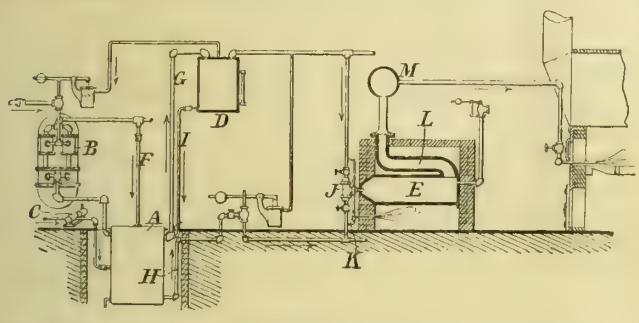
The retort lid or cover is opened, closed, and fixed by a cross-bar, hinged at one end B, and provided with a screw fastening device B^1 (or other suitable contrivance) at the other end. About the centre of the cross-bar, a bolt, with a projection C on its head, is transversely inserted—in this case vertically. The bolt also passes through a slotted hole D in a bracket formed on, or attached to, the lid, and is there fixed by a nut C^1. Immediately behind the bolt, a pin or projection P is formed or fixed on the lid; and a hand operating lever L is provided, having a hole in it adapted to fit on the head of the bolt, and the jaws on the fixed projection P on the lid or cover respectively.

By suitably operating the lever—that is to say, by moving it from side to side in horizontal planes—the lid will be moved to and fro as required upon the face of the mouthpiece or bearing surface, to about the extent indicated by the dotted lines; and this motion effects the required attrition of any intervening material.

Manufacturing Gas from Oil and Air.—Thompson, W. P.; communicated from G. D. Bayaud and G. F. Perrenoud, of New York, and G. H. Harvey, of Pittsburg, U.S.A. No. 5732; March 19, 1895.

In the illustration, A indicates a carburettor, and B a pump for forcing air through it. C is a pump to supply oil to the carburettor. D is a tank to hold carburetted air; and E is a retort. F is an air-pipe, through which a suitably regulated pump forces air into the carburettor in a constant current. The tank D receives carburetted air through the pipe G; and there is another pipe for passing such air to the retorts. Oil is conveyed directly to the retort from the carburettor through a pipe H; a valve regulator being employed, controlled from the chamber D, which in operation contains carburetted air under pressure. I is a pipe to convey oil that may be condensed in the chamber D back to the carburettor. J is a chamber for mingling carburetted air

and heavy oil, which latter is sprayed by the air-jet from the mixer through a branch of the pipe H. K is a burner, communicating both with the air-pipe and oil-pipe, and adapted to spray oil into the combustion chamber under and around the retort. L is an uptake pipe communicating with a gas-main M, with a branch leading to a steam-boiler furnace A regulator controls the steam supply to the air-pump,



which forces air into the carburettor; and in case the pressure in the apparatus rises above the desired limit (15 lbs. for example), it partially closes the steam-inlet until the pressure falls to that predetermined or to 15 lbs. in the case assumed. A regulator in the oil-pipe closes the valve when the pressure of carburetted air in the chamber D falls below the desired limit, as may happen in case of leakage of the carburetted air, or the stopping of the air-pump; and by this means the flooding of the retort with oil is prevented.

The valves in the air and oil pipes respectively, together with similar cocks in the burner pipes, provide for suitably starting the apparatus, which is effected by first forcing air through the oil-tank, and producing the desired pressure in the carburettor, air-pipes, and compression chamber D. The cock in the air-pipe of the burner is then opened for the passage of carburetted air; and afterwards the cock in the oil-pipe of the burner is gradually opened. Thereupon the pressure in the apparatus forces the air and oil out of the burner-nozzle K; the oil being finally divided, and intimately mixed with the carburetted air. This, being ignited, heats the retort; and thereupon air and oil are in like manner introduced into the retort by first opening the air-cock, and then gradually opening the oil-cock. The gas produced from the carburetted air and oil spray is conducted to a main M, or to a holder.

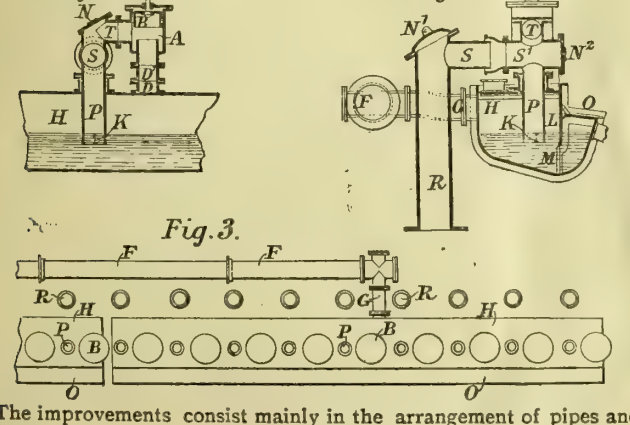
Scrubbing or Purifying Gas.—Slocum, F. L., of Pittsburg, U.S.A. No. 6158; March 25, 1895.

The object of this invention (as stated by the patentee) is to provide for the rapid and effective scrubbing and washing of gases, and for that purpose to bring the gases into contact with the absorbent liquid in such a way as to not only ensure the contact of the gases with the liquid, but the breaking up of the globules of tar and other extraneous matter, and also to prevent the diffusion of the purified gases with those less purified.

The invention consists, generally stated, in forcing the gas through a series of perforated discs, set within ½ inch of each other, and under such pressure as to cause the gas passing through one disc to strike against the solid portions of the next disc, with impact sufficient to bring the gas into intimate contact with the wetted surface and break up the globules of tar and other extraneous matter contained in the gas, and forcing the layer of gas between one set of discs into the space between the next set of discs, without permitting diffusion between the layers of gas. It also consists in apparatus for scrubbing or purifying the gas, having within an enclosing case a series of perforated discs, mounted so as to rotate and dip into the absorbent liquid; the discs being set within ½ inch of each other, and the perforations of one disc being out of line with those of the adjoining disc, so as to accomplish the results above stated. Also in so mounting the discs or plates that they travel sufficiently close to the inner face of the casing to form a film joint therewith through the employment of the liquid absorbent, and so prevent the passage of the gas around the edges of the discs. There are also certain other minor improvements set forth in the specification for the patent.

Gas Manufacture.—Simon, H., of Manchester. No. 7517; April 13, 1895.

This invention relates to means for separating and removing the tarry and other heavy substances contained in gas "as expelled from its material source by heat and suction," and to means to enable each oven or retort to be worked independently of all others in the same battery. It is more particularly applicable to apparatus used in the manufacture of coke in ovens described in patent No. 2616 of 1879.



The improvements consist mainly in the arrangement of pipes and valves attached to the hydraulic main, which may be of the ordinary construction, and fitted with a lateral curtain or apron L, below which there is an opening M, near the bottom of the main, for the removal therethrough of the matters deposited from the main. The gases ascend through the vertical pipes R, pass along the connecting-pipes S S^1, whence they rise slightly, into the pipe T, through which they pass to the valve-box A, and then descend, through the connections D D^1, into the hydraulic main, as in fig. 1. The slight ascent of the gases from the pipe S^1 to T takes place in the dip-pipe P, where the direction of flow is changed from horizontal to vertical, and at right angles in a horizontal plane. This double change of direction causes the tarry matters carried along by the gases to this point to descend through the dip-pipe, and deposit in the bottom of the hydraulic main H, whence they may be removed through the opening M and the cover O. The same opening permits also the removal of any heavy substances which may be deposited from the gases from or through the connections D D^1 and the valve-box.

The stop-valve B may be constructed on the bell principle, and can be worked up and down as required by means of its rod C; thus allowing the gases to be cut off from the other ovens or retorts, or permitting them to be sent direct into the main through the connections D D^1. This valve will be closed when it is down upon its seat; the annular cavity surrounding the valve (being filled with tar) provides the necessary seal.

The outer portion of the hydraulic main H is provided with lids or covers O, which serve to keep out any extraneous matters, and some of which are removed when the tarry matters require to be passed from the main, as described. Flanges and covers N N^1 N^2 may also be provided, to allow of easy access to the interiors of the pipes for cleaning and other purposes. The hydraulic seal K, formed at the bottom end of the dip-pipe P, prevents the escape of gas during cleaning and other operations.

It is preferred that the hydraulic main should be constructed in short sections, as in fig. 3; each section being connected to the gas-main F by the pipe G. This construction and arrangement of the hydraulic main greatly facilitates work in case repairs are necessary.

Ignition Apparatus for Gas-Engines.—Klunzinger, J., of Heilbronn, Germany. No. 8355; April 27, 1895.

The object of this invention is to provide apparatus for use in gas and oil engines of the four-cycle type, by which ignition takes place in a cup-shaped chamber kept red hot by the heat of the outflowing exhaust gases; a clack-valve being also provided to regulate the admission of the exhaust gases to the cup-shaped chamber, so as to keep it at the necessary temperature for ignition purposes.

Gas-Retorts.—Guéguen, A., of Paris. No. 10,145; May 22, 1895.

This improvement in the construction of gas-retorts (described and illustrated in the JOURNAL last week, p. 142) consists in "a novel arrangement whereby the thickness of earthenware retorts may be considerably decreased—thus improving the transmission of heat to the bodies contained therein, while they still retain sufficient strength." It has already been proposed, with a view of more completely utilizing the heat, to increase the heating surface; and for this purpose undulating retorts have been proposed. The patentee's proposal is to make the retorts with very thin walls, to which the required strength is given by means of "ribs or wings" placed on the outside of the retort. These wings are projections moulded with the body of the retort, or formed by cutting away the wall of the retort. They may be arranged either parallel to the axis of the retort, but preferably obliquely, in such a manner as to form helicoidal ribs upon the curved portions—thus providing strengthening supports in the direction in which the retorts have most chance of breaking. The ribs, which should be so arranged as to cause the ashes to fall to the front of the furnaces, may be of any size, and may be placed at any suitable distance apart; they may also be of different sizes, and slope in different directions upon the same retort. In each case the proper conditions are determined by the dimensions of the retort, and the nature of the earthenware employed—taking into account the necessity of allowing the maximum heat to pass into the interior of the retort.

APPLICATIONS FOR LETTERS PATENT.

13,570.—CHANDLER, S., jun., "Washing, purifying, and scrubbing gas." July 15.

13,574.—CLARK, F., and the SOUTHEND GAS COMPANY, "Manufacture of gas." July 15.

13,603.—REDMAN, T., "Lighting gas, gas-lamps, and the like." July 16.

13,612.—YARNOLD, C. J., and ELWORTHY, W., "Manufacture of gases." July 16.

13,635.—GRIER, H. G., and HOTTLE, A. S., "Electric gas lighters." July 16.

13,638.—CROCKER, S. H., "Incandescent mantles for lamps." July 16.

13,645.—FAURE, C. A., and CASALONGA, D. A., "Manufacture of ammonia and ammonia salts." July 16.

13,652.—PEASE, E. L., and ASHMORE, BENSON, PEASE, AND CO., LTD., "Guiding and controlling gas holders." July 16.

13,684.—REDMAN, T., "Construction and support of street-lamps." July 16.

13,692.—BLANCHER, C., "Igniting apparatus for gas and oil engines." July 16.

13,738.—LANGHORNE, T. A., "Gas or oil stoves." July 18.

13,750.—WILLSON, T. L., "Illuminating gas." July 18.

13,764.—BOULT, A. J., "Water gas." A communication from C. Delwick. July 18.

13,766.—WILLSON, T. L., "Illuminating gas." July 18.

13,831.—TORRES, J. B., "Manufacture of oxygen and rich oxygen compounds for the working of metallurgical furnaces, gas producers, and regenerators, ovens, heating apparatus, and the like." July 19.

13,834.—BARRETT, C. A., "Coin-freed attachments for gas and liquid meters." July 19.

13,842.—WANKLYN, J. A., and COOPER, W. J., "Lamps." July 19.

13,862.—KERN, G., "Gas-stoves." July 20.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Discussion on Mr. M'Crae's Gas Institute Paper.

SIR,—I am sorry Mr. Stelfox does not see my contention, and meet it fairly. It is ridiculous for him to complain of my referring to his observations a year after they have been uttered, and to take for personal what is obviously intended to be general. When a man commits himself to print, he cannot escape the responsibility of it in his lifetime. He may explain away, or he may withdraw; but otherwise he is liable to be confronted with his own observations at any time. So long as a man is not misquoted, he can have no ground of complaint at such a course. I was present when Mr. Stelfox read his paper; and the eight lines to which he referred fell upon my ear like a jarring note, or as the weak point in an excellent paper. I pencilled off the part in the printed copy I held, and, when I spoke, I rose with the intention of making some allusion to it; but I refrained for fear of drawing the discussion off on a side issue. I said that Mr. Stelfox had made out the best case for water gas that had yet been submitted, and that, had I been in his place, I should probably have done as he had done. At the last meeting, I expressed my agreement with the action of the Council in having awarded him the first premium. I have a high opinion of Mr. Stelfox, both as a man and as an Engineer; and of his conduct, so far as I know it, I approve. But of his opinion as expressed in those eight lines, I do not approve, and that is all I have said. I have taken my own time for saying it, as I have a perfect right to do. It has given Mr. Stelfox an opportunity for which I should have been grateful; but he does not seem to see it.

In your article on my last letter, you prophesy that, in the next generation, we shall not be able to get men to do stoking. I wish I could think so. The genteel employments are already getting so over-crowded that it is barely possible for the people engaged therein to make a living. So long as a stoker can earn twice the amount of an efficient clerk, you will always be able to get stokers. To a man who is physically qualified, there is something manly and dignified about stoking. I never yet knew a stoker who was capable of doing the work who preferred working at any other job about a gas-works. I have known them when in the yard to display great anxiety to get back to stoking. There is a great deal of nonsense talked about the hard life of the stoker. There was a great palaver a few weeks ago about a gas-works without a stoker. I read carefully through the account; but there was never a word about cheap gas. There are thousands of men out of employment to-day who would consider themselves fortunate if they could get a situation as a stoker.

When it is considered that the primary object of all industrial undertakings is to provide for the wants of the community, it seems strange to talk of settling a labour difficulty by throwing 90 per cent. of the men out of employment. Surely that part of the community with which we are in immediate contact deserves our first consideration; and if we are compelled by circumstances, economic or otherwise, to act harshly towards the men, we need not let it appear, when we have occasion to speak on the subject, that we take pleasure in so doing. I do not think that any of the gentlemen against whom my remarks were directed, have been guilty in act and deed. It has been more a question of carelessness in thought and expression, or perhaps a desire to be epigrammatic, that has led to such expressions; and it is against this carelessness that I desire to caution gas managers, or their printed utterances, in the hands of agitators, may be used as powerful weapons of offence.

Mr. Livesey's letter carries the subject to a further stage, and a much wider field, into which I should very much like to enter; but time will not permit this week. However, as he asks for suggestions, I will at least make one arising out of this controversy; and it is that employers should try to think and to feel towards these men, not as if they were mere machines, or at least "dumb driven cattle," but as if they were men with human hopes and aspirations like themselves. For as a man thinks and feels, so he will speak and act when dealing with them; and it is that cruel display of want of feeling that sometimes accentuates difficulties which have arisen about trifles, and might otherwise have been easily settled. A careless word or an unfeeling act is often at the root of more labour difficulties than all the injustices the men have suffered put together.

Altrincham, July 27, 1895. WM. CARR.

Mr. Irwin's Paper at the Society of Chemical Industry.

SIR,—I notice in your issue of this week a letter from Mr. Lewis T. Wright, in which he criticizes some of the statements made by me in my paper on "Gas Enrichment, &c."

In reply to his first criticism, I would like to say that Manchester gas, with the ordinary standard Argand burner, usually tests about 20 candles; and with a "slit" burner, very little below that. But with a No. 4 Bray union-jet—the burner most commonly employed for household purposes—I have never been able to obtain more than 14 candles when burning at such a rate as to yield the most light with the least consumption of gas, and calculated to 5 cubic feet per hour. Of course, it may be said that the burner is not adapted to the gas; yet it holds its own—the reasons given for its use being that it is more cleanly, and with it there are fewer cracked globes than is the case with other burners

Tested with it, benzene certainly shows better results than any other enricher in the field; though with an Argand burner, it can scarcely compete with others, such as the gas made by the Peebles process, if the published statements regarding the latter are correct—namely, 5d. per candle per 10,000 cubic feet, and to effect which at least ¾ gallon of benzene would be required. What I maintain, however, is that one "standard" candle enriched by benzene is worth more to the average consumer than the same produced by other processes which require the Argand burner to be used with them. I have obtained a mixture of water gas and pentane which with an Argand burner gave a brilliant light, but gave an almost non-luminous flame with a union jet; and, speaking generally, my experiments have shown that, in an enricher, the greater the number of hydrogen atoms combined with the carbon atoms in its molecule, the higher is the temperature required for its decomposition, and consequent enrichment of the flame. Hence the great advantage of using a substance like benzene, which decomposes and precipitates its carbon at a comparatively low temperature, and is therefore available for use with almost any burner.

Referring to Mr. Wright's second paragraph, the mixture of naphthalene and hydrogen was an extreme case; but the addition of benzene to ordinary coal gas will increase its illuminating power much more than its calorific power.

With Mr. Wright's third paragraph, I am practically in agreement; and hence it follows that each gas chemist or engineer should test for himself, if possible, the value of any enricher with the gas with which he has to deal.

Regarding Paris gas, I merely assumed Berthelot's figures to be correct; but high heats without cannel, I know by experience to give a gas the illuminating power of which is chiefly due to benzene.

In reference to Mr. Wright's last observation, I may say that, for testing the action of water on coal gas, I used a 15-litre bottle. I thus had 7½ litres of gas, which allowed me three minutes or so for determining its illuminating power, which is sufficient for a gas of one to two candles.

In conclusion, I would very much like to know from Mr. Wright where he considers the method of carburation faulty. The only source of error which could be imagined—seeing that hydrocarbons of constant boiling points only were employed—would be from absorption by the enricher in the flask of a portion of the hydrocarbons already in the gas. This I do not believe could be the case with the conditions under which the tests were made.

Cheetham Hill, Manchester, July 26, 1895. WILFRED IRWIN.

Mr. Stenhouse on Liquid Gas Enrichers.

SIR,—Mr. Stenhouse, in his paper entitled "Notes on Experiments with Liquid Gas Enrichers," read before the Manchester Section of the Society of Chemical Industry, a reprint of which appears in your issue of 16th inst., quotes the results which I have obtained as the enriching value of benzene and carburene. He appears, however, to have overlooked my description of the method of testing—viz., "by adding small quantities of the two enriching materials to coal gas, tested, before and after the admixture, with the standard Argand burner, with chimney full of flame." I gather from Mr. Stenhouse's paper that his tests of illuminating power were made at the standard rate of 5 cubic feet before and after enrichment; so that his tests are not comparable with mine.

I have on so many occasions given my reasons for departing from the 5 cubic feet rate, especially when experimental comparative tests are made, that it is perhaps unnecessary to repeat them. I may say, however, as I have said before, that it certainly appears wrong to credit an enriching material with illuminating value destroyed in the first place in the coal gas as experimented upon, by an over-supply of air to the burner.

Birmingham, July 23, 1895. CHARLES HUNT.

Mr. Marshall's Gas Institution Paper on the Monier System.

SIR,—Referring to your paragraph in last week's JOURNAL (p. 176), I too regret very much that some inaccuracies have appeared in the reproduction of the formulæ appended to my paper on "The Monier System of Construction," principally owing to the substitution of the divisor sign for the *minus* sign −. Curiously, on the Continent the English divisor sign ÷ is used to denote a *minus;* and, in copying out the formulæ, sufficient attention to this point was not paid by myself. In any case, the total results of the equations remain unchanged; but I can quite understand an English reader being puzzled as to how those results were arrived at. In the forthcoming volume of Transactions of the Institution of Gas Engineers, the English signs will be used. I shall be glad, however, in the meantime, to forward a corrected copy of the formulæ to anyone taking an interest in the matter.

The work connected with the described tar-tank, coal-store, &c., is making rapid progress; and it is open to the inspection of any of my colleagues who care to come and see it.

Copenhagen, July 24, 1895. F. D. MARSHALL.

SIR,—Referring to the paragraph in the last number of the JOURNAL (p. 176), drawing the attention of your readers to the errors in Mr. Marshall's paper on the Monier system, and to the excuse he makes for confusing the signs of − and ÷, I am sure it will be a surprise to engineers in this country to learn that on the Continent these signs are interchangeable. In the paper, not only is the sign ÷ used in the place of −, but also to denote division. This is strange; but it is still more so when we find he also uses the sign − in the ordinary way. Unfortunately, this confusion of signs is not the only error. The omission and misplacement of factors and indices, the confusion of the term "*metre*" with "*centimetre*," and so forth, makes the paper practically useless without thorough revision. Of course, in its original state of confusion, the appendix appears very formidable; but if it were printed correctly, all mystery would disappear.

A large portion of the appendix is devoted to ascertaining the best position for an inclined strut for supporting a wall—a matter which an English engineer would determine in a very few moments by mere inspection, or what may be termed engineering instinct.

As regards the strains in the Monier arches, empirical formulæ have been adopted by Mr Marshall without any explanation or proof of their accuracy. He simply applies to a few examples two formulæ assumed to be correct.

Turning from the mathematical portion of Mr. Marshall's paper, it may be remarked that composite structures of iron and concrete are not by any means new in this country. As regards the adaptation of Monier arches in the form of pockets for coal stores, probably a similar arrangement supported on columns and girders could be made entirely of iron for less money.

Mr. Marshall is to be complimented very much on the originality

displayed in his designs; but it is to be regretted that a paper intended for the instruction of engineers in this country should contain so many errors.

27, Great George Street, S.W., July 24, 1895. F. S. CRIPPS.

Internal Liner or Scoop for Retorts.

SIR,—I notice in your "Register of Patents" for the 23rd inst., a specification of Messrs. Alexander Scott and Peter M'Lean, both of Galashiels, for which they claim the use of an internal liner or scoop to "act as a shield" to prevent the oil, tar, or other gas-producing material from immediately impinging on the heated retort. As an exactly similar appliance, to answer an exactly similar purpose, has been in use in the plant used at the Huddersfield Corporation Gas-Works, and worked under this Company's patents, I beg to claim priority on behalf of my Company.

I have only to refer to Mr. Herring's paper read before the Incorporated Institution of Gas Engineers in May, 1894, in which a drawing of the scoop is shown in the interior of the retort, to convince you of the justice of this claim. Messrs. Scott and M'Lean's provisional application is dated the 18th of July, 1894, and Mr. Herring's paper was read on May 10, 1894.

JOHN ED. GRESTY, Secretary,
Northern Counties Hydro-Oxygen Gas Company, Limited.

Huddersfield, July 27, 1895.

Sloping Retorts at Brentford.

SIR,—In reply to Mr. Graham's letter on the above subject in the last number of the JOURNAL, if he will refer to your issue for June 17, 1890, he will find a full description of the working of 21-inch ⌂ section 20 feet through retorts. In August, 1892, we altered two settings of sevens in No. 1 house to sixes; and, finding them successful, we altered the remaining six sets in July, 1893.

Brentford, July 24, 1895. J. HUSBAND.

Gas Cookers in Trades Processions.

SIR,—Between seven and eight years ago, when managing a corporation gas-works in a neighbouring town, an event of considerable local importance occurred, which the town decided to celebrate by a "Trades Procession" among other things; and one day the Committee called on me, and said: "Here, Mr. Townsend, you have some good cattle and trollies, can't you give us a show." "Well," I said, "that's rather out of my line; but if you wish it, and it will be any benefit to the town, I will think the matter over, and do what I can." I thought the matter over, and came to the conclusion that the best thing we could exhibit was a gas-stove in operation.

I soon settled on most of the details; but how to supply the stove with sufficient gas to last for four or five hours was for some time a poser. However, at last it occurred to me that, if we could borrow one or two cylinders of compressed oil-gas, with which one of the local railway companies lit their carriages, they might answer the purpose. I accordingly put myself in communication with the railway officials; and they very kindly agreed to lend me a couple of cylinders and the necessary governor and attachments.

In due course, they arrived; and I had them placed on a waggon and attached to a large gas cooker. Being fortunate enough to have a meter inspector who had been trained as a baker, I had him rigged out as a cook; and after having the waggon nicely decorated, and getting two well-groomed and decorated horses in it, tandem fashion, everything was ready.

Well the whole thing worked splendidly; the gas-oven cooked beautifully with the compressed oil gas; the cook was thoroughly competent; and everything passed off to the complete satisfaction of the public.

Last Saturday, a "Lifeboat Demonstration" in this city was celebrated by a "Trades Procession;" and wishing to identify the gas undertaking with any good work going on in the city, and being also desirous of assisting to some extent so laudable an object, I thought I would repeat my former experiment. Receiving the hearty support of my Directors, I again approached the railway company, and they very kindly once more lent me a couple of gas cylinders. A local confectioner supplied a couple of bakers; and off we went. As "one of the crowd," I watched the reception given to our exhibit, and was gratified to find it seemed to be as attractive as anything in the whole procession. Men and women especially seemed much astonished and amused to see cooks in full costume wielding their rolling-pins and cooking on a waggon in motion. There was evidently no deception, for a savoury odour of cooking pervaded the air in the vicinity of the waggon; and when a shower of hot biscuits fell among the crowd, they seemed as much pleased as mystified, but ate the biscuits with evident relish. As the *Wakefield Express* of to-day puts it: "The Wakefield Gas Company had an interesting exhibit. Bakers were at work, making biscuits, &c., in gas-cooking stoves; and as the produce of their labour was tossed among the crowds in the streets and roads, many persons were enabled to test the efficiency of cooking by gas."

As Lifeboat Processions are taking place in a great many towns in the country, it occurred to me that some of my brother managers might be desirous of helping such a noble cause, and that my experience might perhaps be useful. Hence this letter. There is also another direction in which it might be of service—viz., as a means of advertising gas cookers in districts not easily reached by gas exhibitions.

I may say that the cylinders lent by the railway company were each 7 ft. 6 in. long, by 15 in. diameter, filled with oil gas compressed to 100 lbs. to the inch; that we cooked for 3½ hours, and in this time reduced the pressure in one cylinder to 25 lbs., but did not touch the other; and that we used one of the largest sized cookers made, but employed only the oven.

I need hardly say that cylinders of compressed coal gas can now be easily obtained if friendly railway companies are not available.

Wakefield, July 20, 1895. H. TOWNSEND.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Monday, July 22.

(*Before Mr. Justice* WRIGHT.)

Incandescent Gas-Light Company, Limited, v. Sunlight Incandescent Gas-Lamp Company and Others.

This summons came before the Judge in Chambers; but it was adjourned into Court for the convenience of Counsel and parties.

Mr. T. TERRELL appeared for the plaintiffs; Mr. ROGER WALLACE and Mr. C. E. E. JENKINS represented the defendants.

Mr. TERRELL said this was a summons for an injunction to restrain the defendants from infringing several patents belonging to the plaintiffs; but the only two which need be considered were the original patent (No. 15,286 of 1885) and patent No. 586 of 1891.

Justice WRIGHT asked if the patent was challenged.

Mr. TERRELL said it was.

Mr. WALLACE said, if his friend confined himself to the actual interpretation of the claim, it was not necessary to go into the anticipations. The claim was for "the manufacture, substantially as herein described, of illuminating appliances for gas and other burners, consisting of a cap or hood made of fabric impregnated with the substances mentioned and treated as set forth." The defendants said they did not use "the substances mentioned and treated as set forth." The plaintiffs, by their cross-examination, attempted to put such a construction on this claim as to enlarge it, so as to cover all incandescent materials and substances; and if they insisted upon this view, he should have to show the state of knowledge existing at the time. If the claim were narrowed to the substances actually mentioned in the specification, it would not be material to go into the anticipations.

Mr. TERRELL said he did not think the defendants were benefited either way. If a construction were put upon the claim that the plaintiffs were limited to a material manufactured of the identical substances mentioned in the specification, he was prepared to show that the defendants had used the very substances named therein. On the other hand, if his Lordship should hold that there was a very small variation from those substances, he should ask him to put this construction on the specification—that the description of the process was the substance of the invention. In other words, that the taking of a cotton fabric, impregnating it with a solution of the salts of the rare earths, and then decomposing that solution by burning out the fabric, covered not only the salts mentioned, but others which he should be able to show were known at the time of the patent to be equivalents for them.

Justice WRIGHT: In what sense equivalent?

Mr. TERRELL: That they were known to be substances which would dissolve, which would oxidize, and which were incandescent at a considerable heat.

Justice WRIGHT said the word "equivalent" was somewhat ambiguous. Did it mean that it could be substituted for the other?

Mr. TERRELL said any chemist would know, reading the specification in the light of the then knowledge, that these other substances had been used.

Justice WRIGHT: You do not mean the same composition?

Mr. TERRELL: No; they are oxides of different metals, all of which were known in one group, called the "earths." Any chemist, on reading this specification at the date of it, would at once have been able to point out ten or twelve other substances which might have been used. Then, in accordance with the decision in *Curtis v. Platt*, he submitted that the use of those substances was a mere evasion, and that the patent covered not only the substances mentioned, but any substances which were known at that time to be equivalents for the purpose covered by the specification.

Justice WRIGHT remarked that at first sight it seemed as if the patent were confined to the substances specified.

Mr. WALLACE pointed out that in *Curtis v. Platt*, the patent in question was a mechanical one; any mechanical equivalent was claimed.

Mr. TERRELL said the addition of the word "equivalent" did not make any difference, if by law the plaintiffs were entitled to the equivalents.

Justice WRIGHT said he thought a mechanical equivalent meant anything which a competent person could substitute without any further discovery.

Mr. TERRELL having cited a passage from the judgment of Vice-Chancellor Wood in *Curtis v. Platt*,

Justice WRIGHT asked if there were any earlier patent relating to a similar process such as this.

Mr. TERRELL replied that there was none whatever. The process as applied to the production of light was absolutely new.

Mr. WALLACE said that point was in dispute.

Mr. TERRELL remarked that, after a careful perusal of the various patents, he had no hesitation in saying his Lordship would come to the conclusion that this process was absolutely new.

Justice WRIGHT: You mean the production of an envelope consisting of the ash left after the incineration of a saturated web of some kind?

Mr. TERRELL said he did, and that it was new. He then proceeded to describe the method employed by Dr. Auer von Welsbach in forming the mantle.

Justice WRIGHT asked how old was the use of charcoal filaments in electric lighting.

Mr. WALLACE said the first patent taken out was about the year 1842. But the Edison and Swan patent had expired for something like two years; so that it was much earlier than this.

Mr. TERRELL said no doubt the use of substances for incandescence was well known and old; but the manufacture of an incandescent material by the decomposition of a salt, and the obtaining of the form desired by the saturation of a fibre, were absolutely new. The first patent in question was for the production of an incandescent material in a particular form, and at the same time obtaining rigidity by the decomposition of the salt. The second patent, which was for the use

of chromium oxide, was taken out by Ludwig Haitinger; and the plaintiffs were now the owners of it. The substantive novelty in that patent was the introduction of chromium oxide.

Justice WRIGHT remarked that the patentee went on to say he might replace the chromium oxide by manganese; and, therefore, it was not quite correct to describe it as a patent for chromium oxide.

Mr. TERRELL said he did not propose to go into the other claims, because they did not come into contest here. The principal point was the method of manufacture as described in the first patent. The defendants had taken cotton fibre and a solution of oxides, then impregnated the fibre, burnt out the cotton, and left a filament similar in every respect to that produced by the plaintiffs. Then they had taken precisely the substances described in Haitinger's specification, and had employed aluminium, zirconium, and chromium.

Justice WRIGHT said he should like to see a copy of the defendant's specification. He supposed they had a patent.

Mr. WALLACE said they had not yet; but a patent was in course of being taken out. They employed the three substances Mr. Terrell had already mentioned, combined with another substance which was not disclosed.

Justice WRIGHT asked what the defendants claimed a right to do.

Mr. WALLACE said they claimed the right to employ the substances they were using, even independent of the secret one. Zirconium was employed before the date of the plaintiffs' patent; and they owned a patent which claimed the use of chromium before the plaintiffs used it. Before the date of Haitinger's patent, there was one by Dellwick which claimed the use of chromium; and it also covered manganese.

Mr. TERRELL remarked that Dellwick's patent was for a different process altogether. As he had already said, it was well known that various substances were incandescent when raised to a high temperature; but what was new in the invention of Dr. Welsbach was the manufacture of an illuminating appliance in the way described in the 1885 patent. Then in the 1891 patent, Haitinger had improved upon the process of Welsbach by taking out a subsequent patent for treating in the same manner a new combination of substances which he claimed. The defendants had slavishly followed the process of Welsbach as described in his 1885 patent, and had taken absolutely the combination of substances claimed in the 1891 patent. Dellwick had really nothing whatever to do with this case. This invention had been a tremendous commercial success, and the plaintiff Company had been the subject of attack on various occasions; and in an action in which Mr. Jenkins was concerned, the validity of the 1885 patent was certified by Mr. Justice Romer.*

Mr. JENKINS said the construction now sought to be put upon the patent was not before the learned Judge.

Mr. TERRELL said no construction at all was before his Lordship; but he (Mr. Terrell) should show that the one put upon it must have been that which Mr. Justice Romer adopted when he gave the judgment he did, because the substances used by Mr. Jenkins's clients were not those described in the first patent, but was one called thorium, claimed in a subsequent patent. The Welsbach patent had been in actual operation since about 1885; and of late years the system had proved a most startling success.

Justice WRIGHT said he understood infringement was not disputed here, except in so far as it was incidental to the construction of the plaintiffs' patent.

Mr. WALLACE remarked that if his friend's construction of the specification was correct, everybody infringed it.

Mr. TERRELL said everybody infringed it who took a known fabric, soaked it in a solution of an oxide of one of the incandescent substances mentioned, and then destroyed the fabric, leaving a skeleton of the oxide. This was exactly what the defendants had done; and he contended that they had infringed the first patent, because it was liable to the wide construction he had put upon it. But even apart from that, they had infringed the first patent so far as the process of manufacture was concerned, and the second patent so far as the substances used were concerned.

The affidavits and the cross-examinations of the witnesses were then read. These included affidavits made by Professor Tatlock and Mr. M'Kean, who had analyzed the defendants' mantles; and the affidavit on behalf of the defendants by Professor Crookes, who agreed substantially, although not entirely, with Professor Tatlock's evidence. He said the analysis of these rare earths was one of the most difficult things a chemist could undertake; and it was almost inevitable that slight discrepancies should occur. He also stated that, in the defendants' mantles, there was about 2½ per cent. of a material which he understood he was not to disclose, which did not appear to have been found or referred to at all by Professor Tatlock.

Mr. TERRELL thought Professor Crookes's evidence amounted to this: Though he had sworn, in his original affidavit, that the process was secret, and the substances were secret, and though he had cast a doubt on the percentage results given by Professor Tatlock, it came ultimately to this, that that gentleman's analysis was correct, and that the process of manufacture was the identical one of Welsbach. The only difference he was able to mention was an addition of 2½ per cent. of some substance to the accurate analysis of Professor Tatlock; and he declined to say whether or not it was contained in some of the plaintiffs' subsequent patents, because the plaintiffs had subsequent patents for these various earths as they were discovered one after the other. There was also an affidavit by Mr. Julius Moeller, the General Manager of the plaintiff Company.

The evidence having been read,

Justice WRIGHT said he supposed both parties would agree that he ought not, on this evidence, to try the question of anticipation. Of course, defendants would not resist an order to keep an account.

Mr. WALLACE said they had offered to keep one, which was the usual course when there was a contest of this kind.

Mr. TERRELL said this would be as fatal to the plaintiffs as a refusal of the injunction. There was no doubt about the plaintiff Company being able to pay any amount of damages; and he was prepared to give an undertaking in damages.

Mr. WALLACE said this was always done; and his friend was offering nothing.

Mr. TERRELL said the question of granting an interim injunction was one always of the balance of convenience. This had been laid down over and over again. Here were the plaintiffs in possession, having an old-established patent; and competition was more dangerous to them than anything that could be suggested. The defendants had not yet started business, or were only just starting. The plaintiffs were able to pay any amount of damages which could by any possibility be recovered, even to the extent of hundreds of thousands of pounds. There was no question as to the validity of the patent; and he submitted that the preponderance of convenience was irresistibly in favour of the injunction, and that the defendants should not go on manufacturing until the trial.

Justice WRIGHT said it was rather difficult to see, if an injunction were granted, in what terms it should go.

Mr. TERRELL: That will be for your Lordship to say.

Justice WRIGHT said, if he were to restrain the defendants from manufacturing mantles, and so forth, so as to be an infringement of the patent of 1885, on any application to commit them the whole thing would have to be fought out again.

Mr. TERRELL remarked that no doubt his Lordship would have to decide that what the defendants were doing was an infringement.

Justice WRIGHT said it was not disputed that it was an infringement on a certain construction of the patent; but that construction was disputed.

Mr. TERRELL, having addressed his Lordship on the construction of the specification, submitted that the patent was for the manufacture, in the way described, of illuminating appliances containing certain rare earths, and that the earths mentioned were merely types either of rare earths which were known at the date of the patent, or which might be subsequently discovered. The actual contest was this: Was there really invention in substituting another rare earth for the one used before? Of course there was, if there was an improvement, or if it developed qualities which the original did not develop. But then the second inventor would have a claim not to the whole of the original invention, but to the improvement he had made. In using his patent, he would infringe the patent of the original patentee.

After some further argument,

Justice WRIGHT, without calling on the defendants' Counsel, said: The case could not have been put better than it has been put; and I regret that I do not see my way to keeping things *in statu quo* until the trial. But, on an application of this sort, if I form a strong opinion, even although it may be a wrong one, about the meaning of the specification, I am bound to give effect to it. In that sense, I do not think I am justified, having a strong opinion, in restraining the defendants from carrying on what is a perfectly lawful trade, unless it can be shown that it is an infringement of somebody else's patent. Now, it seems to me that, looking at the language of the specification, and nothing else, it is a specification the whole point and foundation of which is the discovery that certain specified materials, combined in a particular way, with a limited substitution of other materials for them, will produce a certain valuable result. The process of fabrication by which these materials are to be brought into a useful condition is, to my mind, quite a subordinate part of the claim of this patent. The patentee, after stating his object generally, begins by saying: "For this purpose"—that is, for the purpose of the incandescent hood—"I employ"—and that does not merely mean, "I prefer to employ," because throughout the specification it is expressed in the same way—"a compound of oxide of lanthanium or zirconium, or of these with oxide of yttrium." Even these words appear to me to show strongly that the patentee is claiming these specific substances. Then he goes on: "Which substances, in a finely-divided condition, do" something or other—not merely "which class of substances." Again: "When they are heated by a flame, they give out a full, large, pure, white light," and so forth. This appears to be especially the effect of the substances named; and, in a much less degree, the effect of the somewhat similar substances not named. Then he goes on to say that "the proportion in which the substances are compounded may be varied within certain limits." This seems to show that he did not think other substances would have the same effect. He says: "I have found the following proportions very suitable." Then he tells us what can be dispensed with—oxide of yttrium; and then, instead of it, there may be used yttrite earth, containing no didymium, and but little cerium. I think he has gone to the farthest extent in defining what the limits are beyond which one must not alter the prescription, if it is to be effective. Next comes the part relating to the fabrication of the material; and then he goes on to describe the method of applying it. Actually, the only reference to the important part of the invention as described by Mr. Terrell is in the words, "on igniting the flame, the fabric is quickly reduced to ashes; the residuum of earthy matters nevertheless retaining the form of a cap or hood." There is another substitution mentioned; and then the specification goes on: "Obviously, fabrics of various forms or construction may be employed according to the character of the burner to which they are applied." I am not at all sure that the inventor attached any importance at all, on the true construction of this specification, to the way of obtaining the fabric. I am rather inclined to believe he thought there might be many other ways of doing it. The material was what his mind was concentrated upon. Then comes the claim. I know the claim is not to be regarded as governing the specification entirely; for the specification would do without any claim at all. But still I am entitled to look to the claim, to see what the patentee does say; and if it corresponds with what is the substance of the invention as described in the body of the specification, the form of the claim greatly strengthens one view as to what the specification really means. This is the claim: "The manufacture, substantially as herein described, of the illuminant appliances for gas and other burners, consisting of a cap or hood made of a fabric impregnated with the substances mentioned, and treated as set forth." I think, on the whole, I cannot treat this as a claim which can be described as one for a chemical family of substances. To my mind, it is for certain specific substances; and, on the evidence, I do not think it can be pretended that all these so-called rare earths can be substituted one for the other without any material difference in the result.

* See JOURNAL, Vol. LXIV., p. 876.

I do not consider they are within the rule as to mechanical equivalents at all.

Mr. TERRELL: Your Lordship has not dealt with the second patent.

Justice WRIGHT: I do not regard that as a serious one.

Mr. TERRELL: If your Lordship's construction of the first patent is correct—that the substances are material—the second patent is clearly infringed.

Justice WRIGHT: On the evidence (Professor Tatlock's own evidence) I do not think I could regard that patent as one on which an interlocutory application ought to be granted. Nor do I think oxide of zirconium is named in a way which shows that it itself is entitled to be protected. I think, in order to do as little mischief as possible, supposing I am wrong, I had better order this motion to stand over till the trial. There is no harm in that.

Mr. WALLACE: That is the ordinary form of order. The defendants will undertake to keep an account.

Mr. TERRELL: Will my friends do all that is possible to facilitate our getting to the Court of Appeal?

Mr. WALLACE: Certainly; we shall be only too glad if you go at once. But if we agree to all these things, my friend ought to undertake not to threaten our customers in any way.

Mr. TERRELL: You can get that by a separate application.

Mr. JENKINS remarked that such an application had been opposed.

Mr. WALLACE said, if they were to give the plaintiffs any facilities, they ought to be met in a reasonable manner.

Mr. TERRELL said he would not ask for any facilities.

After some further conversation, it was arranged that no order should be made until the following day, to allow Mr. Terrell an opportunity of consulting his clients.

Wednesday, July 24.

To-day, the case was mentioned in regard to the form of order.

Mr. TERRELL stated that it had been agreed to let the motion stand over until the trial of the action; the costs being reserved till then. The plaintiffs would undertake not to threaten the defendants' customers; and the defendants would keep an account.

Mr. WALLACE said the plaintiffs would also undertake not to bring any action against the defendants' customers.

Mr. TERRELL acquiesced.

Justice WRIGHT: You understand that I express no opinion adverse to the plaintiffs' patent at all.

Mr. TERRELL: Quite so.

WORSHIP STREET POLICE COURT.—Saturday, July 20.

(*Before Mr.* BUSHBY.)

The Scarcity of Water at the East-End.

To-day, the Secretary of the East London Water-Works Company (Mr. I. A. Crookenden) appeared in answer to a summons taken out against the Company by Mr. John B. Kyffin, a draper in the Hackney Road, for failing to provide his premises with a proper supply of water for domestic purposes.

Mr. KYFFIN conducted his own case; Mr. G. KEBBELL appeared for the Company.

Mr. KYFFIN, in his opening statement, explained that, having some 26 assistants in his establishment, he had been put to enormous difficulty owing to the scant supply of water lately afforded by the Company; but, so long as there was sufficient for domestic purposes, he, knowing the difficulties attending fighting the Company, had put up with it. On the previous Sunday, however, there was not sufficient; and on the following Monday and Tuesday, the supply practically ceased altogether. There was no water for flushing the lavatories. Some of his assistants had been ill; and one had had to leave. He was in a position to show that, though the long drought had, no doubt, a great deal to answer for, the Company could have made sufficient provision for the consumers, as the Engineers of the Lea and Thames Conservancies would prove that sufficient filtration had not been provided. Instead, the waters of the river taken into the Company's mains had been used for watering roads in the district. He contended that, under the Metropolis Water Act, 1871, in which provision was made for a constant supply of water in the Metropolis, the Company were liable to a penalty of £200.

A legal discussion of considerable length ensued, it being contended for the Company that the Act cited incorporated the Water-Works Clauses Act 1847, and that the complainant must first, in accordance with that Act, pay his rates for the current period. This, it was admitted, was not the complainant's position, because it was not the custom of the Company to take prepayment. It was further submitted that the complainant had to prove either that the Company had voluntarily undertaken to give a constant supply, or that they had been required to do so by the Board of Trade.

Mr. KYFFIN said he could prove by evidence that the Company had, for about nineteen years, been voluntarily giving a constant supply of water in the district, and dealing directly with the consumer; and that the intervention of the Board of Trade was not necessary to the success of these proceedings.

Mr. KEBBELL continued his argument that the Act of 1871 incorporated the Act of 1847; pointing out that section 70 of the latter Act required prepayment of the rates.

Mr. BUSHBY agreed; and he dismissed the summons. He said, however, that as the complainant's ingenious contention under the Act of 1871 had not been pronounced upon hitherto, he would grant a case for the High Court, if desired.

Mr. KYFFIN said he was too poor to take a case; but hoped some municipal authority would do so.*

* Mr. Kyffin subsequently wrote to the papers that he would be prepared to go on with the case, and even, if necessary, to take it to the House of Lords, if a sum of £500 could be raised.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly Report and Accounts.

The following report, with the accounts showing the working of the Company during the six months ending June 30 last (given on the next page), will be submitted to the proprietors at the half-yearly general meeting on Friday:—

The accounts for the past half year show that, after providing for all fixed charges, there remains a balance of £616,771 1s. 4d., out of which the Directors recommend a dividend at the statutory rate of 12¾ per cent. per annum, carrying forward to the credit of the current half year the sum of £256,800 19s. 1d.

The increase in the quantity of gas sold over that in the June half year, 1894, has been at the exceptionally high rate of 6¾ per cent. The severely cold weather experienced in the months of January and February last contributed mainly to this result. There has been, during the half year under review, a considerable increase in the number of consumers of gas supplied on the automatic meter system.

The Directors have the satisfaction to report that they have completed their purchases of coal for the current twelve months at prices materially lower than those of last year.

After a prolonged and exhaustive inquiry, the Committee appointed by the Board of Trade, in December, 1891, to inquire into and report to them upon the subject of the standards to be used for testing the illuminating power of coal gas, have unanimously recommended that the pentane air-flame furnished by a Dibdin Argand burner be authorized and prescribed for official use in testing the gas supplied by the Metropolitan Gas Companies. It now remains with the Board of Trade to take steps to obtain legislative sanction for the standard thus recommended, and for such other modifications of the existing arrangements as may be found necessary in order to render uniform and invariable the conditions under which the gas supplied in the Metropolis is tested by the Local Authorities.

The Court of Directors have been furnished with the usual certificates, under the hands of their Engineers respectively, that the Company's works, machinery, and plant are in a thoroughly efficient condition throughout.

Following the report is the statement of accounts.

Nos. 1 and 2 are the statements of stock, share, and loan capital, the totals of which on June 30 last were as follows: Stock and share capital, £8,754,000; loan capital, £2,444,000.

No. 3 is the capital account, the receipts on which (with premiums) stand at £12,169,250. The expenditure is shown in the following items:—

Expenditure to Dec. 31, 1894			£11,565,490 9 2
Expenditure during the half year to June 30, 1895, viz.:—			
Lands acquired, including law charges	£72 7 11		
Buildings and machinery in extension of works	28,425 3 2		
New and additional mains and service-pipes	8,157 13 1		
Do. do. meters	34,854 7 2		
Do. do. stoves	21,736 8 4		
	£96,245 19 8		
Cr. By depreciation of meters	£4,775 0 0		
Do. do. stoves	8,355 0 0		
	13,130 0 0		
			83,115 19 8
			£11,648,606 8 10
Balance of capital account			520,643 11 2
			£12,169,250 0 0

Nos. 4 and 5 are the revenue and net revenue accounts. These are given in full on the next page.

No. 6 is a statement showing how the Directors propose to appropriate the balance applicable for dividend.

Nos. 7 and 8 are the reserve and insurance fund accounts. The former shows that the balance of the reserve fund on Dec. 31 last was £125,699, which was increased to £127,344 by the addition of £1645, interest on the sum invested. The insurance fund stood at £84,057 at the end of 1894. This was increased by interest on the amount invested (£1101) to £85,158.

No. 9 is the depreciation account. It stood at £43,285 at the close of the past year; and on June 30 last it had been raised to £43,934 by the addition of £649 received as interest.

Nos. 10 and 11 are as follows; and Nos. 12 and 13 are given on the next page.

No. 10.—STATEMENT OF COALS USED, ETC.

Description of Coal.	In Store, 31st Dec., 1894.	Received during Half Year.	Carbonized during Half Year.	Used during Half Year.	In Store, 30th June, 1895.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common . .	284,469	822,047	970,015	1,733	134,768
Cannel . .	13,826	6,564	7,360	—	13,030
Total . .	298,295	828,611	*977,375	1,733	147,798

* In addition to this quantity, oil and spirit, the equivalent of 44,715 tons of canne were used during the half year.

No. 11.—STATEMENT OF RESIDUAL PRODUCTS.

Description.	In Store 31st Dec., 1894.	Made during Half Year.	Used during Half Year.	Sold during Half Year.	In Store, 30th June 1895.
Coke—tons	47,797	603,546	132,113	426,908	92,322
Breeze—tons	4,447	63,094	29,365	32,913	5,263
Tar—gallons	669,713	10,353,204	10,340,968	12,453	669,496
Ammoniacal liquor—butts	16,333	289,703	265,623	10,186	30,227

ACCOUNTS OF THE GASLIGHT AND COKE COMPANY FOR THE HALF YEAR ENDING JUNE 30, 1895.

No. 4.—REVENUE ACCOUNT.

Dr.

June Half Year, 1894.		£ s. d.	£ s. d.
	To Manufacture of gas—		
£541,772	Coals, including oil, dues, carriage, unloading and trimming (see Account No. 10)	624,366 5 1	
11,885	Salaries of Engineers and other Officers at works	13,004 4 2	
148,639	Wages (carbonizing) £152,536/9/6	168,502 10 3	
14,883	Sundries . . £15,966/0/9		
29,824	Purification, including £15,721/9/1 for labour	32,381 3 4	
152,173	Repair and maintenance of works and plant, materials and labour, less received for old materials, £1925 6s. 7d.	141,882 6 6	
			980,136 9 4
	Distribution of gas—		
25,440	Salaries and wages of Officers (including Rental Clerks)	26,062 9 0	
26,746	Repair and maintenance of mains and service-pipes	40,728 7 3	
22,650	Repair and renewals of meters	22,578 8 4	
19,709	Stove fixing, repairs, and renewals	25,820 19 7	
			115,190 4 2
	Public lamps—		
16,750	Lighting and repairing	..	16,710 18 9
	Rents, rates, and taxes—		
3,231	Rents payable	4,297 9 8	
92,530	Rates and taxes	100,456 9 8	
			104,753 19 4
	Management—		
2,750	Directors' allowance	2,750 0 0	
200	Company's Auditors	200 0 0	
7,683	Salaries of Secretary, Accountant, and Clerks	8,127 14 5	
15,402	Collectors' commission	15,220 3 10	
4,513	Stationery and printing	5,905 1 5	
1,825	General charges	1,904 15 3	
			34,107 14 11
1,827	Parliamentary charges	..	32 7 8
1,143	Law charges	..	1,224 1 10
8,597	Bad debts	..	7,983 10 0
10,810	Annuities	..	10,730 1 3
	Public Officers—		
1,226	Gas Referees and Official Auditor	1,186 19 0	
821	Public testing-stations	1,306 10 11	
			2,493 9 11
£1,163,029			1,273,362 17 2
703,252	Balance carried to net revenue account, No. 5		548,887 5 0
£1,866,281			1,822,250 2 2

Cr.

June Half Year, 1894.		£ s. d.	£ s. d.
£1,332,231	By Sale of gas— Common gas, per meter, at 2s. 10d. and 2s. 4d. per 1000 cubic feet	1,312,948 7 10	
72,000	Public lighting and under contracts— Common gas (See Statement No. 12.)	74,128 7 1	
£1,404,231			1,387,076 14 11
£29,337	Rental of meters	..	..
9,349	Rental of stoves	..	10,167 17 11
	Residual products—		
£249,408	Coke, less £42,494 4s. 1d. for labour, &c.	264,391 16 7	
5,869	Breeze, less £2162 5s. 6d. for ditto.	5,278 13 9	
65,685	Tar and tar products	84,208 17 3	
98,017	Ammoniacal liquor and sulphate of ammonia	66,839 8 6	
£418,979			420,718 16 1
£4,161	Rents receivable		4,032 0 9
224	Transfer fees		254 12 6
£1,866,281			1,822,250 2 2

No. 5.—NET REVENUE ACCOUNT.

Dr.

June Half Year, 1894.		£ s. d.	£ s. d.
£62,660	To Interest on debenture stocks and bonds, accrued to June 30, 1895	..	62,659 12 6
74,015	Dividend on the preference stocks	74,015 5 0	
47,500	Dividend on the maximum stocks	47,500 0 0	
			121,515 5 0
2,434	Interest on temporary loans and sundry funds		3,195 17 5
578,767	Balance applicable to dividend on the ordinary stock		616,771 1 4
£765,376			804,141 16 3

Cr.

June Half Year, 1894.		£ s. d.	£ s. d.
£400,920	By Balance from last account	594,049 19 3	
338,796	Less dividend on the ordinary capital for the half year to Dec. 31, 1894	338,795 8 0	
£62,124			255,254 11 3
703,252	Revenue account (No. 4)	..	548,887 5 0
£765,376			804,141 16 3

No. 12.—STATEMENT OF GAS MADE, SOLD, Etc.

Description of Gas.	Quantity Made.	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Quantity Sold. Total Quantity Sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	*10,526,625	514,227	9,326,685	9,840,912	129,346	9,970,258	556,367	51,706
June half year, 1894	9,872,285	509,255	8,717,459	9,226,714	142,145	9,368,859	503,426	51,300

* Including 738,950,000 cubic feet of "oil gas."

No. 13.—GENERAL BALANCE-SHEET.

Cr.

June Half Year 1894.		£ s. d.	£ s. d.
£	To Capital—		
685,294	Balance at credit thereof	..	520,643 11 2
	Net Revenue—		
578,767	Balance at credit thereof	..	616,771 1 4
	Reserve Fund—		
124,065	Balance at credit thereof	127,314 7 7	
	Insurance Fund—		
83,045	Balance at credit thereof	85,046 12 10	
			212,391 0 5
	Depreciation Fund—		
42,645	Balance at credit thereof	..	43,331 0 0
62,660	Interest on debenture stocks and bonds, due on June 30, 1895	..	62,659 12 6
121,515	Preference and maximum dividends due on June 30, 1895	..	121,515 5 0
8,001	Unclaimed dividends due on June 30 1895	..	8,003 18 9
204,762	Sundry tradesmen and others, for amount due for coals, stores, and sundries	..	241,990 0 6
1,667	Benevolent Fund	..	1,667 6 8
1,916,464			1,829,575 16 4

Cr.

June Half Year 1894.		£ s. d.	£ s. d.
£			
179,791	By Cash at Bankers	..	164,233 6 9
500,000	Amount on deposit at interest	..	275,000 0 0
	Amount invested—		
205,847	2¾ per Ct. Consolidated Stock . . £209,093 19 3	..	211,129 17 11
	Stores on hand, viz.—		
68,392	Coals	95,631 3 11	
12,333	Coke	45,296 0 8	
111,745	Tar and ammoniacal liquor and products	204,314 8 1	
210,678	Sundry stores	214,151 13 8	
			559,393 6 4
	Accounts due to the Company, viz.—		
	Gas and meter rental—		
572,625	Quarter ending June 30, 1895	521,264 10 1	
27,420	Arrears outstanding	20,170 6 7	
			541,431 16 8
26,363	Coke and other residual products	30,697 2 8	
..	Automatic meter supplies (fittings account)	46,167 11 10	
1,270	Sundry accounts	1,229 11 2	
			78,387 8 8
1,916,464			1,829,575 16 4

BRENTFORD GAS COMPANY.

The Half-Yearly Report and Accounts.

The shareholders of this Company will assemble next Friday to receive the report of the Directors and the accounts for the half year ending June 30 last. The report says: "The statement of accounts for the half year ending June 30, 1895, shows the sum of £72,248 available for dividends. The Directors recommend the declaration of the following dividends, subject to income-tax—namely, a dividend at the rate of 5 per cent. per annum on the 5 per cent. preference stock; at the rate of 12 per cent. per annum on the consolidated stock; and at the rate of 9 per cent. per annum on the new stock, 1881; and that such dividends be payable on Sept. 2 next. The Directors have long desired, in the interest of their consumers and of the shareholders, to commence the formation of a reserve fund, which tends to prevent fluctuations in the price of gas, and to maintain the rate of dividend in case of increased expenditure during any half year. They therefore recommend that an amount of £1475, being a sum equal to ½ per cent. per annum for the past half year, be placed to the account of a reserve fund; the said sum of £1475 making, with the amount to be paid in respect of dividends on the consolidated and new stocks of the Company for the half year, a sum equal to the statutory dividends permitted to the Company at their present current price of gas. The inclined retort-houses at the Southall and Brentford works, referred to in the last half-year's report, are making good progress towards completion, and will be ready for work by the ensuing winter. The sale of gas during the half year shows an increase of 11½ per cent. over the corresponding period of 1894. The Directors report, with sincere regret, the retirement from the direction of their esteemed and respected colleague, Sir Hugh Edward Adair, Bart., after many years of useful and honourable service on the Board. They have appointed Mr. R. S. Adair to the vacancy."

Referring to the statement of accounts, it is seen that the capital outlay during the six months amounted to £11,059; making the total expenditure £856,782, and leaving a balance of £30,238. The sum received for gas was £93,679; for meter and stove rentals, £4908; for residual products, £26,463; and rents and transfer fees together made £87. The total revenue reached £125,138; being a gain on the corresponding half of 1894 of £852. The income from gas has only increased by £153; but this must be regarded as very satisfactory, seeing that since the June half of last year, there have been two reductions of 2d. each in the price of gas. A gratifying feature to the shareholders will be the growth of £792 in the stove and meter rentals. Regarding the residuals, coke has returned an additional £850; breeze, £110; and tar, £735; but ammoniacal liquor has suffered a decline of £1785. The total expenditure was £88,383, as against £81,993. On coal an extra £5875 has been spent; and the repair, maintenance, and renewal of mains and service-pipes, has involved an additional outlay of £1137. The other items have not fluctuated to any great extent. The balance on revenue account is £36,755, as compared with £42,293. The coal carbonized during the half year was 66,532 tons, of which 813 tons were cannel. The total compares with 59,639 tons in the corresponding period of 1894. The amount of gas made was 681,937,000 cubic feet; and the estimated quantities of residuals were: Coke, 44,325 tons; breeze, 5381 tons; tar, 687,738 gallons; and ammoniacal liquor (410 butts purchased), 20,222 butts of 108 gallons.

DEVONPORT GAS COMPANY.

The Annual Meeting of this Company was held last Tuesday—Mr R. C. Smith in the chair.

The Chairman, in moving the adoption of the report and the declaration of the statutory dividend, congratulated the shareholders on the gratifying results of the year's working. It was remarkable, he said, how history repeated itself even in connection with gas companies. Some twenty years ago, they were in very much the same position financially as they were now. At that time they were just recovering from the high prices of 1872 and 1873 consequent upon the Franco-German war. Coal, iron, and every material in use in gas-works had advanced almost to famine prices; and the Directors were compelled to increase the price of gas by 20 per cent., in order to meet the difficult position in which they were placed. Two or three years afterwards, in consequence of the reaction, they were enabled to reduce the price of gas and to replace the deposit balance. They were now in pretty much the same position. The years 1891 and 1892 not only depleted their balance, but placed them in serious financial difficulties for the time; and the Directors were compelled to increase the price of gas by 3 per cent. They were now again in the reactionary period. Prices had resumed their normal state; and they had been able to reduce the price of gas during the present year from 2s. 8d. to 2s. 7d. Although it was not safe to prophesy, he thought he might predict that there would be a further reduction during the ensuing year. It was gratifying to find that the gas industry generally was in a more substantial position than it had ever been in during its previous history. Not only was it able to hold its own, but it was in greater favour with the public. Although they had two powerful competitors to contend with—cheap oils on the one hand, and the electric light on the other—in many towns where the electric light had been introduced, the consumption of gas went on increasing year after year. The introduction of the incandescent burner marked an era in the history of gas lighting, and would make gas a more powerful competitor against electricity or any other illuminant. It had been brought into use in many towns; and the 32 burners which the Directors placed in the public park last year had given general satisfaction. It was very probable that their use would be extended to the public streets of the borough. If the Lighting Committee of the Town Council were prepared to meet the Directors in a fair and reasonable spirit, they might introduce them in every part of the borough. Referring to the accounts, he said there had been increases in nearly every item of expenditure. Coals had increased £204; wages, £115; public lamps, £81; wear and tear, £212. Some of the increase on the public lamps was due to the experiments he had alluded to with the incandescent burners; and if they extended the system to the town, they might expect a still larger expenditure under that head. There was an increase of £213 in establishment charges; and of this £170 was due to rates and taxes, which had been very considerably augmented during the past year. The total increase amounted to £1028; but they had a little set-off on the other side. The cost of services and meters had been reduced by £233; so this brought down the increase to about £800. On the credit side of the account, there was a gross increase of £853 on gas sales and residuals; on coke, of £166; and on other residuals, of £167. The increase upon the latter would have been considerably more had it not been for a reaction in the price of sulphate of ammonia. There was a difference of £5 a ton in the price of this residual on the year. The result of the whole year's working was a balance to profit of £6041. The total amount available for dividend was £8765; and out of this the Directors recommended the usual statutory dividend of 10 per cent.

Mr. W. Moon seconded the motion, which was passed.

The Directors and Auditors having been re-elected, the Chairman, Directors, and general staff of the Company were heartily thanked for their services during the year.

INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

Annual Report of the Directors.

The Directors of this Company have issued their report on the working for the year ending March 31 last; and it will be presented at the annual general meeting to-morrow. They begin by pointing with gratification to the fact that their prognostications as to the increase in the Company's business have been fulfilled. The sales of burners for the years ended March 31, 1893, 1894, and 1895, have been approximately 20,000, 105,000, and 300,000 respectively. The net profit for the year, before deducting the commissions due to the Manager and Chemist, amounts to £78,196. To this must be added the amount brought forward from last year, £12,723; making a total available profit of £90,919. Deducting the commissions, the balance will be £70,669, from which the Directors recommend writing off the whole of the preliminary expenses incurred in establishing agencies, amounting to £4330. A sum of £3937 10s., representing 25 per cent. of the debenture issue and bonus, has to be reserved out of profits, in accordance with the terms of the issue. The formation of the English Incandescent Gas Share Company, Limited, to acquire the preference and ordinary shares of the Company, has been very successfully carried out. Out of the 9339 preference shares and 39,755 ordinary shares issued, the holders of 9234 and 37,404 respectively have applied to have their shares exchanged for others in the new Company; leaving only a very small outstanding balance of each class. The Directors state that the formation of the English Incandescent Gas Share Company is of great advantage to the Company, inasmuch as it puts at the disposal of the Directors more than £40,000 additional working capital. In view of the rapidly-increasing business, which demands considerably more capital, it would otherwise have been necessary to reserve this amount out of the profits of the Company, to avoid considerable limitation in the scope of the business. As it is, the Directors can recommend the application of £51,883 for the purpose of dividend (free of income-tax), which represents a dividend of £5 on each preference share, and 2s. 6d. on each ordinary share. This leaves a balance of £14,455 to be carried forward. The Directors congratulate the shareholders on the termination of the internal dissensions which were so prejudicial to the interests of the concern. As might be expected, the Company's success has invited competition; and it has been necessary to institute legal proceedings to protect the property. The Directors, however, are pleased to be able to say that the threatened competition is in no way likely to be prejudicial to the undertaking. During the past year, the Company assisted in the formation of the Austrian Incandescent Share Company, with the object of purchasing a majority of the shares of the Vienna Incandescent Gas-Light Company (Oesterreichische Gasglühlicht Actien-Gesellschaft), from which all the European incandescent gas-light companies obtain their fluid supply. This proceeding has, the Directors state, already resulted in a considerable gain to the Company; while the advantages accruing in future from the position acquired in the Vienna Company are obvious. For some time past, the Directors have been convinced that to work Ireland efficiently would require an independent local management, and considerably more working capital than it has hitherto been possible to devote to that branch. It has, moreover, been represented to the Directors from many quarters in Ireland, and by people who are in a position to speak with authority, that an increased and remunerative business is likely to result by placing the control in the hands of a separate Irish Company. When, therefore, they were offered £30,000 for the exclusive licence for manufacturing and selling the light in Ireland, they felt it would be wise to accept it. They, however, made it a *sine qua non* that £15,000 should be paid in shares; thus retaining one-third interest in the Irish Company. This sale has only been effected within the past few weeks, and therefore it does not appear in the accounts accompanying the report.

The Lighting of the Thames Embankment.—The report of the Highways Committee of the London County Council on the above subject, referred to in the Journal last week, was again before the Council at their meeting on Tuesday. Mr. Thornton submitted the amendment, of which he had given notice, to refer the report back to the Committee in order to obtain reports from the Engineer and the Chemist as to the applicability of the incandescent gas system for the lighting of the places mentioned by the Committee; and it was carried by a large majority. The Committee were also instructed to report as to the cost of the present lighting, of incandescent gas lighting, and of electricity supplied by a company; including in their scheme the Embankment gardens.

THE BONUS FESTIVAL OF THE SOUTH METROPOLITAN GAS WORKERS.

A Healthy Statement—Mr. Livesey on Masters' Men and Men's Men—Reduction in the Price of Gas and Increase of Bonus.

"Queen's weather" and "Bonus Day weather" are becoming synonymous terms, said the President of the Incorporated Institution of Gas Engineers (Mr. C. C. Carpenter) at the annual gathering last Saturday of the officials and workers of the South Metropolitan Gas Company, in the recreation-ground at the Old Kent Road station. And so it seems; for this was the sixth anniversary of the festival, and on each occasion brilliant weather has assisted in enhancing the enjoyment of the day. Admission to the ground (which was gay in its dress of flags and bunting, and at dusk was brightened by hundreds of fairy gas-lights) commenced at two o'clock; and the men and those who have a common interest with them in this sharing of profits—their wives and children—assembled in large numbers. Apart from the liberal provision of amusement, the principal feature of these festivals is the meeting, the arrangements for which, from the point of view of comfort both to the speakers and audience, have improved with experience. A spacious marquee had been erected for Saturday's gathering. The platform was prettily draped; and in front there was a compact bank of choice flowers, palms, ferns, &c. Shortly after three, the Chairman of the Company (Mr. George Livesey), accompanied by one of his colleagues (Mr. John Ewart), the principal officials, and other gentlemen, ascended the platform; and the proceedings commenced at once.

The Chairman, on rising, was greeted with hearty cheers. Having congratulated those present upon the fine day, he said the profit-sharing movement, which was started in 1889, had at the present moment as much vitality as, and, he might say, a great deal more than, it had ever had during the six years of its existence. On the 1st of July last year, the men had funds in the hands of the Company—including the money left in their care, the workmen's savings, and the bonus then declared—amounting to £38,000. Now it was nearly £42,000; so that things were growing. He would remark upon this that it was evidence of continued confidence in the Company, because, he thought, one of the strongest proofs of confidence that employees could show in their employers was to trust them with their money. He was anxious that this should go on still further. In addition to the £42,000, there was something like £20,000 in the Company's stock; so that really he ought to put the total at about £60,000. By an alteration made last year, nearly 400 of their people became shareholders; and something like 1600 were also shareholders in the names of trustees. That was to say, half the bonus that was declared now was invested in the Company's stock; so they had something like £60,000 representing the money that had accumulated in the last six years, or an average of about £10,000 a year. He would ask them, supposing the profit-sharing scheme had not been started, where would this £60,000 have been? Would it have been in existence? A great deal of it certainly would not. It would have been dissipated; and no one would have been a penny the better for it—some probably a good many pennies the worse. This gave him an opportunity of explaining the object they had in view. That object was to create a feeling of fellowship and partnership on the part of all engaged in connection with the Company. For a text, he would take a remark which he had heard, but which he believed was made without thought. One of their people had said: "You know, if a man is for the masters, he cannot be for the men; and if he is for the men, he cannot be for the masters." This was a great mistake. Who were the masters, and who were the men? Everybody present connected with the Company was a servant. He himself was a servant; and he was paid a certain salary. He obtained between £500 and £600 a year as Chairman; and he had to do a good deal of hard work for the Company, both at the offices and at home. They were all engaged doing the work of the Company. Now, who were the Company? The Company consisted of a large number of people—many of the workmen, many small people, and a number of rich people—who had saved their money, and who had put it together, and formed the Company. The money had been spent in establishing the Company, and in providing the appliances to enable them to find employment—remunerative employment—for a large body of men, and to supply a great public necessity. Therefore they were all united (or ought to be) in one object—the promotion of the prosperity of the Company, because the prosperity of the Company meant their own prosperity. In other words, in being united in serving the Company, they could best serve themselves; and in thus serving themselves, they could best serve the Company and their country. The work in which they were all engaged was a beneficent work; and it was a work London could not do without. The Government would be very sorry to see—in fact, they had passed a law to prevent—the extinction of the gas. Workers in other trades might stop at a moment's notice; but workers engaged in the manufacture of gas must not, as it was a penal offence. To stop work like this, and consequently the supply of gas, would, Parliament knew, be playing into the hands of all that was bad. They were therefore engaged in a very useful work; and by making that work prosper, they could better themselves. The prosperity of the Company meant an increase of business; and, with an increase of business, they could produce gas at a cheaper rate. By making gas cheaper, they could reduce the price; and a reduction of the price benefited the consumers, the shareholders, and the workers. The prosperity of the Company meant to the workers not only an increase of business, but something more. It meant that they must be constantly making additions to the plant and to the mains in the streets; and they tried to so arrange the laying of the mains that it should give work to stokers who were not wanted in the retort-houses in the summer. Therefore the Company's prosperity provided work for a large number of men at a time when they would otherwise have to seek other work. If the Company, too, were not prosperous (he was not saying this boastingly), they could not afford this Bonus Festival, which cost them between £700 and £800; and moreover they would not be able to give any bonus at all, nor would they be in a position to do what they were doing in the way of superannuation and sick funds (which amounted to above £3000 a year), or allow a week's holiday, with two weeks' pay, to all those men who had been in the Company's service three years. If, therefore, any man thought that, if he was on the side of the masters, he could not be for the men, or if he was on the side of the men, he could not be for the masters, the sooner he dismissed that idea the better. The Company wanted every man—from the Chairman down to the humblest errand boy—to do his best; they wanted everyone to do what was fair, and to do it with an honest and willing mind. If every man would do this, they would all benefit the Company in a very marked and pointed way. It was a theory, and a very common one among some people, and the Socialists had propagated the pernicious doctrine, that by doing as little as possible more men would be employed. If ever that feeling were to prevail, it would bring ruin and disaster to the whole of the community. What the Company wanted was that each man should work willingly and cheerfully. If all of them considered the Company's welfare, see what 3000 or 4000 men might do. He believed he was the oldest servant of the Company (excepting one or two pensioners); and next to him was Mr. John Surman, who came to the Company 45 years ago, as an errand boy, at the time his (Mr. Livesey's) father was Secretary and Manager. He had interested himself in doing his work well in the past, until, step by step, he had risen to be the Company's chief storekeeper. The principle that must actuate all must be to do justly, and he would add, in the language of the prophet, "to love mercy, and to walk humbly with thy God."

Mr. Ewart, in the course of a few remarks, said the prosperity of the Company must be a matter of great gratification to all present. More especially, he thought, must this have come home to the workmen during last winter, when so many deserving, hard-working, and willing men were out of employment; while those engaged by the Company had regular work. He also referred to the depression of trade, and some of its causes.

Mr. Frank Livesey, the Chief Engineer, speaking of his experience of the profit-sharing scheme, said that undoubtedly it had made great progress during the past year. As had been said before, it was a work of education. They did not expect everyone would understand it when it was first introduced; and it was very clear that everybody did not understand it even now. He also spoke of the good feeling which the scheme had engendered between the men and the officials.

Mr. Frank Bush, the Secretary of the Company, addressing those present as "fellow profit-sharers," congratulated them upon the amount of money that had been distributed during the past year—£13,500, which was the largest sum they had ever had. In the first year of the scheme (1889), the amount was £7000; in the succeeding years, £6000, £11,400, £6600, £8300, £12,400; and in the year ending June 13 last, £13,500. These figures showed that £65,000 had been credited to the workmen and officers. He put the workmen first, as they had the bulk of it.

The Chairman, alluding to the fluctuations in the amounts deposited, said it would be remembered that unfortunately they had some time since to increase the price of gas; and consequently the shareholders' dividends and the workpeople's bonuses were reduced. But the price had gone down during the past year or two; and from June last it had been reduced another 1d. per 1000 cubic feet. The bonus for last year was at the rate of 6 per cent. on the salaries and wages; and now the price had been lowered another penny, it would be at the rate of 7½ per cent. Mr. Bush had addressed them as "fellow profit-sharers," and that title would apply to all but the unfortunate Directors. When speaking of the amount of money deposited, instead of using the word "dissipated," perhaps he (the Chairman) ought to have said it would never have been produced, because he believed it had been produced by the loyalty and good work done by the officers and men.

Mr. J. F. Braidwood, the Engineer of the West Greenwich station, remarked that it had come as a surprise to him to hear that the bonus was likely to be increased. There seemed a possibility of their having gas at the ideal two-shilling price that some of them had fixed upon for a long time.

Mr. C. C. Carpenter, the Engineer of the Vauxhall station, said he should like to emphasize one point that the Chairman had made with reference to "masters' men" and "men's men." His own experience was that the real men's man—the man who had the men's welfare really and truly at heart—was the very best masters' man. With regard to the announcement the Chairman had made as to a reduction of price, he thought all present would agree with him that, had it not been for the bonus scheme, though the price might have been reduced, it would not have been done so quickly.

Mr. A. F. Browne, the Engineer of the Rotherhithe works, said the reason they were all so enthusiastic regarding the bonus scheme was because it was based on justice and loyalty—the two fundamental principles that held society together. In speaking of loyalty to the Company's interests, he incidentally remarked that he regretted the Managers of the outside stations had not anything to do with the outdoor department. He should much like to be brought into contact with the consumers; so that, when in difficulty, they would come to him.

Other speeches were delivered by Mr. J. Surman, the chief storekeeper; Mr. T. J. Coggin, the chief rental clerk; Mr. C. Howard, the Chief Inspector; Mr. H. C. Sims, the Secretary of the Profit-Sharing Committee; and Messrs. Austin, Hussey, and Cooper.

The Chairman here announced that an ambulance class had been started among the Company's workpeople in connection with the St. John Ambulance Association; and he had to hand a silver medallion to each of the 24 members who had gained a certificate.

Mr. G. Hawkins, the Chairman of the London Branch of the Co-operative Wholesale Society, then gave an account of the work which was being done by this organization.

A vote of thanks was afterwards passed to the Profit-Sharing Committee for providing for the entertainment of the large company; and, on the motion of Mr. J. Cooley, seconded by Mr. Manley, the men carried by acclamation a resolution thanking the Chairman and Directors for the "consideration, privileges, and advantages" they enjoy.

Tea was subsequently served in two large marquees. During the evening, an admirable programme of music was performed by the Old Kent Road, West Greenwich, and Rotherhithe works' bands; a capital concert was given by officers, workmen, and friends; and an attractive series of views, illustrated by a limelight optical lantern, was exhibited.

THE GAS AND WATER ORDERS OF THE SESSION.

The Board of Trade have issued memoranda stating the nature of the proposals contained in the Provisional Orders included in the Gas and Water Orders Confirmation Bills of last session.

Taking first the supply of gas, the Barnstaple Order is to empower the Barnstaple Gas Company to raise additional capital, not exceeding £12,000 by shares and £3000 by loan; and to prescribe that the minimum illuminating power of the gas supplied shall be 15 candles. The Bognor Order is to authorize the Bognor Gas Company, Limited, to construct and maintain additional works; to prescribe that the minimum illuminating power of the gas supplied shall be 15 candles; and to fix the standard price at 4s. 1d. per 1000 cubic feet, with sliding-scale as to price and dividend. The Felixstowe Order is to enable the Felixstowe Gas Company, Limited, to maintain and continue gas-works, and to manufacture and supply gas in the parishes of Walton and Felixstowe, in the county of Suffolk, and to supply gas in bulk, by agreement, beyond the limits of supply; to limit the amount of capital which may be raised, to £17,000 by shares and £4250 by loan; and to fix the maximum price to be charged for gas at 5s. 3d. per 1000 cubic feet, with power to the Board of Trade, after the expiration of three years, to alter it, or to substitute a standard, with sliding-scale as to price and dividend. The Kildwick Parish Order is to empower the Kildwick Parish Gas Company to raise additional capital, not exceeding £16,000 by shares and £4000 by loan; to prescribe that the minimum illuminating power of the gas supplied shall be 15 candles; and to fix the maximum price which may be charged for gas at 5s. per 1000 cubic feet, with power to the Board of Trade, after the expiration of three years, to alter the maximum, or to fix a standard with sliding-scale as to price and dividend. The Newark Order is to confer power on the Newark Gas Company to raise additional capital not exceeding £10,000 by shares and a like amount by loan; to extend the limits of supply; to construct and maintain additional works; and to supply gas in bulk by agreement beyond the limits. The minimum illuminating power of the gas is to be 15 candles; and the standard price, 2s. 11d. per 1000 cubic feet within, and 3s. 5d. beyond, the borough, with sliding-scale as to price and dividend. The Rothwell Order is to enable the Rothwell Gas Company to extend their limits of supply, and to construct additional works; to prescribe that the minimum illuminating power of the gas supplied shall be 15 candles; to fix the maximum price to be charged for gas at 4s. 9d. per 1000 cubic feet, with power to the Board of Trade, after the expiration of three years, to alter the maximum, or to substitute a standard, with sliding-scale. The Llanberis Gas and Water Order is to empower the Llanberis Gas and Water Company, Limited, to maintain and continue gas and water works; to construct additional water-works; to manufacture and supply gas and to supply water within the parish of Llanberis, in the county of Carnarvon, and to supply water in bulk, by agreement, within or beyond the limits of supply. The gas capital is to be fixed at £2000 by shares and £500 by loan, and the water capital at £4000 by shares and £1000 by loan. The maximum price to be charged for gas is to be 5s. per 1000 cubic feet, with power to the Board of Trade, after the expiration of three years, to alter it, or to substitute a standard, with sliding-scale as to price and dividend. The Order is to authorize the purchase of the gas and water undertakings, or the water undertaking only, by the Local Authority at any time within six months after the Order comes into force.

The Water Orders relate to Holyhead, Mid Kent, and South Hayling. The first-named Order is to empower the Holyhead Water Company to construct and maintain additional works, and to supply water in the parish of Holyhead; also to raise additional capital, not exceeding £6000, by shares, with borrowing powers to the extent of £1500. The Mid Kent Order is to authorize the Mid Kent Water Company, Limited, to maintain and continue the existing, and to construct additional water-works, and to extend their limits of supply so as to include the parish of Aylesford; also to raise additional capital, not exceeding £12,000, by shares, with borrowing powers to the extent of one-fourth of the share capital actually raised. The South Hayling Order is to authorize the South Hayling Water Company, Limited, to construct and maintain works, and to supply water in the parish of South Hayling. It fixes the capital of the undertaking at £5000 by shares, with power to borrow £1000.

The Water Areas of South Wales.—The water question was again discussed at the meeting of the Pontypridd District Council last Thursday, when it was resolved to offer every assistance to the Glamorgan County Council with a view of formulating a county water supply scheme, and a county water authority, and so secure for South Wales the large local water areas.

Issue of New Shares by the Brymbo Water Company.—The shareholders of the Brymbo Water Company have passed a resolution authorizing the Directors to issue, by tender, shares to the extent of £8000. Owing to the trade demands, and the increase of houses, the capacity of the Company to furnish the supply needed is sometimes hampered from want of storage. It has therefore become necessary to provide for the impounding of a larger supply; and the money is required to complete the construction of a new reservoir at Pendinas, which will increase the total storage capacity of the Company to 125 million gallons. If necessary, £2000 will also be raised on mortgage.

A Water Scheme for Malvern Link.—The Malvern Link District Council have agreed to promote in the next session of Parliament a Bill to extend their district, so as to include Cradeley (Herefordshire), and to construct and maintain water-works for the district. A scheme has been drawn up by Mr. Baldwin Latham, by which it is proposed to collect the water and impound the springs on the western side of the Malvern Hills, and to store it in three reservoirs, constructed to supply by gravitation the houses in the district of the Council at different levels, and to give not less than 20 gallons per head per day. The cost is put down at £29,000; and the land necessary for the works would cost £6000.

METROPOLIS WATER SUPPLY.

The London County Council and the Water Question.

At the Meeting of the London County Council last Tuesday, the CHAIRMAN (Sir Arthur Arnold), in accordance with custom, delivered an address reviewing the work of the Council, who will to-day rise for the recess. Referring to the work of the Parliamentary Committee, the Chairman said: "Our parliamentary affairs have been specially memorable for the preparation and introduction of the eight Water Bills for the acquisition of the London Companies. Although the dissolution of Parliament has interrupted the proceedings of the House of Commons Committee, much has been done to smooth and simplify the course of future inquiry, and to reduce the points of opposition. I have visited the intakes of the Companies from the Thames, and believe that no one who is in any way responsible for public health could regard them as a proper and sufficient source of supply, or fail to be willing to join in the consideration of schemes which for 25 years at least have been suggested for the bringing in of a purer supply as auxiliary or alternative. It is more than a quarter of a century since I read, in the criticism of Mr. Bateman's plan for conveying a water supply for London from Wales, that the introduction of soft water could cause a saving of not less than £500,000 a year to the people of London in tea, coffee, and soap." Passing on to deal with the work of the Water Committee, Sir Arthur said: "The Water Committee have done much to prepare the basis for the Bills recently before Parliament. They are now inquiring as to suitable gathering-grounds in Wales for the future supply of London, in pursuance of a resolution of the Council. The Committee have also been much concerned with the results of the severe frost, which demonstrated the insufficient depth of many of the Companies' mains and service-pipes. It is noticeable that, in capitals where there is much greater severity of frost, the freezing of water-mains is uncommon, because of the greater and uniform depth at which they are laid."

On the same occasion, the Water Committee brought up a report, in which they dealt at some length with the failure of the East London, Lambeth, and Southwark and Vauxhall Water Companies to give a constant supply of water in certain parts of their districts. The Committee pointed out that "a bad and intermittent supply, without cisterns, is very much worse than a well-conducted intermittent supply publicly acknowledged, which has the advantage of cisterns;" and they stated that they had directed communications to be addressed to the local authorities whose areas are within the limits of the three Companies named, asking for information with respect to any failure which may have taken place in the constant supply. Pending the receipt of replies, they recommended that a letter should be addressed to the East London Company, pointing out the facts of the case, and asking whether the Company would give the following information: (1) How much water the Company drew from the Lea during the week ending July 20; (2) how much they have from wells; (3) how much from the Thames; (4) how much from gravel springs at Hanworth; and (5) if the Company are not drawing the 10 million gallons a day they are authorized to take from the Thames, what are the reasons why this has not been done. The adoption of the report having been moved, Mr. Boulnois said the cause of the present temporary suspension was an unprecedented drought, such as had not been known for a hundred years. The Council must themselves take the blame in a large measure for the lack of supply. In 1892, the East London Water Company brought in a Bill to extend their powers, build new reservoirs, and make important additions. That Bill was thrown out by the House of Commons on the opposition of the Council. If the Bill had been allowed to pass, there would have been ample storage for the East of London. He himself had charge of the Bill in 1892, and was therefore in a position to state that it was due to the action of the County Council that there was a deficiency in the supply to East London. Mr. Beachcroft moved, as an amendment, that the following questions be added: "What is the extent of the storage works being undertaken by the Company under their Act of 1894? What is the progress being made with these works; and what the progress now would have been if the Company's Bill of 1892 had been passed in 1893, instead of being thrown over to another session?" Mr. H. P. Harris seconded the amendment. A long discussion ensued as to whether the blame for the present scarcity of water in the East-end rested with the Company or with the Council, who successfully opposed the Company's Bill in 1892; and eventually the amendment was lost. Mr. H. H. Marks, M.P., then moved, as an addition to the recommendation, the following: "That meanwhile the Council's Engineer [Mr. A. R. Binnie, M.Inst.C.E.] do confer with the East London Water Company as to the best means of improving immediately the now insufficient and irregular supply." Colonel Ford seconded the proposition; and the resolution, as amended, was carried. It was also agreed that the following words should be added: "That such application be without prejudice to the Council's and the consumers' rights of enforcing their claims against the Water Company." [With regard to the scarcity of water in East London, we may mention that, at a meeting of the Directors of the East London Water Company last Thursday, it was decided to instruct the Engineer (Mr. W. B. Bryan, M.Inst.C.E.) to place stand-pipes on the constantly charged fire-mains, and to erect temporary pipes in the more densely-populated districts wherever possible, in order to allow of persons obtaining water for immediate requirements. It was also decided that a supplementary service should be turned on later in the day should the scheme be found to be practicable.]

The Water Committee, in their report, also referred to the question of procuring supplementary sources of supply for the Metropolis. They reminded the Council that, according to the report of the Royal Commission on Water Supply, the quantity of water required for the Metropolis was likely to increase to 415¼ million gallons in 1931—thus more than doubling the present supply; and they referred to the fact that the principal source from which it was suggested that this quantity should be obtained was, among others, the Thames. After pointing out that recent investigations had shown that the river could not be drawn upon to the extent proposed, they emphasized the importance

of ascertaining whether a purer and more certain source of supply could be found. On Feb. 19 last, the Council, on the recommendation of the Committee, passed the following resolutions: "(1) That the Council is of opinion that the scheme for a system of storage reservoirs, presented to the Royal Commission on Water Supply by the Water Companies, coupled with the proposal to abstract large additional quantities of water from the rivers, is not the proper method of meeting the future wants of London. (2) That any further capital expenditure on works in the Thames and Lea Valleys for the supply of London should be regarded as of a temporary character, and should be restricted to such improvements as may be for the time indispensable. (3) That the true solution of the problem is the obtaining of the necessary additional supplies from a purer source; and that accordingly the Water Committee be instructed to proceed with the preparation of a scheme to be presented for the consideration of the Council as soon as possible, with a view to an application to Parliament for the necessary powers." The Committee alluded to the fact that the Engineer had for some time been investigating sources of supply outside the County of London, and had asked for further instructions in the matter; his opinion being that, sooner or later, a supplemental scheme would have to be considered. The Committee stated that the total survey would cover, for reservoirs and their allied works, at least 9000 acres, and would extend over 350 miles of conduit; and were the scheme prepared for Parliament in such a way as to comply with Standing Orders, it would be one of the largest ever deposited. The Engineer's report on his scheme had hitherto been regarded as a confidential document; but the Committee had now given instructions for its circulation. Taking into consideration all the circumstances, they unhesitatingly advised the Council to proceed. In anticipation of the work that would have to be done, they estimated their expenditure for the year ending the 31st of March next at £5000. Up to the present time, that which had been sanctioned would probably not exceed £2000, or perhaps £2500. This would leave £2500 available within the limits of the estimate; and they recommended that the Engineer be authorized to expend, under their instructions, any necessary sums within this limit.

Pending a fuller account of the important scheme above referred to, which we shall probably give in a subsequent issue, we may say that the sources of supply contemplated are situated at altitudes above 600 feet, extending to 2800 feet, above the sea-level, at the head waters of the Rivers Usk, Wye, and Towy, in the counties of Cardigan, Brecon, Radnor, and Montgomery. They are described as follows by Mr. Binnie: "The areas from which the water would be derived are composed of the impermeable beds of the primary rocks of the old red sandstone and silurian systems, which are noted for the purity of the water which flows from their slopes. Owing to the general altitude of these districts, on the steep slopes of the surrounding hills, arable cultivation is almost impossible; the lower portions being chiefly composed of mountain pastures running up into bare unculturable wastes, with but a sparse population in any part. On these high lands, situated as they are near the western seaboard, the rainfall, as compared with that of the Thames Valley (27 inches), is very heavy—varying from 45 inches up to 75 inches or more per annum. Consequently, from a total area of 312,400 acres, or 488 square miles, 415 million gallons a day can be obtained, after making full allowance for dry years and evaporation, and giving due compensation in water to the streams and rivers from which the supply is derived, as compared with 300 million gallons a day without compensation from the 3542 square miles in the Thames Valley above Molesey. The altitude and contour of the valleys also is such as to permit of the water being stored in economical reservoirs, and flowing by gravitation into service reservoirs situated at an altitude of about 300 feet above the sea in the neighbourhood of London; so that pumping at the source or for the general supply of the Metropolis is unnecessary." The scheme of works proposed is divided into five main sources—viz., (1) The valley of the Usk; (2) the Yrfon, a tributary of the River Wye, combined with the upper sources of the River Towy; (3) the Edw, another tributary of the Wye; (4) the River Ithon, which ultimately flows into the Wye; and (5) the upper portions of the Wye itself. The yield per day from these sources is estimated as follows: From the Usk and Llangorse areas, 182 million gallons; from the Yrfon and Towy sources, 135 million gallons; from the Edw, 18 million gallons; from the Ithon, 37 million gallons; and from the Upper Wye, 43 million gallons—making a total of 415 million gallons. To convey this water to the Metropolis, Mr. Binnie proposes to have two main aqueducts—one to serve North, and the other South London—each capable of carrying 200 million gallons a day. Their length will be from 150 to 170 miles. The routes taken will be those which lend themselves to most economical construction. They will be formed partly of masonry and concrete, and partly of iron or steel pipes at the valley crossings; and will be entirely covered. With regard to cost, Mr. Binnie has prepared the following estimate: Head works, with their collecting and communicating conduits and compensation reservoirs, £8,135,000; aqueduct from Llangorse to Elstree, £7,160,000; aqueduct from the Yrfon reservoir to Banstead, £8,070,000; terminal works at Elstree filters, and connection with existing pipes, £4,850,000; terminal works at Banstead, do., £5,500,000—total, £33,715,000. Adding 10 per cent. for contingencies (£3,371,500), and £1,685,750 for professional and parliamentary expenses, makes up a total of £38,772,250; being at the rate of £93,494 per million gallons of water furnished. Mr. Binnie points out that it is not necessary that the whole of this expenditure should be incurred in the immediate future. It will, he says, be sufficient if, in the first instance, the supply afforded by the Usk from the Llangorse reservoir, of 182 million gallons a day, be brought into the Elstree reservoir. This would cost £17,500,000, or at the rate of £96,000 per million gallons of water supplied. As to the quality of the waters, the Council's Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.) finds that they are of greater purity in their natural state than the Thames water, is after filtration; and he says they are remarkable when regarded from a bacteriological standpoint. They are also very much softer than the waters now supplied to London.

The Quality of the Water during the Month of June.

The returns furnished to the Registrar General by the London Water Companies as to the water supply of the Metropolis during the month of June, show that the average daily supply amounted to 240,490,973 gallons, as compared with 203,786,540 gallons in the corresponding month of 1894. The number of services being 816,517, the rate was 295 gallons to each service. Of the entire bulk of water sent out, 123,565,852 gallons were drawn from the Thames, and 116,925,121 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·5; New River, 1·1; Tottenham, 1·2; East London (deep well), 1·5; East London (river supply), 1·6; Chelsea and Grand Junction, 1·9; West Middlesex and Southwark, 2; Colne Valley, 2·1; and Lambeth, 2·2. The unfiltered river waters contained the following proportions: Thames at Hampton, 3·7; New River Cut, 2·2; and the Lea at Angel Road, 3·6. The Thames at Hampton was, on the 1st of June, turbid and pale yellow in colour. It was of excellent chemical, but only of mediocre bacterial, purity. As delivered by the five Companies drawing from this river, it was in every case efficiently filtered, and of excellent chemical quality for dietetic purposes. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 99·75; West Middlesex, 99·62; Southwark, (No. 4 well) 98·6, (No. 8 well) 96·31; Grand Junction, (general well at Hampton) 97·58, (general well at Kew Bridge) 96·56, (south filter well) 99·75; and Lambeth, 99·36. The New River Cut, before entering the subsidence and storage reservoirs, was, on the 6th of June, turbid and very pale yellow in colour. It was of excellent chemical, but inferior bacterial quality. By passing through the storage reservoirs, it was greatly improved in bacterial quality; and, after efficient filtration, it was delivered in a clear and nearly colourless condition. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 99·58; No. 1 filter well, 99·79; and No. 7 filter well, 97·71. Both chemically and bacterially, it was of excellent quality for dietetic purposes, ranking in this respect with the deep-well waters. The water taken from the Lea by the East London Company at Angel Road on the 5th of June was turbid, and pale yellow in colour. It was of almost exactly the same chemical quality as the Thames at Hampton four days previously, but bacterially of greatly inferior quality. After storage for fifteen days, it was enormously improved in bacterial quality; and, after efficient filtration, the total bacterial improvement was represented by the following percentage numbers: No. 1 Essex well, 99·57; No. 2 Essex well, 99·86; and Middlesex well, 99·04. The deep-well waters of the Kent and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes, except that the Tottenham and East London waters were very slightly turbid. The Colne Valley Company's water was clear and colourless, but contained, for deep-well water, rather an excessive quantity of organic matter of vegetable origin. The water was softened before delivery, and thus rendered suitable for washing. Seen through a stratum 2 feet deep, the Kent and Colne Valley waters were clear and colourless; the Tottenham and East London (deep-well) waters, very slightly turbid and colourless; the New River and East London (river supply), clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters before and after storage, the gravel water used by the Southwark Company, the Thames water after storage for 14·7 days and 6 days by the Chelsea and Lambeth Companies respectively, and the supplies of the various Companies collected on the 1st, 4th, 5th, and 6th of June, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.		Temperature in Deg. C.
Raw and Stored River Waters.			
Thames at Hampton, June 1	3140	..	18·9
" after storage for 14·7 days (Chelsea Company), June 4	880	..	17·7
" after storage for 6 days (Lambeth Company), June 4	340	..	—
West Middlesex unfiltered water supplying filters Nos. 1–5, June 4	260	..	17·8
Southwark Company's gravel water, June 4	370	..	14·5
New River Cut before passing reservoirs, June 5	1920	..	16·6
" " after passing reservoirs, but before filtration, June 5	400	..	16·5
Lea at Angel Road, June 5	8320	..	17·5
" after storage for 15 days (East London Company), June 5	940	..	18·2
Filtered River Water as Supplied.			
Thames—			
Chelsea Company's general filter well, June 4	8	..	17·7
West Middlesex Company's general filter well, June 4	12	..	17·9
Southwark Company's No. 4 filter well, June 1	44	..	19·2
Southwark Company's No. 8 filter well, June 1	116	..	19·5
Grand Junction Company's general well at Hampton, June 1	76	..	18·8
Grand Junction Company's general well at Kew Bridge, June 4	168	..	17·9
Grand Junction Company's south well at Kew Bridge, June 4	8	..	18·0
Lambeth Company's general well, June 4	20	..	17·5
Lea—			
New River Company's general filter well, June 5	8	..	17·0
New River Company's No. 1 filter well, June 5	4	..	16·8
New River Company's No. 7 filter well, June 5	44	..	18·0
East London Company's No. 1 Essex well, June 5	36	..	17·4

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Filtered River Waters as Supplied.		
Lea (*continued*)—		
East London Company's No. 2 Essex well, June 5	12	17·5
East London Company's Middlesex well, June 5	80	17·5
Deep Well.		
Kent, June 6	12	11·3
East London at Lea Bridge, June 6	20	11·4

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied to London during June, as ascertained by tests of samples taken on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 166 samples examined, one was recorded as "slightly turbid;" the remainder being clear, bright, and well filtered. June was a very dry month; 0·03 inch of rain fell at Oxford on the 1st, and 0·08, on the 11th. With these trifling exceptions, no rain fell till the 26th, when there was a downpour of 0·75 inch. On the 28th, nearly 0·24 inch fell, followed on the 29th by 0·02 inch additional; making a total of 1·12 inch. The mean of 25 years being 2·21, the deficiency is 1·09 inch. Unfortunately, neither the river nor the country is much the better for the 1·12 inch which fell in June. The bulk of this coming down on two stormy days near together, little time was allowed for the water to sink into the ground. The consequences were swollen water-courses for a few hours; a sudden flood in the river, followed by as rapid a subsidence; and little, if any, permanent good as compared with what would have been occasioned by the same amount of rain distributed over a greater number of days. The purity of the Thames-derived waters is now at a very high level; and there is not much room for improvement in chemical quality. That it is kept up, and somewhat improved in all respects, the following table, giving the comparison between the composition of the waters in May and June of this year, is a satisfactory proof:—

Averages of the Five Supplies derived from the River Thames.

	Common Salt, per Gall.	Nitric Acid, per Gall.	Hardness, Degrees.	Oxygen reqd. per Gall.	Organic Carbon, per Gall.	Organic Carbon, per Gall.
May	1·994	0·908	14·41	0·045	0·128	0·206
June	1·951	0·903	13·85	0·034	0·081	0·100

Colour.—May, 13·5 brown to 20 blue; June, 11·4 brown to 20 blue.

Note.—All the figures are means with the exception of those in the last column, which are maxima.

Comparing the composition of the waters in June with that of the corresponding month last year shows an almost equally satisfactory result. Bacteriological examinations of the waters from the general wells of the Water Companies, and from the unfiltered water of the river, were proceeded with throughout the month. At the works, the average number of microbes was 19, and in the river 7625 microbes per cubic centimetre. The amount of impurity communicated to the river by a heavy storm following a long drought is shown by bacteriological examinations before and after the heavy storm on the 26th. Before the storm, the Thames water contained 3230 microbes per cubic centimetre; and immediately after, the number rose to 29,032. This large increase produced no perceptible augmentation of the number of bacteria in the clear-water wells of the respective Companies. A careful bacteriological examination of the water at the Companies' works on the days succeeding the storm showed that the filtration was effective; no appreciable increase being detected in the number of microbes present.

MORLEY WATER-WORKS EXTENSIONS.

Local Government Board Inquiry.

At Morley last Thursday, Colonel J. O. Hasted, R.E., held an nquiry with reference to an application by the Town Council to the Local Government Board for sanction to borrow £42,000 for works of water supply.

The Town Clerk (Mr. R. B. Hopkins), in stating the case for the Council, said the original water supply for the borough, which was then the Local Board district of Morley, was carried out in 1869; the works consisting of a service reservoir at Bruntcliffe, which was in the borough, and which would contain 1 million gallons. To the reservoir, a main was laid from the boundary of Leeds; and from it distributing-mains were carried through the town. There was no catchment area originally; the Local Board obtaining the water in bulk from Leeds. Owing to the high level of Morley, a pumping-station and tanks were erected at Churwell. This was the position until 1890. The consumption of water in the borough had enormously increased between 1869 and 1890, and rendered the works constructed in 1869 quite inadequate. In the year 1870-71, the consumption was 45 million gallons, compared with 151 millions in 1889-90. They were always having difficulty with the late pumping works; and, in consequence, the Corporation went to Parliament, and obtained power to carry out an entirely new and independent water-supply scheme. The project sanctioned in 1890 entitled the Corporation to a gathering-ground, and rendered them independent of any other authority; and the ground was at a sufficient height to enable the water to gravitate to Morley. The reservoir was at Cragg Vale, about 20 miles from Morley. The Corporation had obtained power to borrow £100,000; and part of the present application consisted of £27,000 in order to complete works at Cragg Vale. The balance of the application was made up of £15,000, to be utilized in the construction of a new service reservoir at Bruntcliffe. They were practically confined to one site for this reservoir within the district, because it was very important to them to get to the highest point. The land at that point belonged to the Earl of Dartmouth; and they had been able to make a provisional agreement with his Lordship for its acquisition. The reservoir constructed in 1869 was then sufficient to hold more than a week's supply; but owing to the increase in the consumption, it would only contain practically about a day's supply. The impounding reservoir was about 20 miles away; and consequently they were dependent upon a length of mains. If an accident happened of such a nature as could not be repaired within one day, Morley would be left without water. The Corporation were proposing to construct a service reservoir, to contain 10 million gallons, which would be rather more than a week's supply. They intended to acquire 4 acres of land for this purpose. The cost of the new reservoir was estimated at £15,000; and the tenders showed that the work could be carried out for that amount. Their agreements both with Halifax and Leeds had been terminated; but the Corporation had been able to make a friendly arrangement by which, without agreement, if there was any difficulty or breakdown in their works, they would give a little aid.

Mr. *C. Gott* explained the details of the scheme. Asked a question as to subsidence, he said a settlement would not disturb the reservoir; and it could be readily repaired.

Mr. *W. E. Garforth* described the beds of coal and the workings which had taken place under the proposed site for the reservoir, and said the ultimate settlement which was anticipated would not damage a reservoir constructed in such a way as this.

This concluded the inquiry; and Colonel Hasted afterwards visited the site of the proposed reservoir and works.

A NEW WATER SCHEME FOR SHREWSBURY.

The rejection by the ratepayers last year of the Church Stretton scheme of water supply for Shrewsbury, which involved a very large outlay, and the absolute necessity of providing an improved supply for the borough, have compelled the Gas and Water Committee to seek further advice. They have therefore since consulted Messrs. John Taylor, Sons, and Santo Crimp, who have recently reported as to what they consider to be the best means of providing the town with a better supply of water from the River Severn. The existing population of the borough being not far short of 29,000, and the rate of increase at present low, the reporters have adopted an assumed population of 35,000, which will doubtless leave a considerable margin for the future. The present consumption is sometimes as high as 40 gallons per head per day, which points to great waste. Messrs. Taylor and Crimp have taken 30 gallons as a liberal allowance for the future, which, with the assumed population, is equivalent to a supply of 1,050,000 gallons. Having stated their views as to the requisite pressure, they describe the works which they think necessary for the filtration, pumping, and storage of the Severn water. For the pumping, impounding, and filtration works, a river meadow lying due north of the Holyhead Road just within the borough boundary is proposed, with an intake in the river at the north-west corner of the meadow. A 21-inch intake-pipe would lead therefrom to a screen tank, occupying a position just outside the proposed engine-house. The engine-house would be provided with two beam-engines duplicating one another, each sufficiently powerful to perform the pumping of a million gallons in 21 hours; being furnished with two pumps—one to raise the water from the level of the river into an impounding reservoir, and the other to raise the water from the filtered water-tank up to the service reservoir. In addition to these two engines, Messrs. Taylor and Crimp, make provision to fix a Worthington engine, which has lately been erected at the existing works, alongside the pair of beam-engines. A boiler-house, containing three boilers, two of which would be new, and the third brought from the existing works, would be placed in a position adjoining the proposed engine-house; and there would also be a small coal-store and chimney-shaft. The river water would be pumped, in the first place, into a reservoir to contain seven days' storage—that is to say, 7 million gallons. This reservoir would be divided into two compartments by a low wall running through its centre, to enable either compartment to be cleaned without throwing the whole out of use. The water would be pumped into this reservoir over a dashwater fountain, which would assist to some extent in aërating it; and it would be drawn off to the filters by means of a floating pipe, so that the best stratum of water—viz., that about one foot below the surface—would always be taken. Further aëration would take place by distributing into the filters by means of fountains. The filtering area would be arranged in a group of four filters; each being 100 feet square, and each containing 1110 square yards of sand area. Between the filters a sand space, 40 feet in width, and running the whole length of the filters, would be formed, on which two sand-washing bays would be built of the description most suitable for these works—viz., high-pressure nozzle type. A 13-inch main would be laid from the high-level pumps in the engine-house southwards to the Montgomery Road. A most suitable site for a service reservoir exists at Great Hanwood; and upon this it is proposed to put a covered reservoir holding one day's supply. The top water-line of this reservoir would be about 385 feet above Ordnance, and a 16-inch main would be laid therefrom to the borough, being connected to the 13-inch pumping-main at Porthill. Possibly some further mains would have to be laid to distribute the water; but Messrs. Taylor and Crimp have limited the scheme to a definite point within the town. If the scheme here shortly described is carried out, the projectors believe the borough will be possessed of works sufficient to afford a very ample supply of pure, brilliant water at a sufficient pressure, and capable of meeting the wants of a population of 35,000 inhabitants. Considering the works in detail, the engineers remark that the position of the present station makes it quite unsuitable for serving any useful purpose whatever in connection with the scheme; but the Worthington engine and high-pressure boiler could be moved and usefully employed at the proposed works. The abandonment of the existing tank, which stands in the middle of the town, is suggested, as it is at too low a level to be of any service in connection with the scheme. Although the river water above the borough is chemically of sufficient purity for a domestic supply, it is always more or less discoloured by peaty matter; and it is moreover liable to periods of turbidity arising from floods. The treatment that such water requires, therefore, is: Firstly, to have reservoir room to impound a few days' store of water, so as to admit of the intake being entirely closed while the river is turbid; and, secondly, to adopt a system of very slow filtration to remove the peat stain. The last

source of pollution immediately above Shrewsbury appears to be that coming from the County Asylum and Shelton; and the engineers have provided in their estimate £1100 for diverting this drainage, and to place the intake below the point of outfall. They proceed to state the considerations which influenced them in selecting the site for the works; and then refer to the impounding reservoir, which they say would have a depth of 12 feet of water, with the top water-line 190 feet above Ordnance datum, and a capacity for seven days' storage. As to the filtration area, they consider this should be 4440 square yards in extent, divided into at least four beds; so that three-fourths of this area, or 3330 square yards, will be at all times efficient. Concerning the pumping arrangements, the two beam-engines would be of 75 (pump) horse power each, either of which would be capable of performing the whole of the pumping required. Each engine would be fitted with two pumps—one a low-lift pump to raise the water from the river into the impounding reservoir, and the other a high-lift pump to raise the water from the filtered water tank into the district under the head of the service reservoir. Having explained the use to which the present Worthington engine could be put, the capacity of the mains is dealt with. The main between the pumping-engines and Porthill should deliver a million gallons in 21 hours, without undue friction; and it is therefore recommended that it should be 13 inches in diameter. The main from the service reservoir to the borough has to deliver a million gallons in 24 hours; but as the early morning draft for a few hours is at least twice the rate of the average daily draft, this main must be capable of conveying water at the rate of 2 million gallons per 24 hours, and one of 16 inches in diameter is therefore proposed. The whole cost of the works, including the proposed diversion of the Asylum drainage and engineering expenses, but excluding the purchase of the land and easements, is estimated at £42,525; and the annual cost of pumping and filtration, at £880.

The report, of which the above is an epitome, has been under the consideration of the Council; and it produced considerable discussion. Its adoption was moved by Mr. Cock, who announced that, in the opinion of the Committee, it was the best Severn scheme they had ever had before them: but, of course, it was not yet complete in detail, as the Committee did not think it necessary to spend any more money until a vote of the town had been taken. The discussion turned mainly upon the financial aspect of the scheme; and in the result the report was adopted, only three voting against it. The Water Committee were instructed to draw up a report to be submitted to the ratepayers.

Lighting Corporation, Limited.—Under this title, a Company has been formed with a capital of £250,000 in £1 shares, to maintain and uphold any appliances, apparatus, or plant, requisite for gas, electric, oil, or any other methods of lighting now in vogue, and to carry on the businesses of manufacturers of, and dealers in, incandescent lights, and other apparatus for increasing the illuminating power of gas, spirits, oil, or other light and heat producing agents, and suppliers of light, heat, electricity, and motive power. The Company will undertake work as electricians, gas engineers, gas workers and fitters, manufacturing, analytical, and general chemists, chemical manufacturers, mechanical engineers, and ironmongers.

Opening of the New Salcombe Water-Works.—The new works which have been constructed for the supply of water to Salcombe (Cornwall) were lately opened amid much local rejoicing. The water is obtained from springs in Rood Vale, is collected in 9-inch pipes, and then conveyed down to the pumping-station at Hanger in close-jointed Stanford pipes, so that it is impossible for it to become contaminated or for surface water to get into it. The pumping-station occupies a site nearly 40 feet square. The pump-house is fitted with a Priestman horizontal oil-engine of 6-horse power; the water having to be lifted 350 feet in height. The rising main is 4 inches in diameter, of best grey metal, tested with a head of 400 feet, and coated with Dr. Angus Smith's compound. The new high-level reservoir is 50 feet long by 30 feet wide and 10 feet deep; and it is closed by 4½-inch brick arches in cement on rolled iron girders. Its storage capacity is over 80,000 gallons. The works have cost over £3600. Mr. Herbert started the engine at the pump-house, and Mr. Mildmay, M.P., turned on the water to the town from the high-level reservoir. At the opening ceremony, Mr. Ashley Froude, the Chairman of the District Council, said the credit of initiating the scheme attached to the late Local Board. The work had been carried out in an excellent manner by Mr. Jenkins, the Contractor, under the supervision of Mr. F. Beesley. Luncheon was subsequently served in a marquee near the reservoir, when the names of those who had been concerned in the carrying out of the works were favourably mentioned.

Colne Valley Water Company.—The half-yearly general meeting of this Company is to be held at the pumping-station, Bushey, next Friday. In the report to be presented on that occasion, the Directors state that the amount of capital expenditure during the six months ending June 30 last was £2487; bringing up the amount sunk in the works to £223,803, and leaving a balance of £4197 unspent. This amount being small, the proprietors will be asked to authorize the issue of further capital. The profit on the revenue account is slightly less than for the corresponding period of 1894; but this was to be expected, owing to the severe frost of last winter, which caused an increase of £453 in the pipe system expenditure, as well as extra cost in engine working expenses, due to the loss of water from bursts, leakages, and waste. The Directors are, however, pleased to say that, owing to nearly all the mains being laid at a depth of 3 feet, the expenditure was far below that of most other Companies. The balance to the credit of the dividend and interest account, after paying the dividend in April last, was £313. To this has been added £4230, the profit of the past half year; also £56 for interest, &c., received; and £200 transferred from the reserve account in consequence of the exceptional expenditure during the winter. After paying the usual 4 per cent. interest on the debenture stock and preference shares, and transferring £250 to the old engines suspense account, there remains a surplus of £3107, from which the Directors propose to pay a dividend at the rate of 4 per cent. per annum on the original and new shares, leaving in hand £171.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Everyone, I am sure, will be gratified to learn that the meeting of the North British Association of Gas Managers held at Melrose on Thursday and Friday was a very successful gathering. Though it was an out-of-the-way place for the great bulk of the members, the district had attractions; and there were other reasons, which led to a better attendance than most people expected. The North British Association covers the whole of Scotland; and like those troublesome hydrocarbons which Mr. Young spoke of, it overlaps, to some extent, the territory south of the Border. But it also, of undoubted right, entirely overlaps the territory of the Waverley Association of Gas Managers; and this was the first occasion upon which the North British Association formally took possession of the ground. They have visited places which were considered to be outlying before; but they were never "so far from home" as they have been this week. The Waverley Association did not take any steps to welcome the North British, for which, I suppose, there is the reason that the Waverley claims—I think without dispute—to be parent of all gas associations; and there might have been difficulty upon questions of precedence, and the like. But there is no rivalry between the two bodies; and although no formal greeting awaited the Association, members of the Waverley were among the most active in working for the success of the Melrose meeting. Mr. W. Smith, the Manager of the Melrose Gas Company, and a member of both Associations, was, too, on both days, constantly in evidence; confining his attentions, however, to the direction of the strangers in the matter of sight-seeing, rather than taking part in the discussions, which showed good taste on his part. Mr. Smith has a neat little works, situated in a hollow between the new and the old portions of the town, isolated from both divisions, but yet flanked on each side by dwelling-houses; and thereby most unnecessarily crowded, so as to make extension difficult, should it be required. The Company, through one of their Directors (Mr. J. Curle), gave the Association a cordial welcome to Melrose. Mr. Curle's short address was the most felicitously expressed of all such speeches I have ever listened to; and he thereby struck the key-note of happiness and good-feeling which characterized the whole meeting. The general election may have interfered to some extent with the attendance. One member who was present, it is known, stayed at home on the first day to record his vote; another, on the second day, posted away early in order to get home in time to vote; and there may have been others who could not get there at all.

My expectations regarding Mr. Alex. Wilson, as President, were fully realized. He gave a splendid presidential address; and throughout the meeting he conducted the proceedings with promptness, and with a *bonhomie* which did him credit. Of the technical part of the meeting, I need not say anything—it speaks for itself. The membership of the Association keeps up, though it is a pity that so many feel it to be necessary to retire from it, after having joined it. Especially is it to be regretted that so excellent a member as Mr. G. R. Hislop, of Paisley, should be among those who have left. He was one of the Association's best members. His contributions, in the matter of papers, &c., were always above the average; and he never took part in the discussions without raising their tone. I hope it was accident which led to so many of the managers of the larger towns in Scotland remaining away, and that there is among them no slackening of interest in the Association. No greater calamity could happen to the Association than that the leading members of the profession should grow lukewarm on its behalf. One does at times hear such remarks as that the junior members do not get their share of the work of the Association; but such statements are nonsensical. It is true that there are constant attenders, and constant speakers, at the meetings of the Association. But in this matter there is no monopoly, as it is as open to the member who joined that day—though it might not be in the best taste—to address the chair, as it is to the oldest of them. I know I speak the mind of some who work their hardest for the Association, and are most prominent at its meetings, when I say that nothing would give them greater pleasure than to see junior members pushing themselves to the front. As an illustration of the encouragement given to such members, it is only necessary to point to Mr. Yuill, who a few years ago began to take an active part in the meetings, and who is now President. Mr. Vass, of Portobello, has been mentioned before as one of the rising young members; and this year he read a paper which introduced a subject of almost new importance in the sale of gas, and which was followed by one of the best discussions of the day. There is no reason why others should not also come forward. The more speakers at such gatherings giving their experiences, even though it should be but in a sentence or two, the more interesting would be the meetings.

Thanks mainly to the proposals of Mr. R. S. Carlow, which were adopted at Glasgow last year, for the graduating of the subscription—in which, by the way, he was ahead of the late Chancellor of the Exchequer in the matter of the income-tax—the funds of the Association are in a sound condition. The Benevolent Fund was drawn upon largely during the past winter; but it is still more than equal to all ordinary demands upon it. The Murdoch Memorial Fund remains nearly stationary; but another effort is to be made to raise it to at least £500. It was unfortunate, on the second day, that the weather broke down so completely, and that the excursion was almost *non est* on account of the rain. There was this good fortune in the matter, however, that the Committee had arranged for a very short drive—only about three miles—because the discomfort of riding in a deluge of rain was, as it resulted, thereby reduced to a minimum. With regard to the meeting-place, it may be said that these are becoming scarcer year by year, on account of the growing difficulty of getting places of interest to visit on the second day within reasonable distance of those towns which can be reached conveniently by the members. There is one suggestion I would like to throw out in this matter, which is that now a departure has been made in the matter of visiting a district out of the beaten track, on the next occasion when the Association feel that they can follow the same course, they might arrange for a meeting at (say) Ayr, and have their excursion to Old Cumnock, the birth place of William Murdoch—to the shrine, as it were, of the

inventor of gas lighting. Such a visit would doubtless bring out a large attendance of members, not of the North British Association only, but also of other associations; and it might be helpful to the Memorial Fund. It only remains to be said that Mr. Carlow, the Secretary, discharged the duties of his office with his usual affability and acceptance.

The accounts for the past year of the Gas and Electricity Departments of the Glasgow Corporation have been published. In the Gas Department, the gross revenue was £629,362; and the gross expenditure, including depreciation, £557,428—leaving a gross profit on the working of £71,933. After allowing for sinking fund and interest on loans, annuities, &c., there is a balance of £123. It was decided by the Committee to recommend that the price of gas be reduced 2d. per 1000 cubic feet—from 2s. 6d. to 2s. 4d.—the latter being the lowest rate at which it has ever been supplied in Glasgow. It is proposed that the reduction should be retrospective from the date of the last survey. The financial statement of the Electric Lighting Department gave the gross revenue at £21,196; and the gross expenditure, including depreciation, at £17,138. The net deficit, amounting to about £1500, is made up from the gas account. It was agreed that the price for the current year should be continued at 6d. per Board of Trade unit; it being anticipated that next year will be more prosperous, as there are now 208 more consumers than last year. It was unanimously agreed to recommend to the Gas Commissioners that ex-Bailie Mitchell, the present Convener of the Sub-Committee on Finance, be elected Convener of the Committee in room of the late ex-Bailie Ure. So far as the Gas Department is concerned, the report forms very pleasant reading. The revenue is larger than that reported a year ago by £59,816; and that, too, although the price of gas was retained at the same figure as it had been in the year preceding. The department never had such a large revenue. Next to it was two years ago, when they were selling gas at 2s. 9d. per 1000 cubic feet; but this year it is £35,313 higher than then. On the expenditure side, the same remark holds good. It is the highest ever experienced in the department; being greater than last year by no less than £101,500. The next highest expenditure was in 1891-92, when it was £498,489; and the amount last year exceeded that sum by £58,939. The gross profits have been, of course, affected by the abnormal increase of expenditure. A twelvemonth ago, they were reported to amount to £113,617, or £41,684 more than in the year just closed. But in 1891-92 the gross profits were only £48,983. So that, for the past year, the financial result comes out most satisfactorily. The net profit of £123 is quite sufficient. There is no doubt that the enormously increased expenditure is largely due to the miners' strike of last year; and another reason may be found in the severe frost of last winter. A great portion of the distributing plant in Glasgow is laid under the foot pavements, which is very convenient and economical for all ordinary purposes. But everything has its drawbacks; and this system is less suited for standing severe and prolonged frosts than where there is a greater amount of cover. There must consequently, in proportion to some other towns, have been a very large outlay in the repair of fractured gas-pipes. In the Electricity Department, the revenue is £3181 greater than it was the year preceding. The number of customers of electric current is now 586, it having risen during the year from 378. This is not an increase to boast of in such a large city as Glasgow. But there is this curious feature to bring out, that if £2500 (which is probably above the figure) be deducted from the revenue in respect of public lighting, there is left £18,696, which would make the average amount of the accounts of private consumers about £32 each. If, however, the revenues for the past two years be compared, it is found that there is a difference of £3181, which corresponds to an average annual account of only about £15 to each new customer. From this it would appear that in the area supplied with electricity the better class of customers have practically all been secured; and that now a smaller class of consumers is coming in. On the expenditure side, there has been an increase during the past year of £1484; and instead of the "different result" which was anticipated a year ago, the deficit has risen from £607 to about £1500. For the current year, the anticipation is, as usual, that "it will be a more prosperous one."

The Berwick and Tweedmouth Gaslight Company had a revenue during the past year of £5716, of which £4996 was derived from the sale of gas, and £603 from residuals. On account of a reduction of price last year, the revenue from gas was £110 less than in the preceding year; but while this was the case, the consumption of gas for cooking, heating, and motive power showed a good increase. There was a net profit of £1180, out of which the usual dividend at the rate of 10 per cent. has been paid. The receipts for residuals showed an increase of £93. It is very satisfactory to see that the Manager (Mr. Walker) is still keeping up a good record.

It is as I anticipated when I wrote, a month or two ago, with reference to the attitude of some of the Dunfermline Town Councillors towards the Dunfermline Gaslight Company—the antagonistic feeling was but the precursor to a movement for the acquisition by the Corporation of the undertaking of the Company. A special meeting of the Town Council was held the other night to consider such a proposal. Provost Walker, who presided, moved that they resolve to adopt the Burghs Gas Supply (Scotland) Act, 1876. In support of his motion, the Provost said he had been making inquiries regarding the results obtained by other corporations which had taken over gas undertakings; and in every instance he found them satisfactory. In Dunfermline, they were in the position of having one of the most modern of gas-works, which would meet all the requirements of the town for many years to come. He thought there was no likelihood of their being able to acquire the undertaking by private arrangement, because the Directors of the Company knew more about the works than they did; but he hoped they would be able to go through the work of purchase by arbitration on the most amicable terms. He thought they could borrow money at 2¾ per cent.; and if they did so, there could be no doubt as to the success of the concern. If they owned the gas undertaking, they could arrange the price and quality of gas to suit their customers, and have a good sound profit at the end of the year. The motion was adopted unanimously; and, in terms of the statute, further consideration of the subject was adjourned till November, by which time the local community will have had an opportunity of giving their opinion upon it. Should the electors approve, the transfer will be an interesting one, as the price to be fixed will be for a good-going business, with works which are entirely new; the position thus being unlike that of any other place where a transfer has been effected.

I mentioned last week that the Arbroath Gas Corporation had resolved to abolish meter-rents. This week Mr. Herald, one of the Commissioners, writes to the public press pointing out that the action of the Corporation was illegal, as, under their Gas Act, he considers, they are obliged to supply meters and to charge for them such rents as may be considered necessary. He is of opinion that their charge of 1s. a year for the smaller sizes of meters—which was about the cost of their upkeep—was reasonable, and should have been continued. He also quotes figures to show that to the small consumer the abolition of meter-rents may mean a discount upon his gas account of 25 per cent., whereas to the larger consumer it may be only 5 per cent.; and he therefore considers the arrangement unfair. I do not know as to the legality of the transaction in Arbroath; but, if it is not illegal, the step the Corporation have taken is politic, as it is among the smaller consumers that business requires most to be pushed.

Under the newly-passed Act of Parliament for the holding of public inquiries into fatal accidents in Scotland, which previously used to be conducted by the Procurators Fiscal of counties in private, an inquiry was held before the Sheriff and a jury in Edinburgh on Thursday, into the circumstances attending the death of a labourer named Andrew D. Nisbet, who was killed in the Edinburgh Corporation Gas-Works on the 15th inst. The Gas Commissioners are erecting a service chimney in the works; and Nisbet was killed by a brick falling down the inside of the chimney, and striking him on the head. The evidence showed that he was, contrary to orders, inside the chimney; and that, his duty being to use a hook with which to draw the sling towards him, he sometimes used the hook, and sometimes not. A verdict to that effect was given. I should say the Act will be a most invaluable one for every employer of labour. Hitherto, inquiries having been in private, the employer knew nothing of what was said by the witnesses; and no claim having been made upon him probably for a long time, certain witnesses perhaps disappeared, or forgot some of the circumstances. But whether or not, an enterprising pettifogger got up a case against the employer, which frequently had not a leg to stand upon, though, there being no chance of recovering costs from the other side, the employer was glad to pay something to get quit. That, of course, was what the pettifogger wanted. This Act will clip his wings, as all the circumstances will have to be deponed to in public; and there will be no possibility of actions being brought unless there be some reason for them.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 27.

Sulphate of Ammonia.—During the week, the market has been somewhat irregular. But the tendency has been rather in favour of buyers; and to-day's quotation is £9 8s. 9d. to £9 10s. per ton f.o.b. at the ports. There has been a considerable amount of buying by dealers; but, by assiduously quoting low prices and selling small parcels, they have been able to cover their commitments, mostly in Scotland, and to keep prices down, notwithstanding the small production. There has not been much buying by consumers for prompt delivery. It is reported that speculators are offering over early months of next year at the equivalent of £10 f.o.b. at the ports.

Nitrate of Soda is very quiet; the quotation for fine quality remaining at 8s. 3d. per cwt.

LONDON, *July* 27.

Tar Products.—The most remarkable feature of this market is that benzols continue to droop in value, and are declared to be largely over-produced. Yet there are no stocks worth speaking of in anybody's hands; and stocks in the possession of aniline makers are said to be lower than usual. The production both here and abroad is entirely taken up, notwithstanding that there has been an enormous increase in the quantity offering during the past twelve months; and almost every day brings new additions to the market. Perhaps the explanation lies in the fact that gas managers are now largely using the article for enriching purposes; but this can hardly account for all. Pitch is firm; and fuel makers are grumblingly paying the high prices demanded for next season's delivery. Creosote oils are dull and unsaleable; while carbolic acid is in fair request. But prices are unremunerative. Important tar contracts have been fixed at prices varying between 18s. and 20s. 6d., according to position of delivery. Prices are as follows: Tar, 18s. to 20s. 6d. Pitch, West Coast ports, 34s.; East Coast ports, 37s. Benzols, 50's and 90's, 11d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d.; salts, 18s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 5½d. Anthracene, nominal, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia does not revive, either in demand or price. There are buyers who will pay something more for forward delivery; but spot sales do not realize more than £9 8s. 9d. to £9 10s., less 3½ per cent. Gas liquor is quoted at 6s. 9d. to 7s. 9d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With regard to gas-coal contracts, there is nothing further to report; and with the exception of one or two—the principal being that for Salford—business for the season is being gradually brought to a close. Prices are practically unchanged from those last quoted; 6s. 6d. per ton at the pit remaining the average figure for good screened Wigan four-feet, and 7s. for partially screened Arley mine gas coal. In the general coal trade, a slight indication of improvement is reported here and there; but generally only the smallest possible weight of business is coming forward, and with pits as a rule working not more than three days, supplies are in excess of requirements. The better qualities of round coal, of course, find only a very poor sale for house-fire purposes; but colliery proprietors are holding to their

list rates—preferring to put their pits on shorter time, rather than endeavour to force sales by taking lower prices. In the lower qualities of round coal, the keen competition from outside districts causes all sorts of prices to be quoted where business of any weight is being done; and where colliery proprietors hold out for their quoted list rates, they have either to restrict their "get" or put largely into stock. In engine fuel, the very limited output of slack keeps up a steady tone in prices; but with the fairly large stocks which are still held at some of the collieries coming upon the market at low figures, no appreciable advance is obtainable. At the pit mouth, best Wigan Arley coals are quoted at 10s. to 10s. 6d. per ton; seconds Arley and Pemberton four-feet, 8s. 6d. to 9s.; common house coals, 7s. to 7s. 6d.; good ordinary steam and forge coals, from about 6s. to 6s. 6d.; and common qualities of engine fuel, from 3s. to 3s. 6d., with better qualities at 4s. 6d. to 5s. In the shipping trade, very little business has been done, and for what has been put through, the prices taken are excessively low; ordinary steam coal having been sold at 7s. 3d. to 7s. 6d. per ton delivered at the ports on the Mersey. Some collieries still hold out for 7s. 9d. per ton as their minimum; but this figure is practically unobtainable owing to the keen competition, not only of local collieries anxious to move away surplus supplies, but also from outside districts.

Northern Coal Trade.—With a larger demand for steam coals, there is also a slight increase in the demand for gas coal; so that any change in the working of the collieries is rather towards improvement, though in the gas-coal trade there is still only a sparse amount of work at some of the pits. The steam-coal collieries, however, are generally fully employed; the exports being heavy. Best Northumbrian steam coals are quoted at from 8s. 9d. to 9s. per ton f.o.b.; second qualities, from 8s. to 8s. 6d.; and steam smalls, from 3s. 3d. to 3s. 6d. There is also a good demand for manufacturing coals, on contracts that have some time to run yet, and which are at rather better prices than those now current. There is a little larger demand for gas coals, both locally and for shipment; and the deliveries to the great gas companies are increasing in extent, though they are still below the maximum. Prices of good gas coals vary from 6s. to 7s. per ton f.o.b.; and most of the contracts that are now running are at rates fixed between those prices. Coke is steady, with a fair export demand, and a larger inquiry from the north-west, where more of the blast-furnaces are now in operation than has been the case for some time. Best Durham coke is from 13s. to 14s. per ton f.o.b.; some moderate kinds being about 1s. per ton less. Gas coke shows no alteration of moment this week, either in price or extent of stock.

Scotch Coal Trade.—Work has been generally resumed in the collieries after the holidays; but so far there has been little change in the market. Prices have not much altered; the demand, though improving, being but moderate. A slight rise is expected soon. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. Shipments for the week amounted to 127,885 tons—a decrease upon the preceding week of 32,115 tons, but an increase as compared with the corresponding week of last year of 103,295 tons. For the year to date, the total shipments have amounted to 3,742,784 tons—an increase (the tables being now turned, owing to the strike of last year) of 77,294 tons.

Exhibition of Gas Appliances.—Under the auspices of the Bolton Corporation, an exhibition of gas appliances has been held in the Public Sale Rooms. The collection of apparatus was furnished by Messrs. Richmond & Co., Limited; and a course of cookery lectures was delivered by Miss Richmond.

Liverpool and the Vyrnwy Water Supply.—Mr. Joseph Parry, the Liverpool Corporation Water Engineer, reported to his Committee last week that, for the first time in the history of Liverpool, the district had been supplied without any water being pumped from the wells. The average quantity of Vyrnwy water distributed during the preceding week was 12 million gallons per day, which approaches nearly to the maximum quantity that can be obtained from the Vyrnwy works by the first instalment.

Mr. C. Sellers on Gas and Electric Lighting.—On the occasion of the annual outing of the employees at the York Gas-Works, which took place on the 20th inst. at Hull, Mr. Charles Sellers, the Company's Secretary and Manager, made a few encouraging remarks in proposing the toast of "Prosperity to the York United Gas Company"—a Company which, he said, not only deserved the confidence and mutual support of those present, but, from the honourable manner in which it was engineered by the Directors, deserved, as he believed it most generously received, the confidence of the public. He acknowledged that quite a flutter was being kept up in York by certain individuals who were in favour of the electric light; but very few of those who in theory supported it had any intention of using it themselves. They simply wanted it in York because other towns had it. The intelligent public knew well with respect to cost, light for light, that while 16-candle gas in York cost from 1s. 10d. to 2s. 1d. per 1000 cubic feet, the electric light at 6d. per unit would cost practically 6s. 2d. per 1000 cubic feet; and there were not many people in the city so witless as to pay three times the cost of gas for the sake of having the electric light. By burning gas with an incandescent burner, the comparison was even considerably more in favour of gas. But this handful of electric light supporters seemed to ignore that burner. Some theoretical people were fond of saying, parrot-fashion, that the electric light was the "light of the future." It was far more true to say that gas would be largely the fuel of the future. In York, there were 1200 or 1300 gas-cookers in use; and many hundreds of gas-fires and warming-stoves; and this year the Company had fixed more cookers, fires, and stoves than they had done in any year since gas was first used in this way. For engines also, and for a hundred trade purposes, gas was growing daily in favour. In his concluding remarks, Mr. Sellers pointed to the fact that on the Continent, where gas is dearer than in England, and where the electric light has been longer in use, the latter is now frequently given up and replaced by incandescent burners; and he expressed the opinion that no gas shareholder need lose one wink of sleep from fear of the electric light, either in York or elsewhere. Where people had money enough to pay for it, they had a right to have it; for there was ample room for both systems of lighting. The toast was cordially received, as was also "The Health of the Manager."

Messrs. Joseph Evans and Sons, of Wolverhampton, have been awarded a "Special" first-class certificate for their pumps, &c., at the Tasmanian Exhibition.

Para Gas Company, Limited.—The accounts of this Company for the half year ending March 31 last have been submitted to the shareholders. The net profit, as shown in the balance-sheet, is £941, which has been carried to the profit and loss account. The income from the public and private lighting totals up to £9424; coke and tar brought in £3337 and £528; and the entire revenue is £14,611. The Manager (Mr. J. R. Hislop) has lately been in London in consultation with the Board on the question of extending or terminating the contract with the Government, which will come to an end on Jan. 4, 1896. The Directors have resolved to pay the usual half-yearly dividend on the preference shares.

The Dangers of Electric Currents.—Early last Wednesday morning a fire, caused by an electric current, occurred at the shop of Mr. Davis, a bench maker, at Taunton. We learn from an eye witness that the electric flash proceeded from the supply-wire to the transformer in the street, and that immediately thereafter fire was seen issuing from the wires inside the shop. The flash appears to have set on fire some loose paper and other similar goods, which were in close proximity to a gas-pipe—the current having apparently taken this course to earth. Finally, the connecting gas-pipes (compo) were cleanly melted off both the inlet and the outlet to the meter, and the meter itself was burnt out—the top being melted off. The fire was put out by the local Fire Brigade before any verys erious mischief was done; but the local newspapers assess the damage at £200. The method in which the fire appears to have been caused was, first, the fusion of the wire to the transformer allowing the current to pass to the lead covering of the window and sign-board; and then the passing of the current through the return wire (which was in contact with the lead covering) into the shop, and by way of the compo gas-pipe to earth. Probably the whole strength of the 2000-volt current was in this way conveyed to the interior of the premises, as the non-conducting covering of the interior wires would have been sufficient to prevent any flashing from the current of 100 volts strength, as ordinarily used.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 221.)

Issue.	Share	Whe ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22—23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15½—16½	+½	4 10 11
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	28 Feb.	12†	Brentford Consolidated	100	257—262	+2	4 11 7
180,000	,,	,,	9†	Do. New	100	205—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	+7	4 14 10
888,500	Stck.	28 Feb.	5	Bristol	100	125—130	+4	3 16 11
320,000	20	28 Mar.	11½	British	20	54—56	+1	4 0 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7½—8	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	99—102	..	5 17 8
150,000	20	11 July	8½	Cagliari, Limited	20	28—30	..	5 10 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	299—304	..	4 8 9
165,000	,,	,,	10½	Do. New o.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	260—270	..	4 16 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 [illegible] 9
486,090	10	26 July	11	European, Limited	10	25—26*	+1	4 4 7
354,060	10	,,	11	Do. Partly pa d	7½	16½—17½*	..	4 14 3
5,646,590	Stck.	14 Feb.	12¾	Gaslight & Coke, A, Ordinary	100	288—293	+3	4 7 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105—110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190—195	..	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf..	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	130—133	..	3 0 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	198—202	..	2 19 4
3,800,000	Stck.	10 May	12	Imperial Continental	100	252—257	+2½	4 13 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	16—17	..	5 17 8
150,000	5	24 May	8	Oriental, Limited	5	7½—7¾	+¼	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	+¼	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	+½	6 7 3
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	302—307	..	3 18 2
290,000	,,	,,	13	Do. C do.	100	310—315	+3	4 2 6
775,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172—176	..	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	233—238	..	3 7 3
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	+2	2 15 6
700,000	50	26 June	7	Grand Junction	50	114—118	+1	2 19 4
708,000	Stck.	14 Feb.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—264	..	2 16 9
400,000	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Feb.	12½	New River, New Shares	100	390—400	+5	3 3 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148*	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max	100	157—161	..	2 9 1
120,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	288—293	..	3 8 3

† Next dividend will be at this rate. *Ex div.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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EDITORIAL NOTES.

The Chartered Meeting.

THE meeting of the proprietors of The Gaslight and Coke Company last Friday was a very tame affair. It was not largely attended; and this was fortunate, in the circumstances, as the scene was changed from the great hall on the ground floor, in which these meetings are generally accommodated, to a smaller chamber on the upper floor of the Horseferry Road building. The Governor—Colonel Makins—presided, and exhibited a commendable restraint in speaking of the affairs of the Company and of other people. He did not stir anybody up by sarcastic observations; and consequently the proceedings subsequent to his speech were but brief and unexciting. The Company have done very well of late. There is no gainsaying this fact; and we are glad to recognize it, and give credit where credit is due—which in this case is to the station managers. Circumstances have enabled the Company to sell more gas, and the carbonizing staff and workpeople have made more, and made it at a cheaper rate, than has been recorded for the undertaking of late years. Moreover, a check seems to have been imposed upon the growth of capital outlay upon unproductive works; and not before it was time. The Governor spoke warmly for the station managers in regard to the improvement that has been brought about in the fuel account; and he also very properly praised the distributing staff for their devotion to duty during the past winter. All this is amply deserved by the recipients of the Governor's laudation. The Gaslight and Coke Company have in their service as good men in every rank and office as ever engaged in the industry of gas lighting; and the more this is recognized at head-quarters, the better it will be for the undertaking.

It must be conceded that the Governor spoke on Friday under a certain disadvantage, due to the announcement of a reduction in price by another penny per 1000 cubic feet by the South Metropolitan Company, to which we gave publicity last week. This means, of course, a corresponding reduction of revenue from public lighting, and from the Surrey-side district supplied by the Chartered Company, and an increase of the inequality between the prices charged for gas north and south of the River Thames. But if Colonel Makins was annoyed at this step on the part of the Directors of the Company which his own undertaking are obliged to follow, he kept his feelings to himself on Friday. It is true that his repeated declarations about the necessity for caution in altering the price of gas, and the obligation that exists for considering all the circumstances of an undertaking before anything of the kind is done, bore directly upon the conditions created for the two Companies by the action of the South Metropolitan Board. But he never mentioned this action; and so the matter passed.

There were two points made by Colonel Makins in the course of his speech, as to which some question might be raised in the best interests of the community and of the Company. The first was in connection with the Company's adventure into the field of automatic prepaid supply, which it seems is as yet restricted to particular portions of the Company's district. The Governor said, in the most matter-of-course manner, that there are no automatic prepayment meters in the whole West-end, which his hearers were left to infer is much too aristocratic a region to require such accommodation. While there are upwards of 6000 applicants for these meters still waiting their turn to be equipped with these true "poor man's friends," it is hardly reasonable to ask the Board to reconsider the case of the West-enders. We are not informed as to what precise topographical meaning attaches to the term "West-end" in the official vocabulary of the Horseferry Road. But, taking the term as Londoners use and understand it, we dare aver that there are in the West-end of London very many poor people who would be glad of a supply of gas upon the cash system; and it is by no means clear why a single one of these should be debarred from participating in the advantage which the Company are willing to extend to others, simply because he lives near neighbours far richer than himself.

The other questionable topic dealt with by the Governor was the matter of the storing of residuals by the Company, with the object of dodging the market. Colonel Makins

tacitly admitted the truth of our hint of last week as to the existence in the Company's stores of large stocks to certain products; and he supported the policy of holding such stocks to sell, as is imagined, to advantage at favourable opportunities. We believe, on the contrary—and are supported in the belief by the opinion of most of the managers of gas-works in which residuals are worked up, outside the Chartered Company—that this policy is quite a mistaken one. Where the seller is a public company or corporation, the favourable opportunity for realizing stocks which have once been allowed to accumulate never comes. There is no good theoretical reason why this should be so; but so it is. Official sellers are no match for the trade; and the knowledge possessed by the latter of the amount of stocks held by the former, subject to the obligation to realize at some time or other, effectually keeps down the market rate. It is not as if the products works—say, of the Chartered Company—were an independent, dividend-earning concern, which the Directors were bound to study as their principal business. If all the sulphate at present held by the Company were to be shipped out to sea in the London County Council sludge-boats, and tipped overboard in the Middle Deep, the Company's dividends would not suffer. Why, then, should the Directors be at the pains to try and work the market for the sake of making some problematical profit which never comes to hand? Sooner or later, the man who tries to work this string so cleverly gets tired, and throws all the accumulated store upon the shrinking market. Down go prices; but who cares? Where is the superiority of this would-be clever method of selling, over a regular course of auction sales which would return to producers the values of the day, as well as relieve the market from the terror of impending mountains of stocks?

Some interesting remarks upon municipal methods of finance and incandescent gas lighting served to fill out the Governor's speech; and there was no discussion. On the whole, Colonel Makins did very well on Friday; and if the Chartered Directors will only continue to show themselves as amenable to worthy outside leading as they have been in the matter of automatic prepayment meters, and—to name one opening for amendment—will reconsider their policy of dealing with residuals, they will yet earn the thanks of the gas profession at large.

The South Metropolitan Report.

The Directors' report and the statement of accounts relating to the last half-year's working of the South Metropolitan Gas Company have been issued; and the general meeting will be held on the 14th inst. There are special reasons why as many proprietors as can possibly make it convenient to attend this meeting should do so. The Board have to make an important communication to them respecting the fate of the recent abortive stock-conversion scheme; and much will depend upon the statement of opinion in regard to this matter that may be the outcome of the meeting. All that the report says on the subject is that the Board had to withdraw the Bill of last session; but it is significantly added: "In these circum-"stances, the Directors desire the opinion of the proprie-"tors as to the expediency of re-introducing the Bill next "session." We are unable to publish the accounts this week; and we must therefore confine our observations to the substance of the report, which will be found in another column. At the outset, formal announcement is made of the reduction in the price of gas by 1d. per 1000 cubic feet as from the Midsummer quarter. This price—2s. 3d. per 1000 cubic feet—is a return to the lowest figure ever charged for gas in the Metropolitan area; and it is difficult to see how it can get much lower. And at the same time coke and ammonia are also exceptionally low. Coal is, of course, cheaper; but this consideration does not explain the favourable state of the accounts for the half year, which is due mainly to the extraordinary growth of the consumption, partly caused by the severe winter. The increase has been at the rate of 13 per cent. for the whole period—probably the fastest development ever recorded for a London gas undertaking at any time. The number of consumers continues to increase. During the past half year, 6817 automatic prepayment meters were fixed; bringing up the total number in use on June 30 to 32,333. This is an astonishing tale of expansion. The surplus profit realized for the six months over the amount needed to pay the nominal 13 per cent. dividend is applied to building up the reserve and insurance funds so sadly depleted in the years 1889 to 1892. Of the wisdom of this policy, there can be no doubt. As already remarked, the general meeting ought to be well attended, as the proceedings are certain to be both interesting and of high political importance.

Manchester Gas Affairs.

The report and statement of accounts issued by the Gas Committee of the Manchester Corporation for the year ending March 31 last are, as usual, clear and comprehensive. The consumption of gas showed an increase of 4·28 per cent. for the year, mainly due, of course, to the exceptional weather of February and March, which taxed the resources of the works to the utmost, especially in the daytime. Thanks, partly, to the increased demand, the proportion of unaccounted-for gas further dropped to 2·81 per cent., which is a very creditable figure. Large additions are recorded in the numbers of stoves, engines, and automatic prepayment meters, which means that the community are becoming more and more alive to the capabilities of their gas supply. The average consumption of the prepayment meter customers only works out to something like 4300 cubic feet for the year; but the computation is probably vitiated by the short time during which most of them were in use. The gross profit on the year's working was £134,692. Of this amount, only £30,299 was required for interest on capital, and £13,954 for repayment of loans; leaving what is called a net profit of £90,438. The annual subsidy to the City Fund takes £54,044. In February last the City Council ordered a reduction in the price of gas by 3d. per 1000 cubic feet, and the abolition of meter-rents within the city. The undertaking can very well afford these concessions, as we argued at the time. They will represent a reduction of revenue of £56,100 for the current year. But cheaper coal and cannel will go a long way towards making up for this estimated loss; and increased consumption and progressive management ought to answer for the rest. After all, gas sold in Manchester at the present price—2s. 3d. per 1000 cubic feet—cannot be considered too cheap, even from the point of view of a member of the Gas Committee. There is plenty of profit to be made by selling it at this price, as will in all probability be realized during the next two or three years. Usually five or six years are allowed to pass without alteration in the selling price of Manchester gas; so that meanwhile the Committee will have plenty of breathing time to settle their finances on the new basis.

If one might tender a little advice to the Committee in the circumstances, it would be concerned with their treatment of their consumers and staff and workpeople generally, which might be inspired by a more generous spirit. The Manchester Corporation gas undertaking is not now a struggling concern in which it might be supposed to be necessary to cut everything down to the smallest margin of cost, especially salaries and wages. Without going into particulars in this respect, it is sufficient to note for the exemplification of our meaning that in the list of "miscel-"laneous expenses" of this great undertaking will be found these donations: To the Royal Infirmary, a 50-guinea subscription; to the Royal Eye Hospital, £20; contribution to the Manchester Corporation Thrift Fund, £428. It is true that the Manchester Corporation are not much, if at all, stingier than other trading Corporations; but really this short list of benefactions cannot be deemed creditable to any public authority. We are not in favour of coddling employees of corporation committees, or doing anything out of the way to render corporation employment too seductive to the populace and at the same time putting other local employers at a manifest disadvantage. But could not the Manchester Gas Committee do something to help forward a solution of the problem of old-age pensions? Where is their helpfulness of the research work of the Victoria University? These inquiries are not meant to be impertinent; and we trust our motive in putting them will be seen in a proper light by those whom it may concern.

Dr. Thorpe on Gas Enrichment.

It must be considered a matter for congratulation by followers of the gas industry, that, on such an occasion as the annual meeting of the Society of Chemical Industry, the President should have seen fit to devote a considerable portion of his Inaugural Address to the subject of coal gas enrichment. The meeting was held in Leeds last

Wednesday; and the President for the year is Dr. T. E. Thorpe, who is at the head of the Somerset House Laboratory, and was formerly Professor of Chemistry at the Yorkshire College. His competency and independence are therefore unimpeachable; and, as we have repeatedly acknowledged, it is a great advantage for outsiders of such eminence to tell gas technicians what they think of their aims and methods. As it happened, the gas industry was the first special subject mentioned by Dr. Thorpe, from which it may be supposed that its condition and prospects occupy a foremost place in his thoughts at the present time. He remarked upon the fact that the extinction of the industry was confidently predicted some years ago, by certain prophets of a new light that was imagined to be ready to dispossess it of its place among the appliances of civilization; but he acknowledged that chemists at least would be very sorry to see gas-works abandoned. Dr. Thorpe described a gas-works as similar to a town with many staple trades, each acting and reacting upon the prosperity and development of the others. "This very potentiality, indeed, afforded the "strongest assurance of its continued existence; and with "each fresh economy in production, with each new "application as a source of power, with every new dis-"covery in the use to which the countless products of "the destructive distillation of coal could be put, the "industry acquired a new lease of life. The tendency of "modern life was more and more to turn night into day, "and 'Light, more light!' was the ever-constant cry." These are words of sound practical wisdom, supported by incontrovertible evidence.

Somewhat suddenly after this exposition of generalities, Dr. Thorpe descended into a review of the particular question of gas enrichment, without stopping to discuss the "previous question" of whether such a process is required at all, and, if so, to what extent it is desirable. We should have liked to hear Dr. Thorpe's views upon this head. As it happened, he passed it over without so much as recognizing the existence of such a problem; and he quickly proceeded to a conclusion that "if benzol continued at its "present price, it would constitute the best and cheapest "enricher that could be obtained." Dr. Thorpe entertains a good opinion of oil gas as an enricher; but, with regard to carburetted water gas, he uttered a pronouncement that cannot be disregarded by those who favour the large extension of this manufacture in British gas-works. The difficulty of the carbon monoxide looms largely before the imagination of the Somerset House analyst; and it would perhaps have been better if, before expressing himself so strongly in this regard, he had prepared himself by closer study of the actual results upon the composition of the gas sent out for consumption, in the case of those undertakings which have adopted carburetted water-gas plant. Naturally, Dr. Thorpe is no more partial to acetylene than to carbon monoxide as a constituent of illuminating gas sold for general consumption; but we certainly think that, speaking in the capacity of a chemist, he should have paid some attention to quantities as well as to qualities, when treating of matters in regard to which the "public mind," alluded to by himself, might conceivably form mischievous misconceptions. It has unhappily been a trick of some analysts before Dr. Thorpe to play the part of alarmists by such cries as "there is death in the pot;" and it will be time enough to declare that British coal gas is a deadly compound when the facts are found to warrant the imputation. Very aptly, the Mayor of Leeds (Alderman Gilston), in welcoming the Society to the town, took the opportunity for drawing attention to the practical side of the enrichment question by asserting that it would cost £20,000 a year to add another candle to the illuminating power of the local gas supply. He observed upon this that even light might be bought too dear; and that this supposititious extra candle would not be worth its cost. Most people who understand the matter will heartily agree with him.

Mr. Leo Taylor, F.I.C., F.C.S., has been appointed Gas Examiner to the Leyton District Council. Mr. Taylor holds a similar position in connection with the Walthamstow District Council; and he is the Public Analyst for Hackney.

Mr. W. B. Jackaman, who has been for many years a Director of the Ipswich Gas Company, died last Thursday morning at Guernsey. The deceased gentleman (who was in the 63rd year of his age) had been in failing health for some time.

WATER AND SANITARY AFFAIRS.

Two remarkable reports relating to the water supply were brought before the London County Council on Tuesday. One came from Mr. Cripps, the Parliamentary Agent to the Council, who scouted as "absurd" the idea that the rejection of the East London Company's Bill in 1893 had anything to do with the recent insufficient supply in the Company's district. As the rejection of the Bill at that date has for the present prevented the district from receiving a large addition to the daily quantity of water, there is evidently some connection between what happened in Parliament and the interruption of the constant service in East London. But Mr. Cripps had something still more astonishing to say. He declared that "there was "no opposition on the part of the Council to the Company "making additional works." This allegation is simply incomprehensible; and it is at once qualified by Mr. Cripps's own statement, that in acting on behalf of the Council he required the Company to limit the amount of capital proposed by the Bill to that which would be necessary for the next two years. Such a restriction was, of course, simply out of the question, and rendered the opposition absolute. Mr. Cripps tries to make it appear that the Council objected to the Bill because of certain conditions which it sought to impose upon the consumers; but it is perfectly clear that if these conditions had been withdrawn, the Bill would have been opposed by the Council on account of the proposed works. Moreover, the Council have always alleged that they opposed the Bill because it would add to the capital account, and would increase the cost of acquiring the undertaking. The interests of the consumer played a very small part in the contention of the Council; and we can fancy the Progressives feeling rather surprised to find how virtuous they have been. But the question is well disposed of by a reply which the Company have given to a communication from the Council. In this rejoinder, signed by Mr. Crookenden, the Secretary, it is shown that, if the Bill of 1893 had been allowed to proceed, the supply from the wells would by this time have been increased by 3 million gallons per day, besides 7 million gallons from the reservoirs; thus precluding any interruptions in the constant supply. The letter of reply is very strongly worded, and charges the Council with being the entire cause of the recent scarcity of water in the Company's district.

Next to Mr. Cripps we have Mr. Binnie, whose report was even the more remarkable of the two. The Chief Engineer to the Council might, in some respects, serve as a very good witness for the Water Companies, or at least for the East London Company. He showed that this Company had really poured a vast quantity of water into their district. In the months of February, March, April, and May, the quantities so supplied had "exceeded any "previous record." During the first five months of the year, the supply averaged more than 53 million gallons per day. This would exceed 44 gallons per head—certainly a very large quantity, though the Grand Junction Company have given more for several years past. But Mr. Binnie contends that there has been a great and sudden increase in the rate of supply on the part of the East London Company; and he finds an explanation for this in the theory that the mains were broken by the frost in February, and that an enormous leakage has been going on ever since then—the water running away underground. Subsequent to the appearance of this report, the mains of the Company have been examined under the direction of their Engineer; but, though some pipes have been found damaged and defective, it is stated that this has not occurred to such an extent as would in any way account for the failure in the supply. Mr. Binnie, however, gives as his conclusion that what the Company are now suffering from "is not an insufficiency of supply," but an extraordinary leakage, due to the damaged state of the mains. There is water, therefore, beating all previous record, only the supply fails to reach the consumer. But the short supply only dates from the middle of July, and the pipes were broken in February. However, one thing is made clear, that there was abundance of water down to the end of May. The Council may, if they please, adopt Mr. Binnie's view as to the cause of

the present—or rather recent—difficulty; and, if they do, they must take the statistics their Engineer has cited, though these operate to the prejudice of their plea that the state of the East London supply shows there is not enough water in the valleys of the Thames and the Lea to meet the wants of London. How the County Council can manage to reconcile Mr. Binnie's report on the East London supply with their proposal to "supplement" the present system, we are rather at a loss to conceive; yet the Council decided on Tuesday to proceed with their investigations in connection with Mr. Binnie's project for an expenditure of £38,000,000 in order to obtain a supply from Wales.

In the midst of all the agitation and excitement which has been raised in reference to the East London water supply, an article has appeared in *The Times* from a special correspondent, stating that, though there has been a deficiency in the supply, there has been "nothing "approaching to a famine." The writer deprecates the "exaggerated language" which has been used on this topic, as likely, if uncorrected, to "cause a false impression, "and to create needless alarm." On the other hand, the correspondent says he found the allegations of the Company as to reckless waste of water during the month of June "amply confirmed out of the consumers' own "mouths." Following this judicious article in *The Times* —so different from what we generally find in the Daily Press—there appears a letter from Mr. Walter Hunter, in which the writer shows the practical importance of retaining a cistern in the house, even though there is the expectation of getting a constant supply. Mr. Hunter also dwells on the fact that "London householders have not "yet learned the lesson that waste of water is a grave "offence against the community at large." Light is thus dawning on the water question; and it may be safely asserted that there are few subjects on which more misapprehension exists, or concerning which there is a greater amount of unreasoning prejudice.

That it should have remained for a layman to take a new point against the Water Companies, when so many lawyers have cudgelled their brains in the effort to devise a means of getting over an explicit statutory enactment, is, to say the least, remarkable. To Mr. John B. Kyffin, a draper of the Hackney Road, belongs the honour of having raised such a point—a barren honour, however, because nothing came of the objection. There is but small chance, we fancy, of Mr. Bushby's decision at the Worship Street Police Court being set aside by any superior tribunal. Section 70 of the Water-Works Clauses Act, 1847, is about as plain in its meaning and its terms as a section can be made. That section requires the pre-payment of water-rates, not the pre-delivery of water. Whether a company insist or do not insist on their statutory rights in this respect, is a question that cannot affect the legal aspect of the case. The law is there. If a company waive compliance with its strict requirement, that is an indulgence shown to the consumer; and it should be duly appreciated. In the present case, apparently, the indulgence is not appreciated, except as a weapon that may conveniently be used in attacking the East London Water Company. The rule of law has been affirmed again and again until there is really not the smallest excuse for attempting to evade it or to explain it away. Henceforth there ought to be no more of these ingenious, but hopeless, arguments. If a water consumer wishes to proceed against a company, he may reasonably be required to begin at a proper legal starting-point. The company may or may not apply to him for his money in advance. But the consumer must see that he pays before he prosecutes. The law does not impose the duty of sending round collectors; but the consumer can always take his rates to the company's office, and the money is not likely to be refused.

If some of the newspapers that habitually rave and rant over the supposed misdeeds of the London Water Companies were to turn their attention to the question of water supply to the teeming millions of India, they might find a useful field for their energies. Some of the remarks made by the President of the British Medical Association at last week's congress would furnish our contemporaries with a telling text for the discourse. In India, according to Dr. Ernest Hart, there is the most ignorant and monstrous opposition to the diffusion of modern knowledge on the subject of water-poisoning and sanitation. The deadly trammels of red-tape fetter the action even of those members of the medical service who would fain pursue a more enlightened policy. The system is so ill-judged and cumbrous that it becomes almost impossible to trace the sanitary history of any body of troops; while in the sanitary reports of the officials may be read signs of intense discouragement on the part of the writers, and evidence of perfunctory compliance with the duty of filling in innumerable forms, "dictated apparently in a pure spirit of "book-keeping." A strong indictment, truly, when coming from an eminent medical authority; and there is only too much reason to believe that the charges are in no respect exaggerated. In the whole of the Bombay, Madras, and Burmah Presidencies, there is no skilled examiner of water. A bacteriological laboratory is unknown where it is most wanted; and—folly of follies—medical officers are not even allowed the use of microscopes, unless they provide them at their own expense. In view of such astonishing and discreditable facts, who can question the justice of Dr. Hart's earnest claim for the appointment of a Royal Commission or a strong Departmental Committee, whose duty it should be—without the delay that is only too common in such inquiries—to demonstrate the truth or the inaccuracy of those allegations, and recommend a prompt and efficacious remedy. The President of the British Medical Association asserts, meanwhile, that upwards of 1,250,000 deaths occur annually in India from malarial infection, and nearly 750,000 from cholera; while our English troops are decimated by typhoid fever owing to the present condition of the water supply.

The Gas Interest in the New Parliament.—In addition to the members of the new Parliament whose names we have already given as being associated with the gas industry, Mr. J. T. Firbank, who has been chosen to represent East Hull, is a Director of the Newport (Mon.) Gas Company.

Mr. G. H. Hill, the Engineer of the Manchester Corporation Water-Works, has been appointed by the Sub-Committee of the Works Committee of the Edinburgh and District Water Trust, to advise as to the construction of the embankment and works for the new reservoir on the Talla, in order to secure that it shall be sufficiently strong for the public safety.

Dust Destruction and Electric Lighting.—We learn that Mr. F. Hastings Medhurst, M.Inst.E.E., of Westminster, has been instructed by the Hackney Vestry, of which he is the Consulting Electrical Engineer, to prepare for the parish a scheme of electric lighting in conjunction with dust destruction. Mr. Medhurst, it will be remembered, read a paper on "Electricity Supply from Town Gas" at the meeting of The Gas Institute.

Mr. E. K. Burstal, M.Inst.C.E., of Messrs. Stevenson and Burstal, of Parliament Street, has received instructions from the Santos Improvement Company to proceed to South America on the 6th prox., to report generally upon their undertaking, and as to the advisability of making considerable extensions in respect alike of sources of supply and distribution. His partner (Mr. E. H. Stevenson) is just returning from a professional visit to Canada in connection with large gas undertakings.

Scarcity of Water in New York and Chicago.—A great outcry has lately been raised at the enforced curtailment of the water supply at the East-end of London, consequent upon the recent unusual drought. In the opinion of many, the water service is much better managed in America than in this country; but, according to reports just to hand, it has not been altogether satisfactory in New York, while Chicago has been absolutely on the verge of a water famine. We learn that all over the former city there has been a notable decrease of water during the past few months, and complaints have been freely made by the occupants of the higher parts of buildings. In one house, only a few hundred yards distant from an aqueduct station, the only water received on the upper floors for the last few months has had to be pumped into a tank on the roof, and consequently it reaches the consumers charged with whatever impurities may have found their way into that receptacle. Many petitions, signed by hundreds of taxpayers, have lately been forwarded to the Commissioners of the Sinking Fund, urging that serious consideration should be given to the needs of the community in this respect; and asking that any water supply, under gravitation, that can be secured should be added to the present service. In Chicago, the trouble seems to be in the pumping capacity of the city waterworks rather than in the sources of water. The tunnel supply throughout the city is estimated to aggregate 434 million gallons a day; but the nominal capacity of the present pumps falls short of this figure by nearly 80 million gallons. It is reported that they have never been able to furnish more than 276 million gallons in a working day; and this amount is found to be inadequate for the growing population. The subject has been brought before the City Council, and an appropriation of at least $1,000,000 has been asked for.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 302.)

In the week which intervened between a settlement and an August holiday, it could scarcely be expected that there would be a full attendance in Capel Court, or that business in the Stock Markets could be anything better than decidedly limited. And such was the case last week; but an unusual concomitant of the slack business was the fact that prices, so far from drooping, made a very fair improvement. A more cheerful feeling in such leading departments as Home Rails and the Foreign Market had a marked effect; while a conviction that the top of the tide in the Kaffir boom has not yet been reached, kept that animated market in a state of wonderful buoyancy. The Government stocks have not moved much; but several of the gilt-edged division have improved on their already wonderful prices. The Money Market remains in the same condition. Business in the Gas Market has naturally been at a rather low ebb; but it is probable that this is owing almost more to the scarcity of stock to be obtained than to any holiday influences. Short and quiet as the five-days week has been, yet substantial improvements are apparent in several quotations; while of most of those which have not actually risen, it may be said that they are only waiting for a chance of business being done in them to show their value. Gaslight "A" opened at an advance, and kept it evenly through the week; while actual business done in the "B" limited and the 6 per cent. debenture forced the quotations up freely. South Metropolitans were stagnant and untouched; people waiting to see what the half-year's report and accounts will show. A single transaction in Commercial old stock at top price was all that was marked in that line. The Suburban and Provincial division were hardly touched; and quotations remained unchanged. Among the Continentals, Imperial was fairly active, but unvaried. Union, however, had another smart rise; and European also improved. Of the rest, Buenos Ayres and Monte Video advanced fractionally. In Water, business was quite as plentiful as was to be expected. The old figures were unchanged, except in East London, which had another fall, owing to troubles in relation to its supply.

The daily operations were: The Gas Market opened strong on Monday; and prices were good throughout the list. Gaslight "A" advanced 2; and European and Monte Video, ½ each. Activity was well maintained on Tuesday, with a generally favourable tendency. Continental Union improved 5. Wednesday showed that business was getting quieter, and prices of Gas stocks stood still; but East London Water fell 3. On Thursday, many transactions were marked at higher prices; but quotations were still left undisturbed. On Friday, however, they were not to be denied; and Gaslight "B" advanced 2; and ditto 6 per cent. debenture, 2½. The Stock Exchange was closed on Saturday.

ELECTRIC LIGHTING MEMORANDA.

Tyranny in St. Pancras—Niagara at Work—The Cost of Gas and Electric Lighting.

St. Pancras seems to be supplying many lessons illustrative of the unconsidered incidental results of municipalizing electric supply. The latest news of the kind relates to an application of the London Hydraulic Power Company for permission to lay pipes in certain parts of the parish for the purpose of working lifts in some premises requiring the accommodation. The Electricity and Highways Committees of the Vestry agreed in a joint recommendation that the permission sought should be refused on the ground that "the Company must be regarded as competitors with the Vestry, inasmuch as the Electricity Department are prepared to supply the necessary power for the purpose required." Notwithstanding an emphatic protest from some members, who perceived the objectionable character of the recommendation, and strove to save the Vestry from committing an act of monopolistic tyranny, this remarkable resolution was adopted by a narrow majority; so that if this state of things holds good, any ratepayer of St. Pancras desiring to instal a power lift upon his premises, will be debarred by the Local Authority from using a system which has conferred great benefit upon the rest of the Metropolis, with the express object of forcing him to support an undertaking in which the same authority are commercially interested. It remains to be seen whether the Vestry are justified in law in thus employing for commercial reasons a power which was entrusted to them for administrative objects only. The best course the Hydraulic Power Company and their intending customers can follow in the circumstances will be to defy the Vestry, and make the latter take the case into Court. The Company cannot afford to allow their prospects to be prejudiced in this way at the caprice or to subserve the selfish aims of trading Vestries.

A remarkable letter from Professor George Forbes appeared in *The Times* of the 27th ult., describing the progress made with the Niagara Falls electrical power scheme. It has been reported that the first commercial delivery of electric current from the great 50,000-horse power generating station at the Falls has been started—the consumers using it for the reduction of aluminium. Professor Forbes claims that his plans for this undertaking have proved thoroughly successful. The Niagara Power Company are actually supplying electrical energy at variable pressure to the 1000-horse power electric furnaces of the Carborundum Company, and are arranging for the transmission of more of the same power to Buffalo, where it is to be made available for arc and incandescent lighting, for electric tramways, and for factories and mills. All this has been rendered possible, according to Professor Forbes, by his deciding, in the face of much opposition, to employ alternating currents at low speed of alternation; commuting them into continuous currents only as and when required for electro-metallurgical purposes. The price charged to local consumers at Niagara is half a farthing per Board of Trade unit; and this returns a handsome profit. Professor Forbes declares that there is no difficulty or experiment in going to great distances; this being merely a question of expense and of the value of power at the place to which it is transmitted. The Niagara Company naturally prefer to do as much business as posssible close at home. But Professor Forbes thinks there are plenty of places in the world where it will pay well to carry electrical energy 400 or 500 miles; and he has "no hesitation in saying that the low cost and perfect success, practically and commercially, of the Niagara works opens a new era in the world's industrial evolution." These be brave words; but they arrest attention and command respect on account of their basis upon an accomplished fact. Professor Forbes, like most electricians, knows how to crow; but at least, unlike the majority of his professional brethren, he has laid his egg first.

The well-worn controversy concerning the relative cost to the user of gas and electricity for lighting purposes is not yet dead, although not so much is now heard of the subject as was the case before there was a possibility of checking estimates by reference to facts. It may be revived a little by the publication of the striking figures we reproduced in our "Electric Lighting Notes" a fortnight ago in regard to the experiences of a Manchester firm, which more than bear out our habitual contention that electric lighting, when supplied from a central station, costs the consumer about three times as much as gas, in the same locality. A sudden rise of the lighting bill from £45 odd to £118 odd, is something calculated to "give pause" to the most enterprising of shopkeepers, especially when no particular countervailing advantage can be claimed for the dearer system. The electric lighting comes out badly enough on the surface of this comparative statement; but it can be made to look very much worse by supposing, as may well be the case, that the same consumer goes back to gas, and for the sake of economy and brilliant effect adopts incandescent burners. Then, light for light, the improved system of gas lighting will work out to about one-fourteenth only of the cost of electricity, taking Manchester prices for both supplies. Hence it is not to be wondered at that the electric lighting interest, as one man, anathematizes the name of Dr. Auer von Welsbach. But there is no comfort in cursing. What Welsbach lamps have done in the past, they will continue to do in the future, "only more so." And alongside them will appear in due course a brilliant crowd of devices similar, or with a similar object; and municipal and other speculators in central station electric lighting will have to face a competition infinitely more severe than anything they may have experienced up to the present time. It will not be possible for these speculators to treat all improved gas lighting systems as the St. Pancras Vestry have treated the Hydraulic Power Company; yet nothing that this Company can do to take business away from electric supply stations is worth a second thought in comparison with the havoc actually being wrought upon the prospects of such undertakings by the improved methods of gas lighting of which we are now only seeing the beginnings.

Presentation to Mr. W. Yates.—Mr. William Yates, who is retiring, for private reasons, from the position of Manager of the Hoylake and West Kirby Gas and Water Company, after acting in that capacity for sixteen years, was recently the recipient, from the employees of the Company, of a testimonial, in the form of a marble clock, as a mark of the esteem in which he is held by them. The presentation was made at the works, by Mr. A. G. Readdy, the Secretary, who spoke in the highest terms of Mr. Yates, of the good feeling which existed between him and those under him, and of the great regret they had at parting. He expressed the earnest hope that Mr. Yates would have health and happiness in his retirement. There were a good number of the men present, most of whom endorsed these remarks. Mr. Yates, who had no previous knowledge that the presentation was to be made, and consequently had an agreeable surprise, responded to the remarks of Mr. Readdy and the men in a manner which showed how strongly he felt and appreciated the good feeling expressed. The clock bore the following inscription: "Presented by the employees of the Hoylake and West Kirby Gas and Water Company, to Mr. William Yates, on the occasion of his retirement from the management. July, 1895."

A NEW SUGGESTION IN ECONOMICS.

Not many months ago, a work by an Austrian writer named Max Nordau, entitled "Degeneration," appeared in an English dress, and created a considerable sensation by reason of the fresh light thrown by the author upon some of the most remarkable aspects of modern literature and art. Encouraged by the success of this publication, Mr. Heinemann has just brought out another work of the same author, under the somewhat startling title of "Conventional Lies of our Civilization;" and in drawing our readers' attention to a portion of the contents of this book, we are actuated not by admiration of the author, but merely by the desire to place upon record a certainly striking suggestion offered by him for dealing with a recognized economic problem. Suggestions for curing the evils of the established economic and industrial system which do not fall into the categories of Socialistic or Communistic remedies are not often met with. We all know what the latter are; and most people are convinced that they are impossible. But, on the other hand, few of us would commit ourselves to a profession of faith in everything being for the best in the best of all possible worlds. It may not be, and in point of fact is not, true that, under the existing economic system, the rich are growing richer and the poor poorer, in all that constitutes real wealth. But the glaring inequalities of condition which mark the present era of man's history can be neither overlooked nor defended by those who are still persuaded that, on the whole, the course of civilization has made for the general good. How is it, we are perpetually asking ourselves, that pauperism is so peculiarly the curse of the richest communities, and that the problem of the unemployed looms largest in those countries which are most eminent in manufacturing production? Is there any fundamental error in the existing industrial system which produces this embarrassing result, and makes the pauper the noxious bye-product of a generally beneficent economic and social organization? If there is, it should be possible to distinguish and eliminate it without having recourse to the crude method of the Socialist, which would probably kill the whole body politic in the attempt to cure the diseased member. It is indeed a vital question.

"This latter part of the nineteenth century," says Nordau, in approaching the subject, "is filled by the cry of 'Bread for the Masses.' . . . The causes of modern revolutions are not constitutions on paper and democratic party cries, but the longings experienced by so many to toil less and live better." It is not, as he is careful to show, that the majority of the people now living under civilized conditions are absolutely poor. On the contrary, as compared with their forefathers, they are much more comfortably circumstanced. The trouble arises from the undoubted fact that they are relatively poorer, in comparison with the rich of their own epoch, than the tillers of the soil, the hewers of wood and drawers of water, who were their predecessors. This he puts to the discredit of the modern growth of the city and the factory. "This is the point to which all the countries of Western Europe have arrived—countries considered to be the wealthiest and most highly civilized in the world. Their population is divided into a small minority, living in the midst of an aggressive and extreme luxury, and a vast number consisting of persons who can only support life by the hardest exertions, or who, in spite of all their efforts, find it impossible to attain to a normal human existence. . . . Never before were there so many persons entirely without possessions as at the present time." This is the subject, it may be well to observe here, that a Committee of the British House of Commons was recently appointed to inquire into.

It is safe to prophesy, however, that no Parliamentary Committee would ever arrive at the remedy for the evil of "the unemployed" that commends itself to this author. He arrives at it through a discussion of the sources of great wealth, which he finds to be due in almost all cases "to the appropriation of the results of others' labour, not one's own. . . . When the real estate inherited by a certain man increases in value, it is not the result of his own exertions, but of the fact that the number of working men torn from the land and soil is constantly increasing, that all forms of industry are growing in extent, that the cities are becoming more and more populous, that the labour of civilized society is being confined more and more to manufacturing industries, thus causing the price of provisions to rise in the same proportion as the price of manufactured articles is falling—in short, because other men are working, not because the landed proprietor exerts himself. When the speculator amasses millions, it is by the abuse of a superior strength, either of information, sagacity, or of combination, with which he deprives the labouring and saving classes of their property, just as the brigand relieves the wayfarer of his purse, first knocking him down with his club. When the manufacturer becomes a Crœsus, it is by systematic plundering of his workmen, who receive, for their exertions in his behalf, nothing more than food and shelter, like so many domestic animals, and both the scantiest possible. The entire results of their labours flow into the money-bags of their master."

The foregoing picture of the origin of great relative wealth is, of course, exaggerated, probably purposely. Nor is Nordau more complaisant when he turns from the contemplation of the accumulation of wealth to the conditions of manufacturing industry. It is a fine thing for engineers to apply the sources of power in Nature to the use and advantage of man. "But machinery has not proved as yet the saviour, the liberator, and the ally of the workman, as was first hoped, but, on the contrary, has made him its slave," because production is not governed by demand, but by the desire for the employment of capital. So, according to this trenchant critic, manufactures are increased, but men decay. "That which theory has neglected up to the present time, practice will soon set about in earnest—namely, to demonstrate the preposterousness of the definitions and principles of the present science of political economy, invented and maintained by and for capital, and accepted without inquiry by the world."

Yet Nordau will have naught to do with nationalization of industry, nor any other proposal to destroy the natural institution of private property. He holds that the disturbing element in our economic system is the artificially created right of inheritance. "When a man accumulates a fortune, he wishes to bequeath it to his family in such a way that its members will be, if possible, relieved for ever from the necessity of earning their own livelihood. This is contrary to Nature's laws. It is a violent disturbance of the regular arrangement of the world, according to which every living being is compelled to win for himself his place at the great table of Nature, or perish. This disturbance of Nature's regulations is the cause of all the evils of the economic world." This is the sum and substance of the whole matter, according to Nordau; and we cannot do better than leave him here. How he shows that the system of inheritance really defeats its own end, while helping to ruin the industrial world; how he proves by at least plausible argument that his advice to abolish this right is only an extension of the familiar British system of leaseholds; and how he claims that the absorption of all goods into the public property after the death of the accumulator would create an almost inexhaustible public fund, without interfering with individual possession—we have no space to recount. Suffice it that we have helped to circulate a suggestion in regard to the reform of the existing economic system which is quite new, and may serve to arouse reflection in many minds.

A NEW INCANDESCENT GAS-LIGHTING SYSTEM.

There is at present on view at Broad Street Avenue, an installation of a new form of incandescent gas-burner generally described as "Verstraeten's system." The system in question, which is in full commercial operation in Germany and Belgium, presents several novel and promising features, besides repeating in a general way the best results obtained by the familiar Welsbach lamps. In appearance, the Verstraeten lamps are at the first glance hardly distinguishable from the standard Welsbach pattern; but yet there are differences between the two devices which become noticeable upon closer examination of the newer model.

In the first place, the Verstraeten lamp has a chimney divided, at middle height, into two "stories," which enables provision to be made for the suspension of the "mantle" from the brass-work of the divided chimney, instead of (as in the Welsbach) from a vertical central rod. Several advantages are claimed for this alteration of the manner of suspending the mantle. Then the Verstraeten mantle itself differs widely from the prototype. It is carbonized in a closed vessel before being impregnated with the refractory material in solution; and it is claimed that, on this account, the skeleton absorbs more of the solution, and absorbs it better, than if it were soaked while still retaining its organic nature. As sent out to users, these impregnated carbonized mantles are packed flat in boxes; and they will thus endure a fair amount of handling. They are burnt off before being placed in their working position, which operation is much facilitated by the division of the chimney. With regard to the efficiency of the system as applied to gas lighting, we are able to testify, from observation, to the brilliancy, good colour, and silence of the light, and also to the neatness of the whole appliance. It is claimed that an illuminating power of 60 candles is obtained with a consumption of from 75 to 80 litres (about 2¾ cubic feet) of gas per hour; and also that the mantles are very durable, and not likely to break the chimneys, if by chance they should get damaged in use.

An exceedingly interesting modification of the Verstraeten system (also on exhibition here) is its adaptation to portable oil-lamps, which is an entirely new departure in incandescent lighting. For this purpose, at present methylated spirit is found most economical and suitable; but it is confidently expected that any description of mineral spirit or volatilizable oil will eventually be usable with the system. The essential feature of these incandescent oil or spirit lamps is another "two-storied" disposition, in which a small asbestos wick first burns a tiny quantity of the fluid in a position where its heat can be utilized to vaporize a larger supply of spirit; and this vapour is then burnt atmospherically inside a mantle, as with the gas lamp. The effect is practically the same with the fluid as with the gaseous fuel; and it is easier to admire the ingenuity of the arrangement, and to perceive the vastness of the field thus opened up for the system, than to foreshadow the effect of the discovery.

It will thus be seen that the Verstraeten system is very much more than a mere copy of the Welsbach appliance. The fact remains, however, that the Verstraeten lamps conform to the Welsbach type, just as all successful electric incandescent lamps have conformed to the type established by the genius of Edison and Swan. This conformity is in a sense copying; but it is also something more. The original producer of a typical article may naturally regard all his followers as imitators; and so they are, up to a point. But this is emphatically a connection in which "imitation is the sincerest form of flattery." There is no property, save that of credit, in a type. It will always be counted to Dr. Auer von Welsbach that he equalled Edison and Swan in framing the type of a great improvement upon known systems of artificial lighting; and having endowed the world with this type, the discoverer cannot prevent its repetition, which is a compliment.

There are, however, no compliments in trade; and consequently it is quite possible, and likely, that the present owners of the Welsbach patents, and the other patents that have been added to them, may regard the Verstraeten system as trespassing upon their preserves. How this may be, we know not, But it is stated, on the authority of Mr. W. R. Bousfield, Q.C., that the method by which it is proposed to prepare the mantles (which is a secret) would not infringe the Welsbach patents mentioned by him. It should be observed that there is great activity just now in the Continental trade in incandescent gas-burner systems; and that in all cases the manufacturers of new lamps of the kind prefer to keep their mantle preparations secret, instead of patenting the composition of their dipping solutions. It is not for us to pronounce upon the wisdom or otherwise of this line of conduct; the interest of the gas industry being rather in the production of as many improved lamps as possible, than in the commercial policy of rival inventors and traders.

NOTES.

The Behaviour of Building Bricks under Heat.

In discussing the qualities of building bricks, a writer in the *Builder* observes that comparatively little is known concerning the behaviour of bricks when subjected to intense heat, beyond the fact that, unless made of fire-clay, or other suitable material, they become destroyed in furnaces, and similar situations in a very short time. Reference is made to the result of an experiment to determine the expansion of a tall chimney at Messrs. Cubitt's works. This stack was circular in section, 105 feet high, and the flue was 5 feet in diameter to the top. The brickwork was 14 inches thick at the bottom, and 6 inches thick at the top; the bricks being specially moulded for the structure. It stood in the centre of a small square of buildings, and had stone steps leading to the top; but these did not touch the shaft anywhere. It is remarked that such a structure offered unusually perfect facilities for ascertaining the effect of heat on the brickwork. As a matter of fact, it is recorded that, an index having been set up on the topmost landing of the stone staircase, under cover, it was observed that this length of shaft became $\frac{5}{8}$ inch higher when the fire was lighted than when it was out. This record suggests that gas managers and their assistants have unusually good opportunities for observing and collecting data respecting the movements and other behaviour of masses of brickwork under the influence of heat; and it would be to the advantage of the science of building construction if they were to make use of these opportunities, and publish the results in the technical press.

Glass Sand for Brick Making.

A new use has been suggested for the enormous quantities of broken black bottles which are a concomitant of modern civilization. A correspondent of the *Builder* suggests that, as the material has no market value, it might be found economically feasible to collect and pulverize it for use as builders' sand. The cost of grinding is stated to be very small; and any quantity of black and other glass is to be obtained in London for the carriage. Commenting upon this suggestion, the *Builder* remarks that the idea is not altogether novel, though very little has been done practically in this regard. There is no doubt that ground or crushed glass would be suitable for mortar; being sharp enough to take the place of the sharpest sand. As for the chemical composition of glass, which is principally composed of silica, with lime, soda, and iron in varying proportions, there is very little likelihood of its being able to materially influence the action of the mortar in any way. The only question is that of cost; and it is stated that the chief reason why crushed glass has not been more largely used abroad for mortar making is because it is found to make a good brick for use in chemical works, as the material is almost proof against the action of acids. Our contemporary has often wondered why the Thanet sand and lower greensand of the neighbourhood of London have not been extensively used for the manufacture of fire-bricks, since glass-sand mixed in proper proportions therewith would form an excellent flux. The question is of interest for the large Metropolitan consumers of fire-bricks; and so far as we are aware, it has not been asked before.

A Question of the Ether.

The persistently recurring question of how the ether moves with or through matter has been again attacked by Herr L. Zehnder, who recently contributed an interesting paper on the subject to *Wildemann's Annalen*. He endeavoured to ascertain for himself, by experiment, whether the ether is pushed along by atoms or bodies, or whether it passes through their substance without resistance, or, finally, whether only a portion of the ether adheres to the particles of bodies; and this portion only is carried along. Herr Zehnder's apparatus, which he relied upon to furnish replies to these inquiries, consisted of a cast-iron cylinder, in which an air-tight piston moved. A small tube led out from one end of the cylinder, doubled back upon itself, and returned to the other end. Now if the cylinder was exhausted of air, so as to leave nothing but ether behind, and the piston was then worked, the inference would be that the ether would stream through the small tube with a velocity as much above that of the piston as the ratio of the sectional area of the one to the other. This ratio was 560 to 1; and exhaustion was carried to the 40,000th part of an atmosphere. To ascertain whether the ether moved in the sense contemplated, a beam from a brilliant sodium flame was passed through two thick parallel glass plates; the second one being silvered at the back. This plate, by its two reflecting surfaces, split the beam of light into two, each part travelling through one portion of the small tube. Then the same beams were reflected back upon the thick plate, and returned along the way they had travelled; being finally reflected into the reading telescope by the first plate. Interference fringes were thus produced in the field of view, the motion of which would have indicated a movement of the ether; but no such motion was observed when the tubes were thoroughly exhausted, so that it was concluded that the ether passes through solid bodies. The alternative view, that there was no substance in the apparatus answering to the name of ether, does not appear to have occurred to the experimenter. These experiments supply one more demonstration of the negative character of the physicist's ether.

The Occlusion of Hydrogen by Platinum Black.

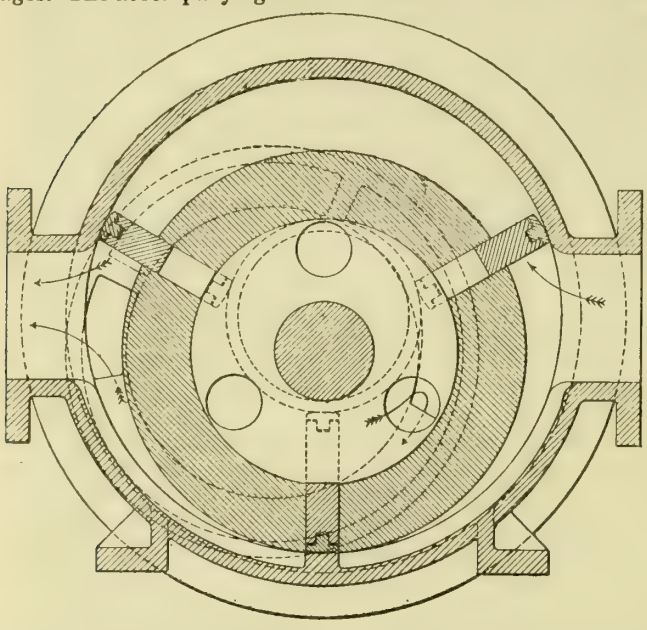
Some remarks on the occlusion of oxygen and hydrogen by platinum black have been submitted to the Royal Society by Dr. Ludwig Mond, Professor Ramsay, and Dr. John Shields. The authors described some preliminary experiments on the occlusion of oxygen and hydrogen by platinum sponge and foil, which generally confirm Graham's results. At most, only a few volumes of these gases are occluded by the more coherent forms of platinum. It is stated that platinum black, when dried at 100° C., retains in general 0·5 per cent. of water; and this can only be removed *in vacuo* at a temperature (400° C.) at which the black no longer exists as such, but is converted at least partially into sponge. At any given temperature, the water retained by platinum black seems to be constant. Platinum black contains about 100 volumes of oxygen. In determining the quantity of hydrogen occluded, the authors have carefully distinguished between the hydrogen which goes to form water with the oxygen always contained in the platinum black, and that which is truly absorbed by the material itself. Altogether about 310 volumes of hydrogen are absorbed per unit volume of platinum black; but of this 200 volumes are converted into water, and only 110 volumes are really occluded by the substance. The quantity of hydrogen absorbed is very largely influenced by slight traces of impurity, probably grease or other matter, which forms a skin over the platinum. Referring to the results of the phenomenon of hydrogen occlusion obtained by Berliner and Berthelot, the authors observe that the heat measured is due for the most part, if not entirely, to the formation of water by the oxygen always contained in platinum black, and declare that it has yet to be proved that the absorption of hydrogen by pure platinum black is attended by the evolution of heat.

Sewer Ventilation.—At the meeting of the British Medical Association last week, Mr. J. Parry Laws, F.I.C., read a paper on this subject. The author, it may be remembered, has made a special study of the bacteriology of sewage, upon which, in conjunction with Dr. F. W. Andrewes, he has reported to the London County Council. In his communication to the above-named Association, he pointed out that, in order to find a thoroughly satisfactory solution to the question of the harmlessness or otherwise of sewer air, our attitude must be influenced by the conclusions at which we ultimately arrive. Although the hypothesis which regarded sewer air as capable of disseminating the morbific germs of disease is, he thought, proved beyond reasonable doubt to be an erroneous one, one must not therefore forget the immense benefits and the saving of life that modern sanitation, mainly influenced by this hypothesis, has brought about. Whatever the ultimate verdict be, whether sewer air is harmless or otherwise, it will always be the imperative duty of those charged with the care of the public health to ensure rapid and efficient removal of all sewage and refuse matter, and, above all, to guard against defective drainage and probable pollution of water supplies. The more light that is thrown upon the dissemination of those diseases which have been, he thought erroneously, associated with sewer air, the more evident does it become that polluted water and milk supplies are among our most insidious foes.

TECHNICAL RECORD.

MESSRS. GWYNNE AND CO.'S NEW PATENT EXHAUSTER.

The exhausters of Messrs. Gwynne and Co. are well and favourably known to gas managers all the world over; the firm having consistently maintained a high standard of material and workmanship in these indispensable adjuncts of carbonizing plant. Hitherto, however, they have been content to reproduce, without fundamental alteration, a very familiar type of machine—the rotary exhauster with an eccentric barrel and double slide, which can be traced directly back to the Beale rotary steam-engine. This year, Mr. J. E. A. Gwynne and Mr. J. Ingham have patented an improvement upon this machine which, while preserving much of the appearance and the essential principle of the type, presents several notable advantages. The accompanying illustration shows a transverse section



of the new patent exhauster, the chief points of which are as follows: By a novel disposition as simple as it is ingenious, the space occupied by the eccentric drum is made available for the work of exhaustion, and the same slides are utilized for the purpose. There are three slides instead of two, as in the ordinary machine, and these are double acting. When they project into the lenticular space between the drum and the interior surface of the exhauster barrel, they sweep gas forward through this space as in the old machine; but when they are retracted into the eccentric barrel itself, they also sweep gas forward through this inner space. Practically, therefore, the new machine is an exhauster within an exhauster—both of the same pattern, acting on the same principle, and by the same moving parts. By an arrangement of the case, gas enters both the exhauster proper and the drum, or inner exhauster; and inasmuch as the latter is exerting its maximum influence upon the gas while the former is passing through its minimum phase, the gauge on the gas-main is kept at a uniform level, which does not depend upon the rate at which the machine revolves. Moreover, owing to segment guides not being required for the triple slides, a chief source of friction in the old machines is abolished. Thus, while the utilization of the space once occupied idly, so far as exhausting effect is concerned, by the eccentric drum, increases the useful effect of the new machine by from 30 to 40 per cent. for the same driving speed, the elimination of a great deal of the friction incidental to the old style of guiding the slides enables the speed to be increased by one-half. This means that about double the exhausting work possible for an old-pattern exhauster can be done by a new machine occupying no more space.

We recently had an opportunity of inspecting the experimental working, at Messrs. Gwynne's establishment in Brooke Street, Holborn, of the first exhauster built on the new system. This was a machine that on the old pattern would have been rated at a pumping capacity of 10,000 cubic feet per hour, driven at a speed of 250 revolutions per minute. It ran up to 340 revolutions per minute easily, without showing the slightest indication of heating; and when, at our request, it was slowed down to 100 revolutions per minute and less, the gauge showed that these variations of speed have no influence upon the pressure. It is indisputable that, in their new pattern exhauster, Messrs. Gwynne and Co. have a speciality likely to commend itself to those gas managers who possess a keen sense of the advantage of a steady gauge in the exhauster-room, and are at the same time anxious to do the work of exhaustion or gas pumping at the smallest possible cost for fuel. Apart from economical and technical considerations, it is interesting to see that in its old age the familiar rotary gas exhauster has been made to submit to a radical improvement that has doubled its usefulness, besides removing a besetting evil. After this, who shall say that the mechanical side of gas engineering has no further surprises in store for the technical world?

DR. THORPE ON GAS ENRICHMENT AND THE FUTURE OF THE GAS INDUSTRY.

At the Annual Meeting of the Society of Chemical Industry, held in Leeds last Wednesday, the PRESIDENT (Dr. T. E. Thorpe, B.Sc., F.R.S.) devoted a portion of his Inaugural Address to the subject of the enrichment of gas as bearing upon the future of the gas industry.

Having alluded to the fact that the extinction of gas making was predicted some years ago, Dr. Thorpe remarked that threatened manufactures, like threatened men, sometimes lived long. So many industries were now dependent upon the gas manufactory, that it was like a town with many staple trades, each of which acted and reacted upon the prosperity and development of others. This very potentiality, indeed, afforded the strongest assurance of its continued existence; and with each fresh economy in production, with each new application as a source of power, with every new discovery in the use to which the countless products of destructive distillation of coal could be put, the industry acquired a new lease of life. The tendency of modern life was more and more to turn night into day, and "Light, more light," was the ever-constant cry.

At the present moment, the question of enrichment was engaging the attention of every gas engineer. This enrichment might be effected by three methods: (1) By causing the gas to take up the vapour of volatile hydrocarbons; (2) by mixing the coal gas with oil gas, obtained by decomposing oils by heat; or (3) by mixing the coal gas with carburetted water gas, made by decomposing oils in heated chambers while subjected to a current of water gas. The idea of carburetting coal gas with volatile hydrocarbon vapour was, of course, not new. Something like forty years ago, the late Dr. Letheby sought to put this idea into practice, but without success. The hydrocarbons he employed were four, uniform in character, of very different degrees of volatility, and of varying illuminating value; so that after the gas had passed through or over the enricher for some time, the more volatile portions having been evaporated, the residual hydrocarbon was more likely to decrease than increase the illuminating value of the gas. In the Maxim-Clark process, this difficulty was obviated by using a light spirit of fairly uniform composition, which was volatilized into the gas as required; and there was little doubt that, if benzol continued at its present price, it would constitute the best and cheapest enricher that could be obtained.

The fall in the price of oils, which took place a few years ago, naturally gave an impetus to the manufacture of oil gas, and to its utilization for the purpose of enrichment. Enrichment by oil gas had been largely adopted in Scotland and many English works; and most gas managers who had given the process a fair trial had abandoned the idea of returning to cannel, as oil gas was not only far cheaper, but it was more easily worked, and the illuminating value of the gas as sent out was more under control.

A serious drawback to the employment of carburetted water gas was that it contained 30 per cent. of carbon monoxide; and though the Board of Trade had not yet taken any steps to limit the amount of carburetted water gas that might be mixed with coal gas for distribution, there could be no question that its use was attended with great risk. To anyone acquainted with the poisonous action of carbon monoxide, the distribution of so deadly an agent into our houses would be viewed with serious apprehension. If the public mind once realized this danger, the gas industry might suffer a blow from which, with the electric light on its flank, it would not readily recover.

Wöhler's discovery of the carbides of the alkaline earths, and the mode of their decomposition by water, after lying dormant for many years, seemed about to bear fruit. One had in calcium carbide, which was now being produced on a relatively large scale by means of the electric furnace, a ready means of producing large quantities of acetylene of a high degree of purity. This substance could be made to burn, under proper conditions, so as to produce a flame of extraordinary luminiferous value and character. It remained to be seen what practical application could be made of this fact. Unfortunately, acetylene was hardly less dangerous to breathe than carbon monoxide. Should either of these gases ever come into general use in connection with gas lighting, some more stringent tests as to the character of the gas-fittings and mode of distribution would have to be insisted upon, or the public health would suffer.

In connection with the subject of destructive distillation, the President alluded to the great improvements made in the construction of continuous stills for the production of sulphate of ammonia. Although tar had many virtues, tar-works, he said, were not usually regarded with very much favour by those who happened to live near them. Hence the Lennard process,* which obviated the nuisance incident to intermittent work, would, no doubt, be warmly welcomed by the sanitary authorities. Having next referred to various chemical processes,

* See JOURNAL, Vol. LXIV., p. 604.

Dr. Thorpe concluded this portion of his address by remarking that, in view of the repeated warnings that in the chemical industries we were falling behind our continental competitors, it was satisfactory to note that, in at least one important manufacture, we were more than able to hold our own.

HYDRAULIC STOKING MACHINERY AND LABOUR-SAVING APPLIANCES IN MODERN GAS-WORKS.

By A. S. Biggart, of Glasgow.

[A Paper read before the Institution of Mechanical Engineers, July 31.]

The conditions of labour in almost all industries have undergone, and are constantly undergoing, continuous modification and improvement, due principally to the ever-increasing uses to which mechanical appliances are being adapted. This statement may be aptly made of many of the modern gas-works; for in no industry have the conditions of work been more radically altered. The bulk of the labour employed in gas-works is absorbed in the retort-house, in the handling of the coal previous to and after carbonization.

In works where hand labour is chiefly employed, according to the old methods which still retain sway in the great majority of instances, the following may be taken as representing the general routine of those having the most approved arrangements. The supply of coal is usually brought by rail to the position most convenient for the retort-benches, where the waggons are emptied by hand. If necessary, as is generally the case, the lumps are broken into suitable size by hand. The retorts are next charged by hand labour; and after carbonization is completed, the coke is withdrawn, also by hand. The coke is either wheeled out to the yard, or may fall below the floor to a lower level, to be there quenched by water. The surplus beyond what is required for firing, has then to be removed to the yard. In the yard, hand labour is again called into requisition, to screen the coke, and fill it into the carts or waggons, for distributing it to the consumers. The variations in the details of the handling are such that scarcely two works follow the same routine; and the foregoing outline can therefore be taken only as generally representative.

The same remark also applies to the following outline of the routine pursued in works where labour-saving appliances are largely used. The supply of coal in such modernized works is usually delivered direct from the railway truck into the coal-breaker. After passing through this machine, and being all reduced to a proper size, it is raised by an elevator to a large hopper, so fixed that the coal can be automatically delivered into the hopper of any of the charging-machines. The charging of the retorts is then done altogether mechanically, by means of a hydraulic charging-machine, by which it is done more evenly and otherwise better than by hand. After carbonization, the coke is withdrawn again mechanically by a hydraulic drawing-machine, entailing a minimum of labour to the attendant. The surplus coke, guided in its descent by shoots, falls into a bogie underneath the floor, and is run out to the yard. In some instances, beneath the stage-floor are placed conveyors, on which the coke is carried to circular revolving screens, whence it is delivered into large storage-hoppers, or into the railway waggons, or into bags for small consumers.

The old methods involve continuous and repeated operations performed by hand; while the new are such that no hand labour is employed in dealing with the coal, from the time it leaves the railway truck till it arrives there again in the form of coke. Thus hand labour is entirely superseded by mechanical power, to the great advantage of the labourer and employer alike. The number of men required in the retort-house under the new system is not half that needed under the old method. The saving which this represents, after allowing for maintenance of plant and interest on additional capital, will average about 1s. per ton. As the quantity of coal which might be carbonized annually in this country under the improved system will amount roughly to about 8,000,000 tons, the saving to the gas consumers would be about £400,000 per annum, if stoking machinery were fully adopted. Stoking machinery is not of recent date, though successful plant for such work has been used only a comparatively short time. For the successful working of the stoking-machines, considerable auxiliary machinery is necessary.

The coal-breaker into which the coal is delivered direct from the trucks by shoot or otherwise, varies greatly in strength, according to the different classes of coal; but the principle of the machine is in nearly all cases the same. Fixed over the breaker is a hopper, which is kept filled with coal, thus maintaining always a supply of coal directly in contact with the two top rolls, each of which has a series of claws shaped in cast steel, and working into one another, thus drawing in and breaking the coal in its passage through the rolls. Here it is only partially broken; but it falls directly upon two other rolls, which break to suitable dimensions any remaining larger pieces. These lower rolls are set closer to each other than the upper pair; and their crushing-teeth are much smaller, and of a different form. The coal delivered from these lower rolls is raised by an elevator to the large storage-hopper, from which the various charging-machines draw their supplies. The breakers are necessarily of a strong design. The cheeks and gearing are of steel throughout; and in all other respects, the machines are made equal to the exceptionally heavy work required of them. The elevators are of the usual kind, raising the coal in buckets fixed at short intervals on a travelling link chain, which passes round two revolving wheels—one fixed at the top, and the other at the bottom of the steel framing that carries the whole. In passing round the lower wheel, the buckets dip into the coal to be raised; and in turning over the upper wheel, they tip it into a shoot leading to the storage-hopper.

Each charging-machine has to serve a large number of retorts at varying heights, and also at varying distances from one another. Consequently, the range—that is, extent of retort-bench surface requiring to be effectively served by the charging-machine—is considerable. The horizontal range is obtained by laying rails parallel to the retort-bench, along which the charging-machine may travel. The vertical range is secured by raising and lowering the charging or drawing apparatus on the machine, by means of a hydraulic ram, which is fixed to the machine itself. In addition, therefore, to the coal regulating and charging apparatus, the body of the charging-machine has to be provided with gear for traversing and raising and lowering; while on the top of the framing, at a sufficient height, a large hopper is permanently fixed, capable of carrying from 2 to 5 tons of coal, or a still larger quantity if desired. The regulating gear, for delivering from the hopper in greater or less quantities the coal with which the retorts are to be charged, is securely fixed immediately underneath the hopper.

The whole of the motions are automatic, and are regulated by a single lever. The first step is to drop from the hopper, by means of the coal-regulating apparatus, a certain quantity of coal in front of a pusher-plate, by which it is then pushed into the retort, and delivered by a series of six or seven pushes into successive positions—beginning from the far end, and extending forwards through the whole length of the retort. These positions are so close to one another, and the form of the pusher-plate is such, that the charge is left practically level throughout the retort. The apparatus for accomplishing this work consists of a horizontal slide-beam, on which are placed two hydraulic rams—one for giving the forward movement to the pusher-plate, and the other for drawing it back. Alongside the forward or pushing ram is a turning shaft, carrying a series of stoppers, which come into play in rotation as the shaft is revolved, and bring the pusher-plate to a stand in the successive positions of its stroke, so as to spread the coal evenly over the whole length of the retort. When the drawing-ram bringing the pusher-plate back is near the end of its stroke, it actuates the lever of a hydraulic valve, which, in opening and closing, puts in motion and also stops the coal feeding and regulating supply. This gear consists of a divided drum, revolving underneath the coal-hopper, and put in motion at regular intervals by means of a combined hydraulic ram and rack, with wheel and rachet gear, worked as already mentioned. The hand-lever regulating the pushing and drawing rams serves also to lower the pusher into position when entering the retort, to raise it before returning, and also to revolve the stopper shaft for spreading the charge in the retort. The usefulness of the charging-machine is enhanced by the provision of various adjustments—such as means to vary the quantity of coal in a charge. This is effected by altering the length of stroke of the co-regulating ram, thereby giving a greater or less movement to the revolving coal-feeding drum. A larger or a smaller quantity of coal can also be placed at any particular part of a retort, if this should be desired owing to the temperature of the retort varying at different points.

This charging-machine has now been in regular use for over two years, and is giving every satisfaction. Like all such work, it has reached its present advanced state of efficiency only by a process of development. The first charging-machine made of this kind was an experimental one; and while the main features have throughout varied little from the original design, the details have been considerably altered. In the experimental machine, the coal-hopper was attached to the charging apparatus, rendering it essential, when any change of height was required, to raise and lower the hopper and its contents. In all subsequent machines, this position was discarded, with the exception of one machine specially so fitted, which is still doing good work. The alteration was found desirable, owing to the limit practically put on the coal capacity of the hopper, and also on account of the loss of time in raising and lowering the extra load. It was further found that the new plan gave a more compact design than the old. The coal-feeding drum was at first rotated by causing the back end of the pusher-rod, when near the outer end of its stroke, to strike and carry with it a connecting-rod attached to a lever with pawl and ratchet combination on the drum-shaft. Owing to the sudden blow, however, this did not work satisfactorily. A single-acting hydraulic ram then took the place of the connecting-rod, with a spring opposite the ram to force it back; the ram being worked by a valve with a lever, as at present. Although this alteration proved a great improvement, it was found desirable to replace the spring by a second hydraulic ram, as now adopted; and this change was followed with the best results.

In the experimental machine, only fairly large pieces of coal were at first dealt with; and with these no trouble at all was

experienced. As small coal, however, is extensively used in some gas-works, a trial was made of it, with the result that, when once the coal began to run between the drum and the face-plate opposite, it sometimes did not cease running until the hopper was empty. As the opening could not be reduced without the risk of large coal jamming, and as each machine ought to be suitable for large and small coal alike, it was found essential to adopt some arrangement capable of dealing with all sizes. The difficulty was simply and effectually solved, by fixing in the coal-space in front of the drum a swing plate, having a lever and weight so attached as to cause it to press the coal against the face of the drum, and thus automatically to close, by a sort of flap or clack valve, the space through which the small coal formerly ran freely. The revolution of the drum moves back the flap-valve without difficulty, and allows the coal to flow freely when charging.

Another point, for which it was not at first thought necessary to make any special provision, was the momentum of the coal-feeding drum when in motion. The amount of travel or rotation of the drum after the hydraulic ram had come to a stand, was found to vary greatly. This was owing to the vanes in the drum being often in a different position in relation to the clack-plate at the moment when the hydraulic ram ceased to exert its power. The evil effects were reduced to a minimum, and rendered unimportant, by simply fixing a continuously acting brake-wheel and brake on the end of the drum-shaft.

A machine of this kind is naturally subject to a considerable amount of vibration and shock when in use; and especially is this so with the class of labour usually employed. For various reasons, the former stokers are put to work these machines, which consequently have frequently to stand an amount of rough usage not usually associated with hydraulic machinery. Various minor matters revealed this usage. One was the effect on the copper tubes. More than the usual number gave way at the couplings, although the tubes themselves were of ample strength; the working pressure being only 400 lbs. per square inch, while they were strong enough to stand a working pressure of 1000 lbs. It was therefore found desirable to alter the form of joint, and at the same time still further to increase the strength. The change consisted in simply putting in heavier copper tubes, and, instead of screwing the collars on at the ends of the tubes, in flanging the copper over, and soldering the collar behind the flange. Other minor details have also been improved; and modifications will no doubt continue to be made as the experience of actual working is gained.

About a year ago, it was thought desirable, with a view to increasing the capacity of the coal-hopper on the machine, to introduce mechanical power for traversing it along the floor, and a hydraulic motor was designed and made for this purpose. Hydraulic power, being already used in the machine, was naturally deemed the most suitable means to adopt—more especially as the load to be moved is a fairly constant one. It was decided to employ two hydraulic rams, with racks working in the opposite sides of a spur-wheel, which is free to rotate backwards and forwards. On this wheel are secured two pawls, each working in a spur-wheel alongside the first wheel. As the first wheel moves in one direction, the pawl in gear on one of the side wheels goes with it; and on the motion of the first wheel being reversed, the second pawl takes the other side wheel in the opposite direction. Each of the side wheels revolves a separate mitre wheel; and as the two mitre wheels are geared into the opposite sides of a common mitre wheel, the latter will revolve continuously in one direction. This common mitre wheel is keyed on a shaft that is geared with the main axle of the machine, through which it traverses the charger backwards or forwards as desired. To reverse the motion of the common mitre wheel, it is only necessary to reverse the action of the two pawls gearing into the side wheels. The hydraulic rams receive their water through a three-ported slide-valve, which is made to reverse by a secondary key-valve. The latter is controlled by a double lever, which is actuated by the two hydraulic rams themselves as they approach the outer end of their stroke. A simple arrangement of lever-gear has been adopted for reversing the pawls; so that, by moving a hand-lever, the action of the hydraulic motor sends the charging-machine in either direction at the will of the attendant. In order that the charging-machine may be more completely under control while travelling, a brake has been added to the motor; so that, when the machine is nearing the stopping point, the water is cut off, and the brake brought into action.

While the charging-machine is employed in filling the retorts with coal, the drawing-machine is for the reverse operation of withdrawing the charge from the retorts after it has been converted into coke. For this purpose, a rod having a plate fixed at its end is used, similar to that which pushes the coal into the retort in charging. But for withdrawing the coke, the plate can be held in either a vertical or a horizontal position. It is held horizontal while the rod is being inserted into the retort above and clear of the coke to the distance desired; and it is then lowered into the vertical position, so as to cut into the coke, and drawn forwards, bringing in front of it part of the carbonized charge.

The action of the drawing-machine is so similar to that of the charger, that there is considerable similarity in some of the parts. The arrangements for travelling the machine along in front of the retort bench, and for raising and lowering the slide-beam which carries the withdrawing-rake, are in principle similar to the equivalent arrangements in the charger, though differing in detail. The drawing-machine is so light in itself that it is unnecessary to apply mechanical power for traversing it backwards and forwards, as is done in the case of the charger. The drawer consists essentially of a carriage fitted with travelling gear, and having a bow frame fixed near the centre, which carries the slide-beam, with its pushing and drawing rams and connections for actuating the rake. This bow also carries the hydraulic ram for raising and lowering the slide-beam as required. The rake is pushed into the retort and drawn out again by simply reversing a hand-lever, the motion of which not only reverses the valve, but also raises the point of the rake-head at the beginning of its stroke, and lowers it at the end of the stroke. The rake is raised as it enters the retort, and passes over the coke. It is depressed again before beginning the return stroke, thus dipping into the coke, and raking it out at every draw.

The number of retorts charged or drawn per hour by these machines varies to a considerable extent in actual work. In some cases, owing to special circumstances, not more than 24 per hour are available for each machine; while in other more favourable instances, as many as 48 per hour are allotted to each, and even with this larger number a reasonable time remains for rest for the stokers at the end of each hour. The labour of charging the retorts and withdrawing the coke is much lightened by these mechanical means; and the number of retorts charged and drawn for each stoker employed is largely increased. It might at first be imagined that coal placed in retorts in only six to eight large charges by the machine would not be so evenly laid as a much larger number of smaller charges put in by hand. The machine, however, lays the coal by far the most evenly, owing partly to the shape of the pusher-head, which is bevelled so as to allow the small ridge of coal raised in pushing forwards to fall back when its support is removed on the withdrawal of the pusher-head. Another advantage possessed by machine work over hand labour is that the charging is done more quickly; and thus there is a diminished loss of gas before the retorts are sealed up.

Apart from any other consideration, the mechanical charger could not fail to prove beneficial in view of the greatly improved conditions under which it enables work of a most trying nature to be carried on. The old method of hand-charging was a severe ordeal for the stokers, requiring great exertion to get through the work in the shortest time possible, while exposed throughout to a high heat. Such adverse conditions are now entirely done away with where mechanical stoking obtains. The single lever by which the whole of the operations are controlled, is worked from such a position that the attendant is quite removed from the discomfort of close proximity to a high heat; while, at the same time, the former severe bodily exertion is replaced by light and easy work. Even greater improvements in the conditions of labour arise from the introduction of the drawer, which accomplishes, under all the better conditions attending the use of the charger, work of a still more trying nature. The withdrawing of the live coke from the retorts was work for which even the stokers themselves, accustomed as they were to it, admitted that mechanical appliances were required. Here, again, all is worked by a single lever, in such a position as to remove the attendant from the former discomforts of withdrawing the coke at a white heat at the mouth of the open retort.

In conclusion, the author said that the hydraulic power employed, at the pressure usually of about 400 lbs. per square inch, is distributed in the way generally adopted for similar installations. He showed, by means of drawings, various typical methods of handling the coal and coke; and he remarked that, about two hundred of these machines are now in use, or in course of manufacture. They have been adopted at many of the largest gas-works in this country and abroad—including those of Glasgow, Birmingham, and Liverpool, the South Metropolitan and The Gaslight and Coke Companies in London, and the Vienna and Amsterdam stations of the Imperial Continental Gas Association. In Glasgow, where the Corporation have adopted the machines for all their stations, the quantity of coal dealt with by them amounts to about 500,000 tons per annum.

In the course of the discussion on the paper,

Mr. W. Foulis testified to the satisfactory way in which the machines worked. He said they ran night and day without giving the slightest trouble; and their introduction had effected a great saving of money.

Mr. Flett said there was no doubt that mechanical retort stoking was much better than hand labour; for under the former system there was no difficulty in levelling up the various successive charges, so as not to leave spaces in the body of the coal in the retort. He believed the adoption of this machinery would in time become general.

Mr. J. West said he agreed with all that had been said as to the great benefit arising from the adoption of machinery in place of hand labour. He was anxious that some facts and figures should have been given as to the advantage to be derived in regard to the question of cost; but as this had recently been done by the President of the North British Association of Gas Managers (Mr. Alex. Wilson),* he supposed Mr. Biggart did not think it was necessary. He also remarked that while the author of the paper said that stoking machinery had been in operation

* See *ante*, p. 228.

only a short time, it was actually in use twenty years ago. He (Mr. West) believed he had done more than anyone else in the invention of machinery for this purpose; and at Manchester, coal-breaking and elevating machinery had been in use since 1875. He was pleased to see that machinery had now been introduced in Glasgow. Reference had been made to the amount of manual labour required in charging and discharging retorts; and it was said that this gave an idea of the pressure that would be required. He had found that nearly all inventors had started out with making the machines too light; and as they proceeded they had to strengthen and increase the size of the various parts of the machinery.

Mr. J. HEAD remarked that the ingenuity displayed in the charging and discharging of retorts had been very much the effect of the labour troubles of some two or three years ago. This showed the tendency of these difficulties. Instead of contributing a greater amount for labour, which was the object of these difficulties from the workmen's side, they generally ended in machinery that cost less for labour, to the general benefit of the community. They were much obliged to Mr. Biggart, Mr. Foulis, and others, who had managed to make such a very complete and effective plant. He would like to know whether Mr. Biggart had turned his attention to the substitution of electricity for hydraulic power in this kind of machinery. It seemed to him that this machinery had a resemblance to an overhead travelling crane; and in America electricity had in these cases very much taken the place of other mechanical appliances.

Mr. BIGGART, in reply to the discussion, said that elevators and similar labour-saving machinery had been long in use in the country meal-mills; and the principle of the elevators now in use in gas-works was the same, only the details were altered to suit the new kind of work. With regard to electric power, this was a matter that had received attention. But the objection to such power was that they would require to introduce revolving machinery and shafts. After the members had passed through some of the business premises where electric power had been introduced, they would come to the conclusion that, of all kinds of machinery that should be adopted in retort-houses, revolving machinery should be avoided. In the hydraulic machines, the principle had been recognized that the moving parts should be reduced to a minimum; whereas with either air or electric motors, there were an immense number of moving parts, and the cost of wear and tear was very high.

The PRESIDENT (Professor Kennedy), in moving a vote of thanks to Mr. Biggart for his paper, said he saw these machines some years ago, when they were in an early stage. He was very much struck with them then; and he had no doubt that in their latest form they would be still more interesting.

The vote of thanks was cordially passed.

THE STANDARDIZING OF METER UNIONS.

By J. NAPIER MYERS, of Saltcoats.

[A Paper read before the North British Association of Gas Managers, July 25, 1895.]

Addison, the prince of English essayists, who died many years before the birth of William Murdoch, the Ayrshire millwright who invented gas for lighting purposes, was no doubt correct in his observation that there is nothing so variable in nature as a lady's head-dress. But the milliners of his day have been out-distanced in the art of dissimilarity by the makers of gas-works apparatus, as there is nothing, I believe, either in nature, art, or manufactures, possessing such absence of sameness; while it will be readily granted that there is no branch of engineering which lends itself so fully to concerted uniformity. I could have wished that this subject, simple as it is, had been placed before you by one of our *solar* men—the men who draw after them their own firmament of planets. In the North, South, East, and West districts of Scotland, it is known that *solar* men exist in the gas profession, with their attendant moons or reflected lights; but it is quite a mystery to me that these "men of light" have not been "men of leading," like the master-spirits in other branches of the engineering trade, who formulated and advocated the adoption of uniformity in all departments of manufacture.

The industry with which we are connected is old enough to have celebrated a centenary, yet the gas engineers have not made any combined attempt to adopt a uniform standard size of the different appliances which form the plant for gas making. It is not very creditable to our profession that we have not yet settled the most suitable sizes for the various form of retorts, or the shape of mouthpieces. Were this done, makers would be warranted in making for stock, and this would affect prices at least 10 per cent. in favour of buyers. It is not, however, to the diversities of gas-works appliances as a whole that I wish, at this time, to call your attention, but to the diverse unions in use among meter makers, who, in the variety they have put in force, are "sinners above all men."

It fell to my lot for some years to manage the works of a gas company where the meter unions were all of the London pattern, and interchangeable; and at present I control a works where my predecessors bought meters from nearly all the different makers, as their fancy prompted—the result being endless variety of meter unions. My experience of uniformity and dissimilarity of meter unions has forced on my notice the evils that attend varieties in meter connections. In the former case, where the meters were nearly all made at the same place, it facilitated the exchange of meters, and was a contributing cause of the unaccounted-for gas being under 5 per cent. This evil is, no doubt, felt most by those who, like myself, manage small or village gas-works; where the work of surveying, testing, and changing meters falls upon the manager. We have at Saltcoats 1500 meters, and I find that about a dozen, or 1 per cent., at each survey require to be shifted; and as the unions are not interchangeable, we require, in most cases, to employ the services of a plumber, which means an expense of not less than 2s. per meter for small sizes. If the unions were all made to standard patterns, the work of exchanging a meter could be done by an ordinary unskilled labourer or handy man on the works. If this work were easier of compass, we should be encouraged to do as we ought to do—*i.e.*, test 10 per cent. of our meters per annum; and this, in most cases, would reduce the percentage of unaccounted-for gas.

The meters made in Edinburgh, besides their other excellences, excel in the variety of their unions. I have here the unions of the 2-light size of meters of six different makers; and they vary in the outside diameter of the screws from $\frac{31}{32}$ inch to $\frac{55}{64}$ inch. Only two of them are alike; and even these are not interchangeable, by reason of a difference in the linings. In casting about in my mind as to whose sizes of unions I should recommend, I have come to the conclusion that Whitworth's standard for gas-tube screws would be the best for meter unions, as set out in the following table:—

For 1 and 2	light meters,	same as	$\frac{1}{2}$-inch	gas-tube,	14	threads	per	inch.
3 and 5	,,	,,	$\frac{3}{4}$	,,	,, 14	,,	,,	
10 and 15	,,	,,	1	,,	,, 11	,,	,,	
20 and 30	,,	,,	$1\frac{1}{4}$	,,	,, 11	,,	,,	
50	,,	,,	$1\frac{1}{2}$	,,	,, 11	,,	,,	
60	,,	,,	$1\frac{3}{4}$	,,	,, 11	,,	,,	
80 and 100	,,	,,	2	,,	,, 11	,,	,,	

I would recommend that the nose of the linings should be of uniform size, and tapered; and with a little grease in the boss, a joint could be made without the aid of tools or washers. The caps should be made a little deeper than is usual, and this would admit of slight variations in the diameters of the boss and linings that would doubtless occur in practice.

My experience with meters above 100-light capacity is too limited to warrant me dogmatizing about the connections for large sizes. But I think for meters above 100-light size, the connections should be made by flanges screwed for iron tube; and these should have a fillet or nose for a washer, and be secured by bolts on the side of the meter. For wet meters, the plugs and caps for watering should be Whitworth's standard size and pitch for bolts.

I have enumerated the sizes, and some of my neighbours in Ayrshire will join with me and support meter makers who are willing to aid us in this reform. But before proceeding further, we wish the *imprimatur* of this Association to our proposals. In this list of screws recommended for meter unions, there are only two pitches of thread; and with only three patterns of unions, you would cover nearly all necessary domestic supplies of gas. I sent copies of my proposals to a number of managers known to me personally, and to other gas engineers known all over the world as pioneers of improvements; and I received replies from these gentlemen, some of whom manage our largest gas-works. Several made suggestions which I have embodied in my remarks; most of them agreed that Whitworth's standard for screws should be adopted; and all were unanimous as to the desirableness of having interchangeability of parts and practical accuracy of fit for all sizes of meter unions. The objections offered by one or two to adopting a new standard are that in some instances it would be out of line with the old screws; and that it would not be a present benefit. Some of those with whom I have corresponded have not experienced our difficulties, because, they say, "for many years we have bought all our meters from one maker," or "we have our standard patterns, and all makers must make to our gauges."

It is far from my intention to add to the confusion by advocating another standard; but I want this Association to stir up the Standards Department of the Board of Trade to legalize these proposals as the common standards; and then all other patterns would be special. The progress made in artificial illumination during the last fifteen years has disturbed the "rest and be thankful" attitude of the gas industry; and great improvements have been effected in all departments. But during this time no improvement has been made in the mode of measuring gas. The prepayment attachment is a change; but it is a questionable improvement, as it doubles the cost of the spoon without giving any more broth for the penny. If the gas-meter trade could come to a common understanding in this little matter of detail, the reform would soon be effected; but conflicting trade interests and jealousies block the way. If this Association will examine these proposals, and recommend them to the Standards Department, it will do much towards clearing the way not only for uniformity of meter connections, but contribute largely to the principle of uniformity in all other parts of gas-works apparatus. If the Board of Trade approved of the proposals, they could be legalized by an Order in Council, and makers of meters would be instructed to make standard Board

of Trade unions after a date to be fixed, except where buyers expressly ordered special unions.

In every branch of civil and mechanical engineering, progress in the simplification of production has naturally been indicated by a diminution in the number of parts or varieties used; and whatever helps to reduce complication, lessen the number of parts, or unify the sizes heretofore considered necessary, attains the highest kind of merit claimed for philosophy by its earliest as well as by its latest representatives. It is from this point of view that an Adam Smith or a Lord Kelvin looks at and counts up the results of the progress in science, art, or manufactures. Judged from that standpoint, it must be admitted that improvements tending to uniformity of standard in the manufacture of gas-works accessories, and more especially in meter unions, have not kept abreast of the progress in simplification attained by cognate industries; and I appeal to gas engineers to combine in an effort to get these suggestions adopted and enacted, and thereby redeem our profession from that reproach.

Discussion.

Mr. J. Hepworth (Edinburgh) said he had listened with much pleasure to Mr. Myers's paper. It had, however, not convinced him that uniformity was desirable; because he had, for very good reasons, he thought, advocated uniformity for a very long time, and he believed that most of the managers of gas-works who had had the experience he had had would welcome such a result as Mr. Myers aimed at in his paper. He (Mr. Hepworth) did not see any serious objection to its being accomplished. They were very slow to move, he supposed, in this country; but he was not aware, naturally, whether the matter had ever been brought before the meter makers, as a whole. He thought, however, that it was brought before the Standards Department of the Board of Trade, some seven or eight years ago; but the result of this action he was afraid he never knew—at all events, he did not remember at the moment what it was. He quite concurred in the suggestions made by Mr. Myers, that it might very well go before the department again. He thought that if the Association could confer with other institutions of a similar character, representing the whole of the gas industry of the United Kingdom, they would very soon arrive at some modest statement which could be laid before the Standards Department on the subject; and, at all events, so far as the meter makers were concerned, he did not himself see any reason why they should not fall into line in the way which Mr. Myers suggested, and with advantage to everyone concerned.

Mr. A. Bell, sen. (Dalkeith), concurred very much with Mr. Myers. He thought the question was a very practical one. As a small manager, he had suffered very much, and did still suffer, from this want of uniformity. He remembered the time before the tube standard was fixed. In those days, the Scotch tubes had a very much coarser pitch than the English; and when so many tubes were used in oil-works, it was extraordinary how much stock was required to be kept. A man had often to go to store for a very trifling matter. This state of things had been cured simply by the representation of the users of tubes. It was the Whitworth pitch all through for tubes now; and he did not believe the Scotch thread was employed, except in such works as were fitted up to begin with under the old standard. Mr. Myers mentioned that he thought it was trade exigencies that kept them from being uniform with meters. He (Mr. Bell) did not see why this should be; and it could not have much weight, because the meter makers were now pretty much a ring. They were combined in many ways—with regard to the price of meters, the allowance for old meters, and such like; and why should they not agree upon this other little point, and make their unions uniform? He did not think there would be much objection to it being done. Of course, they could easily understand that if one meter maker had a little out-of-the-way pitch, he might think that customers would buy his meters again; but he did not believe that would have very much weight now. He thought if this and other Associations were to put it before them, as Mr. Hepworth said, their representation would have very much weight.

Mr. T. Douglas Hall (Montrose) thought, if he remembered aright, the subject of the paper was brought before the Association many years ago; and the matter was handed over to the meter makers, to try to get them to come to some arrangement as to having the unions made uniform. He thought, with Mr. Hepworth, that they, as an Association, ought to combine with other Associations to make some representation to the Board of Trade, and try to get the matter fixed. There was no doubt it was a point which pressed very heavily upon the managers of small works. Managers of such works knew that if anything went wrong with a consumer's meter, the first question asked was, "Have you got a meter in stock that will couple?" Why should they have to put such a question? The next question was: "Who is the maker of the meter?" (which was again wrong); and they had to look up their stock to see if they had another meter of the same make and size. In a small works, again, where they did not have a gas-fitter, they had to employ an outsider, or make a temporary connection until a meter of the proper size could be ordered. He thought the managers of small works felt that the subject was worth looking into; and they were very much indebted to Mr. Myers for bringing it before the meeting.

Mr. D. Macfie (Edinburgh) said he had not felt disposed to take any part in the discussion, for one or two reasons. Among others, the subject admitted of only one side; there could be no answer to Mr. Myers's indictment of the variety of meter unions. But when he asked who was responsible, it was difficult to find that out. He (Mr. Macfie) supposed that, if they went far enough back, they would find out that the millwrights each had his own thread and his own screw; so that if a mill required repairs, he must be employed. That, of course, had been all put aside; and the man who would continue to make his own screw, with regard to any of the ordinary mechanical appliances, stood a very small chance of getting orders. It might be different with meter makers; but sometimes he thought the question could be very easily settled. He did not think it should be necessary to call in the aid of the Board of Trade; he believed that the mere hint of this or any other Association, would be concurred in by the meter makers. Looking at Mr. Myers's suggestion, it seemed to him to be a very reasonable one. He would not—no one would—like to commit himself to the sizes named in the paper, at first sight; but undoubtedly the proposal as to the thread to be used seemed a very reasonable one. With regard to the sizes, he did not know that he could say anything as to modifying them, except with regard to the three-light size. This might be made a $\frac{5}{8}$-inch instead of a $\frac{3}{4}$-inch standard. But, altogether, it seemed to him that the list which had been produced looked, upon the face of it, a very reasonable one, and might be very easily adopted, if a representation were made in the proper quarter, without going to the Board of Trade.

Mr. A. Yuill (Alloa) said that, as the matter was rather a subject for the meter makers than for them, as gas managers, it would go more from them as a recommendation to the meter makers; and seeing they had got the expressed opinions of the representatives of meter makers there, he did not think that much difficulty would be experienced in considering the matter. But he thought that, seeing the Association had a Research Committee, it was a subject which could be very fairly put before them; and the Research Committee could confer with the meter makers, and see if they could arrive at something like uniformity. He would propose that the matter be remitted to the Research Committee to consider.

Mr. J. Ballantyne (Rothesay) said there was just one other matter he would like to call attention to, more by way of suggestion than anything else. It was this: Supposing they had the unions made upon the forms suggested, unless the meters were exactly the same size, or very near it, the unions would not be of very much use, without the aid of a gas-fitter. If they had a meter fixed in a given situation, and the pipes for the meter were exactly on a level to fit it, and if they took away the meter and substituted one which, although it had the "universal union," if the pipes were 2 or 3 inches shorter, the whole thing would be useless. It seemed to him therefore that it should be suggested that the meters should be made as near as possible of the same height; if they were made of the same height, he could see the benefit. He had often wondered how landlords did not object to the way they cut their pipes. They knew that if a pipe were found to be too short, the plumber simply soldered a piece on; and if, again, a meter were set up which required a shorter pipe, he cut so much out. The cutting and lengthening went on from time to time. Gas-fitters, again, were not very particular. They would try to force the half of one coupling to fit the other; and the consequence was that the threads were often stripped, and the meter was practically destroyed. They were very much indebted to Mr. Myers for bringing his paper before them; but he thought the other matter should also be attended to—to have meters of the same light made of a uniform height.

Mr. J. Renfrew (Langbank) suggested that, in approaching the meter makers through the Research Committee, it might answer their purpose quite as well to give it forth, from the Association, to the meter makers, that only makers who adopted the standard sizes of unions would have their meters taken up by the members.

Mr. D. M. Nelson (Glasgow) endorsed what had fallen from Mr. Yuill with reference to the suggestion that the matter was one for the Research Committee. A recommendation would come better from them, perhaps, than from any other body. He remembered that, many years ago, a similar difficulty arose in relation to wrought-iron tubes. There was the Scotch pitch, as it was called, and the Whitworth pitch; and he remembered they had to adopt the principle of making both pitches, and by-and-bye this became a very troublesome thing in practice. But there was a sort of moral suasion which operated in the matter; and they did not have to apply to the Board of Trade. He thought the same moral suasion would apply here; and that the meter makers would quietly adopt the pitch that was most "in line." By-and-bye the others would become obsolete. At the same time, he thought it should go through an authoritative body, such as the Research Committee.

The President said he would just like to point out that, of course, a certain amount of loss would be entailed upon the meter makers in effecting the alteration. At the same time, the gas companies would have to bear their share of the loss. In fact, the loss would be pretty well divided; and in this way they were not asking too much. He thought that the point which Mr. Ballantyne brought out was almost included in the title of the paper. The union itself might almost include the two

unions. If the matter were remitted to the Research Committee, he (the President) thought it might be arranged in a very amicable way with the meter makers.

Mr. MYERS thanked the members for the manner in which they had received his paper. They seemed to be all of one mind in regard to the matter—that it was one of extreme desirability; and there appeared nothing standing in the way of its being adopted, except the steps which they should take to carry it into effect. Mr. Hepworth referred to the former application to the Standards Department. Well, he had lately entered into correspondence with them; and he found that communications had been made to the department in 1867. But the matter fell through, for the want, he supposed, of such an Association as theirs pressing them to an issue. The other point which would call for any comment was that made by Mr. Macfie, that the 3-light meters might be made with $\frac{5}{8}$-inch unions. In these first two or three sizes, he (Mr. Myers) suggested that they should have a range—that besides having uniformity of unions, they should, further, have a small range of change of screws—of different sizes, because every gas-fitter knew of a place where there was a 3-light meter where there ought to be a 5-light, and he knew also of a place where there was a 5-light, where there ought to be a 3-light one. In putting these four pairs together, therefore, in a common union, he had the idea of effecting a little change, even in sizes of meters, as well as in having common screws for them.

The PRESIDENT, in proposing a vote of thanks to Mr. Myers, asked if he was to take it that the remit to the Research Committee to go into the matter was agreed to.

The suggestion was assented to.

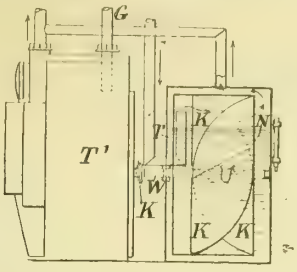
Effect of Gas-Stoves on Coal Traffic.—It is not often that gas supply figures in the proceedings at the half-yearly meetings of the great Railway Companies; yet it has done so lately at those of the Great Eastern Railway Company. Addressing the shareholders last Tuesday, Lord Claud Hamilton had to announce a falling off to the extent of £36,000 in the Company's coal traffic, in spite of the increase which has taken place in the population in their district. He attributed this mainly to the diversion of trade caused by the great coal strike of 1893; but another cause was, he said. the substitution of gas and oil stoves for open grates—a change which was really working a silent revolution in the domestic arrangements of large masses of the people. His Lordship went on to say that, in the suburbs which the Company served, he found the large Gas Companies estimated that they had 90,000 gas-stoves hired, as against 80,000 at the end of 1893; and they were steadily increasing. Therefore, taking the number of stoves mentioned, it meant about 90,000 tons of coal less consumed in the district served by these companies; and the bulk of this coal would have been carried by them. The same tale came from the large towns and country districts. This movement really began in earnest during the coal strike of 1893. The miners were led into the strike under bad advice, regardless of the inconvenience they would cause to the public and to their fellow-labourers in other industries; and their fellow-labourers were driven to obtain fuel other than coal. Thus the heaviest blow which the consumption of household coal had received had come, not from the capitalists or the "classes," but from the miners themselves.

Society of Chemical Industry.—The annual meeting of this Society was held at the Yorkshire College, Leeds, last Wednesday, under the presidency of Dr. T. E. Thorpe, F.R.S. The Secretary (Mr. C. G. Cresswell) read the Council's annual report, which showed that the number of members on the register is now 2892, as compared with 2828 at the preceding annual meeting. During the year, 226 new members were elected, as compared with 251 in the previous year; and 160 members were removed, as compared with 207. During the session, 85 papers appeared in the Society's *Journal*, as against 77 in the previous one. The excess of revenue over expenditure amounted last year to £178 10s. 2d., as against £574 17s. 9d. in 1893. For this diminution in the balance, the increase in the size of the *Journal* is entirely responsible; the actual revenue of the Society showing an increase of nearly £100. The report having been adopted, the Hon. Treasurer (Mr. Rider Cook) submitted the financial statement; and it was passed. The President then delivered his Inaugural Address, an extract from which, dealing with the subject of the enrichment of gas, will be found in another column. At the close of the address, a cordial vote of thanks was passed to Dr. Thorpe. The result of the ballot for the election of officers for the current year was subsequently announced—the new President being Mr. T. Tyrer; and it was resolved to hold the next meeting in London. The Mayor of Leeds (Alderman Gilston) having given the Society a hearty welcome—remarking, in reference to the President's observations on the subject of enrichment, that to increase the illuminating power of the Leeds gas by one candle would cost £20,000, and he thought it was not worth it—the proceedings closed. The members then took luncheon together; and in the afternoon, various works were visited. In the evening, the Mayor emphasized the welcome accorded by him earlier in the day by inviting the members to a *conversazione* in the Town Hall, which was handsomely decorated for the occasion. Between 600 and 700 ladies and gentlemen accepted the invitation.

REGISTER OF PATENTS.

Heating and Illuminating Gas.—Daus, E., of Schöneberg, near Berlin. No. 13,114; July 6, 1894.

This invention relates to "the production of an intensely hot flame by the use of a mixture of gas and air, prepared before the entrance of the same into the burner-pipe, in the manner that a drawing or suction device in connection with an ordinary gas-meter fixed to a gas-supply pipe draws air and mixes the same in a suitably regulated quantity with the gas as this leaves the meter and before entering the burner-pipe."



The mixing apparatus consists of two casings, in each of which is a rotary drum, mounted on the same shaft W. The drum in the casing T is chambered, and serves for drawing and delivering air; the other drum in T^1 is for measuring and delivering gas. Both drums are in communication with a pipe leading to the burner-pipe. The gas-drum and casing have preferably the form of an ordinary gas-meter; and, like it, the drum is operated by the pressure of the gas in the outside gas-supply pipe G. The drum thus driven transmits its motion to the air-drum, so that, for a given quantity of gas, there is a certain amount of air delivered for mixture with it. The air-drum, constructed with vanes K, is so designed that there is no back-pressure for it to overcome in delivering the air, which enters at one side, and passes out at the top as shown, whereby the capacity of the drum chambers formed by the vanes may be regulated by the height of the water N which is supplied to the drum-casing. By means of the vanes, several chambers are formed, the capacity of which is regulated by the height of the water.

The apparatus works as follows: The gas flowing to the gas-drum drives this and the air-drum also. The latter delivers air to a pipe leading to the gas-pipe; and when gas is passing thereto from the gas-drum in a measured manner, the mixed gas and air flows to the lighted burner, where it produces a noiseless blue flame, by which any "glow attachment" is heated, so as to diffuse an intense light.

With burners which also act as mixers, says the patentee, a constant composition of the mixture is not attainable, as the pressure of the gases in the burner-pipe varies—sometimes more and sometimes less air being carried along; while in the mixing apparatus the air is drawn by chambers which, when once made suitable for a certain mixture, always supply the same quantity.

Prepayment Meters.—Orme, D., of Oldham. No. 16,281; Aug. 27, 1894.

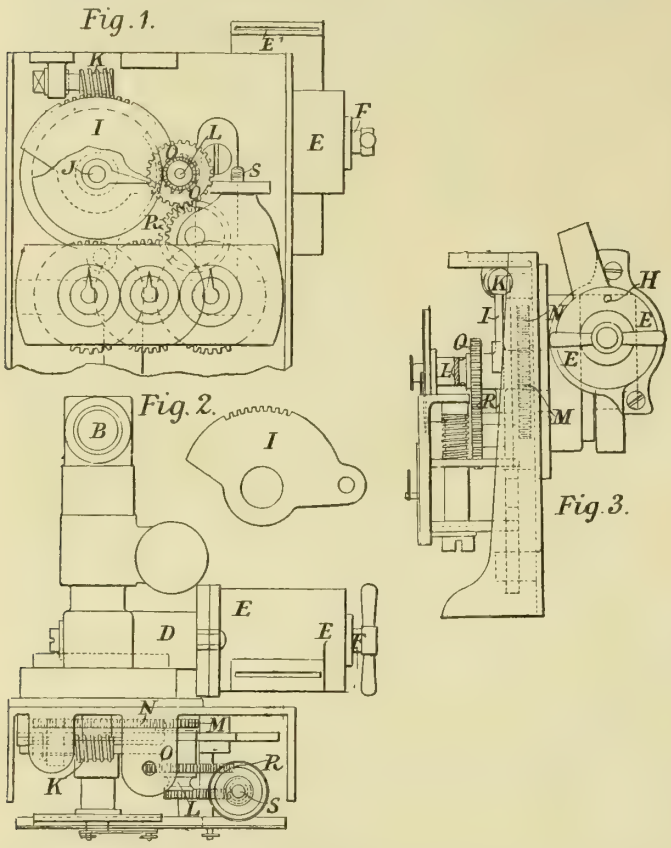
This invention is more particularly applicable in conjunction with the arrangement of meter described in patents No. 18,490 of 1890 and No. 15,740 of 1893. In the specifications of these patents, coin-receivers are described with which are combined means for increasing or diminishing the quantity of gas delivered in accordance with the price of gas. The chief points of the present invention are the employment of a coin-receiver of simplified construction and working, and the transference of the means for increasing or diminishing the quantity of gas to be delivered from the coin-receiver to gearing or parts not forming a portion of the coin-receiver, and "thereby rendering more difficult or impossible the fraudulent manipulation of the meter."

Fig. 1 [next page] is a front view of the dials and mechanism of such a prepayment meter; fig. 2, a plan of fig. 1; and fig. 3, a side elevation at right angles to fig. 1.

A branch D projects from the casing in which are the valve-spindle and valve; and this branch contains the worm-spindle, the outer end of which terminates in a disc carrying two driving projections. On the end of the branch, is fitted a hollow cylindrical casing E, which contains a revolvable cylindrical body F, formed with a coin-receiving slot. A short spindle projects from the cylinder F through the outer end of the casing, and is furnished with a handle, whereby it may be turned. The cylinder is recessed at its inner end, to admit the projections already referred to. The cylinder is also cut out midway; and at the outer end it is checked, so as to present two shoulders, which are intended to limit the revolution of the cylinder by coming in contact with a stop-pin H, screwed through the end of the casing. The coin-receiving slot goes entirely through the cylinder F, and is wide enough at the top to receive a proper coin—say, 1d. At the foot, the slot is contracted, so that the coin shall not drop through the cylinder, but will remain therein until the cylinder is turned. On the other hand, if a smaller coin should be inserted, the slot is wide enough at the foot to let it drop entirely through into the coin receptacle as soon as the cylinder is moved, without affecting the apparatus at all. The casing E has a slot in it; so that, when a coin of the proper size and value is used, it drops down into the slot in the cylinder, and rests upon the contracted edges of the slot beneath. In this position, the projecting edge of the coin on one side of the cylinder has entered between the projections on the disc. The cylinder may now be turned by means of the handle; and the edge of the coin, as it is carried round, engages with the projections, and, acting like a screw-driver, turns both the disc and the spindle. This has the effect of advancing the cam, and opening the gas-admission valve, as described in the former patents.

When the cylinder has been turned round rather more than half a revolution, the wide end of the slot and the contained coin come opposite to the delivery slot in the casing leading to the coin receptacle; and the coin drops through the slot. At the same time, the shoulder

comes against the stop H, and further rotation of the cylinder is arrested. The cylinder is now moved back—the spindle remaining in the situation to which it has been turned; the projections having been left in a position which enables the next coin inserted to slip between them. In turning the cylinder back, the shoulder comes against the stop H, and arrests the cylinder in a position which brings the slots exactly in line, and ready to receive another coin.

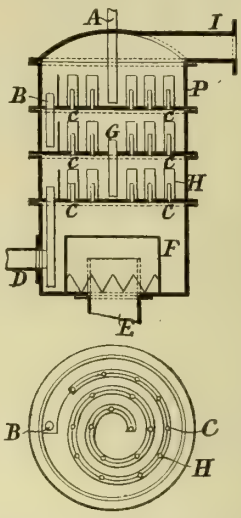


As the cylinder fits the casing closely for a portion of the circumference, it is impossible for a fraudulent consumer to recover the coin by attaching anything to it. Further, as already mentioned, a smaller coin than the appointed one would also fail to actuate the mechanism, as, before it could operate the spindle, it would drop through the contracted end of the slot. In the apparatus described in the earlier patents, means were combined with the coin-receiver for varying the quantity of gas to be delivered in accordance with differing prices for gas. In the present apparatus, by using a change-wheel having more or fewer teeth, the wheel, and consequently the bowl which operates the cam and valve spindle, is moved at a determinable rate of speed, and more or less gas is delivered to the consumer. To effect this, an adjustable quadrant I is mounted loosely upon a sleeve on the outer end of the valve-spindle J. The quadrant (shown separately) is furnished with teeth on its periphery. Above it, and gearing therewith, is a worm K; the spindle of the worm being carried in a bearing projecting from a bracket on the frame of the apparatus. By turning the spindle and worm, the quadrant can be adjusted to any desired position; and, when set, the quadrant is locked by the worm K, and therefore requires no separate locking means. One side of the quadrant I has a boss carrying a short spindle L, the inner end of which is furnished with a toothed pinion M gearing with a similarly toothed spur-wheel N, mounted on the axis of the cam, and operating by means of a bowl carried on a bracket to move the valve-spindle to-and-fro, as described in the earlier patents. On the other end of the spindle L is a change wheel O, which can easily be replaced by a wheel having a greater or less number of teeth.

The wheel O gears with, and is driven by, the pinion R, which is part of the gearing of the meter—receiving motion from the upright shaft S or other driving means from the measuring cylinder of the meter. As the wheel is thus the medium of communication between the mechanism of the meter and the means for closing the gas-supply valve at B, the quantity of gas passed through the meter between the opening of the valve by the insertion of a coin and the operation of the coin-receiver and the closing of the valve by the revolutions of the meter may be varied—either more or less gas being passed, according to the number of teeth in the wheel.

Gas-Washer.—Pettigrew, G., of Middlesbrough. No. 17,395; Sept. 13, 1894.

This washer is made up of a series of shallow trays, the area of the bottoms of which is divided off in the form of a helix. The water or other liquid by which the gas is to be washed, is let into the washer at the top by the pipe A to the centre of the helix formed in the top tray P, flowing round each circumvolution of the helix from the centre to the overflow-pipe at the circumference, and down this overflow (the lower end of which is sealed by the liquid) to the circumference of the next tray. The liquid now flows round each circumvolution of the helix, from the circumference to the centre overflow-pipe C, and down this pipe to the centre of the helix in the next tray. Here the lower end of the overflow is sealed in the liquid, similar to B. After passing through any number of trays, the liquid finds an exit from the washer by the overflow pipe D. The gas to be washed enters at the bottom by the pipe E, the open end of which is covered by a hood F much larger than itself. The hood is serrated round the circumference, to a depth less than the height of the overflow from the bottom of the washer—thus ensuring the serrations being always covered with liquid. The pressure of the gas depresses the liquid under the hood F, passing out through the serrations, and up through the liquid, and through the openings C in the helix, into the helical



hood H covering the helix. The gas depresses the liquid under the hood—passing out through the serrations; up through the liquid; and then through the openings C into the hood H of the next tray. Here the process of washing is repeated; and the gas then passes through any number of trays—finally leaving the washer by the pipe I. The depth of the helix in each tray being always more than the height of the overflow, ensures the liquid flowing round each circumvolution of the helix to the overflow.

Incandescent Gas-Lamps.—Moeller, J., of Palmer Street, Westminster. No. 9070; May 7, 1895.

The patentee remarks that, when incandescent gas-burners are employed for street lighting or in localities subject to vibration or shaking, the mantle is apt to give way, owing to the vibration conveyed to it through the burner and the post or other frame which supports it, and the pipe which leads to it. The object of the present invention, therefore, is to provide against the communication to the mantle of such shaking or vibration as might cause it to give way, by providing an elastic support for the burner.

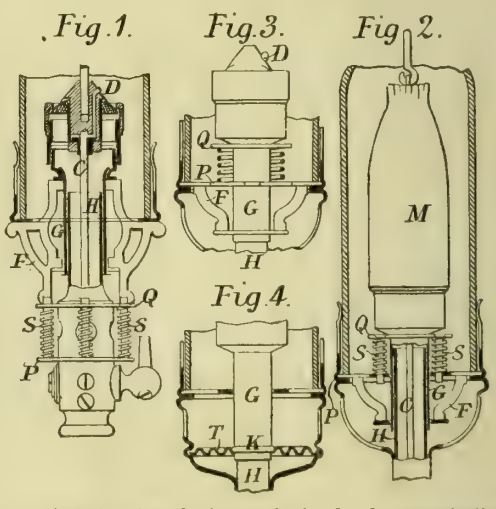


Fig. 1 is an elevation (partly in section) of a burner similar to that described in patent No. 10,587 of 1894, with an elastic support. Fig. 2 is an elevation partly in section, showing a modification. Fig. 3 illustrates a further modification, in which a single spring is employed. Fig. 4 is a part section of an elastic diaphragm support.

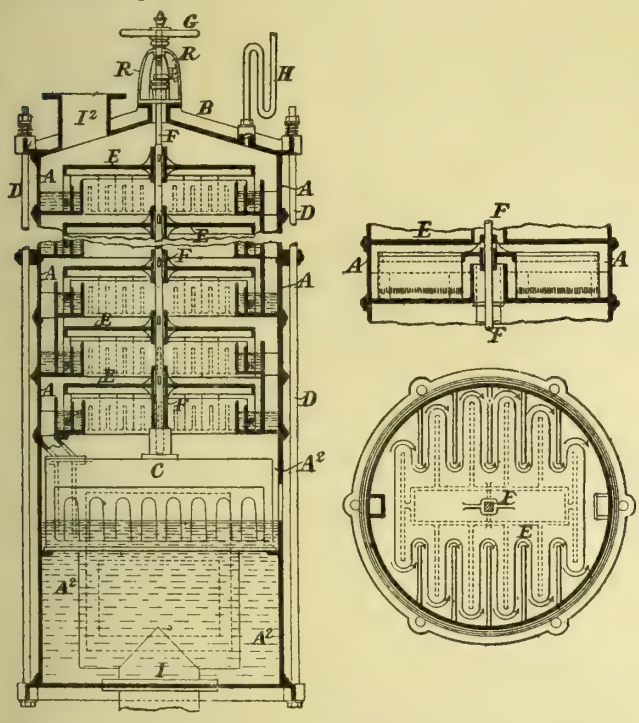
The elastic support applied to existing burners is fixed on the shoulder just above the stopcock. An annular plate P having several stud-pins S (of which four are shown) is fixed in and projects up from it; each being surrounded by a helical spring. On these springs rests another annular plate Q, having holes through which the pins S freely pass. On the plate Q rests the frame F of the gallery, which carries the upper part of the burner. The outer tube G of the burner being free to slide on the inner tube H, and also the top of the central tube C, which supplies the pilot-light D, being free to slide in the hole which it enters, the gallery and burner with the mantle supported on it rest entirely on the springs; and thus any vibration or shaking of the parts below is deadened before reaching the mantle.

As shown in fig. 2, the burner only, and not the gallery, is supported on the springs. For this purpose, a frame-plate P, with arms projecting into an internal groove of the gallery, has holes through which freely pass the stud-pins fixed in, and projecting down from the upper plate Q. The springs interposed between P and Q deaden the vibrations, which might otherwise be communicated to the burner, and thus destroy the mantle M.

As shown in fig. 3, a single helical spring is interposed between P and Q, and in fig. 4 an elastic diaphragm T (which may be a disc of thin sheet metal circularly corrugated) carries the burner, a collar K of which rests upon the middle of the diaphragm, while the outer edge of the diaphragm rests on an internal ledge of the gallery.

Washing and Scrubbing Gas.—Walker, C. C., of Donnington, Shropshire. No. 9556; May 14, 1895.

The claim for this invention of apparatus for washing and scrubbing gas is for "a tower consisting of the combination of a series of superposed trays or divisions, with or without a tar-extractor at bottom; each tray or division being provided with an opening at the bottom (for the passage of gas) surrounded by upwardly extending sides; ribs or projections extending upwards from the bottom of the tray or division, and interposed or arranged so as to form a circuitous passage for liquid passing through the tray; a hood provided with a depending rib shaped to correspond to, and caused to enter the circuitous passage formed by the ribs; perforations or slots in the depending rib of the hood, through which gas is caused to pass; a rod or spindle, to which the hoods are attached; and means whereby the spindle with the hoods may be raised and lowered, so as to vary as required the depth of seal and back pressure."



As shown in the engravings, the apparatus consists of a tower, composed of several divisions or trays A placed one on top of another—the tower being built to any desired height. Each division is provided at its upper end with a socket, to receive the lower end of the next tray above; the socket on the uppermost division receiving a rim formed on the cover B of the apparatus, and the lower edge of the lowermost division entering a socket formed on the upper edge of a chamber A^2, containing a tar-extractor C, as described in patent No. 3619 of 1881. The several trays A are connected together, and to the cover B and the chamber A^2, by tie-rods or long bolts D, tightened up by nuts screwed on to the rods—preferably with springs interposed, so as to allow of expansion and contraction without affecting the stability of the structure.

Each division or tray is provided in the bottom with an elongated opening, surrounded by upwardly extending sides. Projecting upward from the bottom of each tray are ribs—one set extending from the sides of the opening to within a short distance of the rim of the tray, while the other ribs (which are interposed) extend from the sides of the tray to within a short distance from the sides of the opening, thereby forming a circuitous passage between the ribs. At a short distance from each end of the elongated opening, is a rib projecting from the bottom of the tray, parallel to the other ribs, and extending in both directions to within a short distance from the sides or rim of the tray. In the bottom of the tray on the outer side of one of these latter ribs is an opening, having upwardly extending sides, through which liquid passes into the division or tray below. Another opening is provided at the diametrically opposite side of the trays, into which the liquid from the tray above passes—the opening being situated between the rim or side of the tray and the rib at that end of the elongated opening.

These openings are surrounded by upwardly projecting sides, extending to a level with the top edge of the rim of the tray; so as to form a continuation of the opening in the tray above—the sides having passages at their lower ends through which the liquid passes into the tray. In each tray is placed a hood E, having a depending thin metal rib of an endless corrugated or serpentine form. The hoods are carried on a vertical rod or spindle F, which extends from outside the cover B through all the trays, and is supported at its lower end in a footstep on top of the tar-extractor C. The upper end of this spindle is screw-threaded, and passes through a stuffing-box on the cover B, into a bearing in a bracket R fixed on the cover—a wheel-nut G being screwed on to the spindle, and caused to bear on the bracket R, so that, by turning it in one direction or the other, the spindle F, together with the hoods E, may be raised and lowered as required. Near the lower edges of the ribs of the hood E are perforations or slits through which the liquid and gas can pass. The liquid is admitted to the uppermost tray of the series by a syphon or bent pipe H, and flows downwards over and through each tray in succession, and out from the apparatus by an outlet in the chamber A^2 containing the tar-extractor.

The gas to be washed enters the apparatus by the inlet-pipe I, and passes upwards into the tar-extractor C. From thence it passes into the lowermost tray A, through the central elongated opening therein; and thence over the upwardly projecting sides of the opening. As this opening is covered by the hood E, the gas is caused to pass down into and through the water contained in the tray, and through the perforations in the depending rib of the hood, to the exterior of the hood. The gas then flows from this lower tray into the next tray above; through the liquid contained therein; and so on upwards through all the trays of the series. It finally passes from the apparatus through the outlet I^2. The gas "is thus caused to pass through a continuously flowing stream of liquid travelling in a circuitous direction, the reverse to that of the gas, whereby the ammonia and other impurities contained in, or combined with, the gas are effectually absorbed by the liquid." By means of the wheel-nut G, the hoods E may be raised more or less above the bottoms of the trays, to admit of the gas passing through a greater or less depth of liquid on each tray before going through the slits; the depth of seal and back pressure being thus regulated as required.

Conducting Air to the Flames of Gas-Burners.—Schülke, A. H. J., of Berlin. No. 10,463; May 27, 1895.

This invention relates to means for conducting air to the flames of gas and other lamps or burners for lighting and heating purposes; the object aimed at being "to spread out and flatten the flame, whereby the illuminating surface is enlarged, complete combustion of the gas or vapour is secured, and a perfectly white flame is produced." By these means, it is also possible, it is claimed, to burn the heaviest hydrocarbon vapours and gases without depositing carbon, and without the necessity of using very fine passages. The spreading of the flame and securing complete combustion are produced by an air-supplying device in which the flame itself is situated at the meeting point of two or more jets of the air intended to support combustion—such jets of air being directed against one another by suitably formed and directed channels or passages. The jets of air impinge upon one another, and are broken up; thereby effecting an "energetic spreading out of the flame, and a complete combustion of all the hydrocarbon therein."

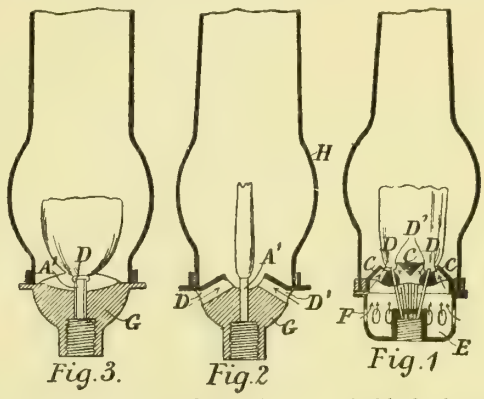


Fig. 1 is a vertical section of a gas-burner suitable for burning heavy gases. Figs. 2 and 3 are vertical sections (at right angles to one another) of a modification of same.

The burner shown in fig. 1 consists of several small burner-tubes A, leading through the cover of the inlet-passage B, which screws on to the gas-pipe. These burner-tubes pass at their upper ends through a ring C, in such manner that they stand in a circle therein; and the small gas-flames burning at the upper ends of the tubes, combine together into a "closed crown of flame." In order that this effect should be accompanied by the widest possible spreading of each small flame, the ring C has on each side of every one of the tubes A channels D D^1, which converge towards the mouth of each such tube; the channels serving as air-passages, and allowing the air entering through the openings F of the burner jacket E below the chimney H to act in jets directed against one another and against each small flame, somewhat like the jet from a blow-pipe.

In the burner shown in figs. 2 and 3—in which there is only one central burner-tube A^1—the air channels D D^1 are formed in the cast body G, which contains the thread for screwing it on to the gas-pipe, and at the same time forms the gallery for the chimney H.

APPLICATIONS FOR LETTERS PATENT.

13,867.—Arrol, Sir W., and Foulis, W., "Charging gas and other retorts." July 20.

13,879.—Goodson, J., "Gas-burners." July 20.

13,938.—Hooker, W. and L., "Solution for illuminant mantles for Bunsen gas-burners." July 22.

13,959.—Lapointe, H. L. A., "Manufacture of oxygen." July 22

13,960.—Petrèano, E., "Carburettors." July 22.

14,009.—Spiel, C., "Vaporizing and igniting devices of gas and similar motors." July 23.

14,053.—Denayrouze, L., "Mixing gas and air supplying incandescence burners." July 23.

14,069.—Rotherham, J., "Swivel joints for tubes or the like conveying liquids or gases at a pressure." July 23.

14,090.—M'Gillivray, J., and Ayton, J. G., "Gas-heated ovens for baking." July 24.

14,115.—Rickman, W. B., "Intermittent gas-lights." A communication from R. and O. Pintsch. July 24.

14,171.—Bosted, D. T., "Preventing the freezing of water in service-pipes, cisterns, and the like." July 25.

14,189.—Connor, J., "Stopping leaks in water-pipes or other pipes conveying fluids or gases." July 25.

14,197.—Glover, R. T. and J. G., "Preventing persons fraudulently operating coin-freed apparatus." July 25.

14,198.—Tourtel, J. M., "Prepayment gas-meters." July 25.

14,200.—Bennett, R. G., "Mixing air and gas for incandescent lighting and heating." July 25.

14,208.—Bichel, C. E., and Schulte, E., "Producing inexplosive acetylene gas." July 25.

14,242.—Ladd, J. H., "Explosion-engines and gas-generators to be used in connection therewith." July 26.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Mr. Young's Paper at the North British Association.

SIR,—I do not think that Mr. Young's answer would exactly please Mr. M'Gilchrist, who, unable to discuss the brilliant paper he had listened to, remarked that "they had heard a lot of 'rot' about illuminating power and illuminating value," and asked Mr. Young to give them some further information upon the subject. The circumstance that he desires some further information on the subject is the one redeeming feature in Mr. M'Gilchrist's attitude. There is always hope for the man who desires "some further information."

Possibly in the face of Mr. Young's admission that the question bristles in many ways with difficulties, and that he preferred to be allowed to shirk it, Mr. M'Gilchrist may now be induced to think that, after all, there is something in it, and that, at least, the term "rot" is hardly applicable as a description of what has been written and spoken on the subject. Opprobrious epithets will not supply want of argument, or make up for narrowness of view.

As bearing upon the complex question of luminosity and the diffusive or "quantity" power of lights, I may call attention to the recent article* of M. Poincaré in the *Revue Générale des Sciences*, in which it is pointed out that the cathode rays produced in vacuum tubes (a discovery of Professor Crookes) do not issue in straight lines, but actually turn round opaque bodies.

I would suggest, further, that, in a discussion of the interesting subject of light diffusion, the inquiry whether the direct ray does not propagate other rays at right angles to itself, is also worthy of consideration.

5, Norfolk Street, Manchester, Aug. 1, 1895. THOS. NEWBIGGING.

Effect of Admixture of Gas and Air on the Illuminating Power of Gas.

SIR,—In Professor Lewes's paper on "The Combustion of Coal Gas for Fuel Purposes" he describes a new burner invented by M. Denayrouze, which gives 27 candles of light per cubic foot of gas consumed. This excellent result the Professor attributes to the complete and thorough admixture of gas and air, as supplied to an atmospheric burner, by means of an electric fan, whereby the heat of combustion is greatly increased. On reading this, it occurred to me that the same result ought to be obtained if the gas and air were thoroughly mixed and consumed in a suitable burner; and a few experiments have been made which certainly seem to prove that the theory is correct, for the illuminating power is improved quite 50 per cent.

The best results obtained have been 20 candles per cubic foot of gas consumed; and this was with a mixture of four of air to one of gas. The percentage of air will, of course, vary with the composition of the coal gas; and experiments have to be conducted with care, as a small increase in the percentage of air would make an explosive mixture. An apparatus, however, could be designed for working such a system which would prevent any danger of an explosion, and would be a far simpler plan than that proposed by M. Denayrouze. With the increase of heat produced, the durability of the mantle must be considered; but lengthy experiments only can decide this matter.

South Metropolitan Gas Company, Aug. 3, 1895. FRANK LIVESEY.

Gas Flames and Luminosity.

SIR,—The article in this week's JOURNAL, on "Gas Flames and Luminosity," contains many interesting suggestions in connection with the relative value, to the consumer, of high and low power gas; but it appears to me that some of the statements made in regard to the gas supply of Manchester are more sweeping than economical considerations would justify.

Mr. Irwin is probably correct when he states that the 20-candle gas supplied in Manchester, when burned in a No. 4 Bray's union-jet burner, will give a light value of 12½ candles only. This merely proves that consumers use a burner which is not the most suitable for the gas. But do they generally use the most suitable burners? As Mr. Irwin says, they prefer the union-jet burner; and it is pretty certain they would continue to use this burner if the illuminating power of the gas were reduced. What amount of light would a consumer get out of a union-jet burner from gas of 14 or 16 candle power? On this point, information is wanted before it can be definitely ascertained that, in paying a lower price for gas of inferior quality, the consumer would save money.

Another factor required to be known, in order to determine this question, is the amount of reduction that would be effected in the cost of the gas by diminishing its illuminating power; and, *pari passu*, the proportion of cannel carbonized. The cost of enrichment by cannel in Manchester and in London are two very different items. If the use of cannel were entirely abandoned in Manchester, the saving effected would not exceed 3d. per 1000 cubic feet of gas sold. Now suppose that this were done, and gas of 16-candle power were supplied, instead of 20-candle gas. How would the consumer benefit thereby? He would consume the 16-candle gas as he does the 20-candle gas in union-jet burners; and, assuming that the burner effected an equivalent reduction in the light-value of the gas, he would get the value of 10 instead of 12½ candles. I do not know what light-value a union-jet burner gives with 16-candle gas; but I am not aware that it is more suitable for burning such gas than for burning 20-candle gas. In fact, I should expect it to be less so. The consumer would be paying one-ninth less per 1000 cubic feet for his gas than at present, and would get one-fifth less light for his money. Would he be content with the reduction? I hardly think so. I imagine he would seek to get as much light as he had previously been accustomed to; and he would do this by increasing his consumption. The result of this would be that he would, in the end, pay more for an equal amount of light than he had previously done.

I am aware that the proportion of one-ninth in the reduced cost of the gas to the consumer is not the same as the actual reduction in the cost of manufacturing the gas; because all other charges but that for the material carbonized remain the same. This, in actual practice, is unavoidable.

Such a reduction in the illuminating power and in the price of the gas, would result in a large increase in the general consumption; but I doubt whether the Corporation would in consequence be enabled to make and distribute the gas more cheaply. When a certain magnitude of operations has been reached, further economies in manufacture are not to be expected from an increasing business. Nor do I think the charges on capital account would, in consequence, become less; seeing that they are already as low as they can be in Manchester. The only way in which an increased business could be conducive to a reduction in the cost of the gas to the consumer, would be by providing a larger quantity of gas over which to distribute the net profits of the undertaking.

I am, however, far from thinking that enrichment by the use of cannel only should be continued in the future. I consider Mr. Irwin has done us good service in showing the useful effect of benzene as an enricher. What I should like to see is the benzene retained in the gas from the beginning, instead of being afterwards returned to the gas by enrichment. But the realization of this presents difficulties hitherto only partially overcome.

I am also of opinion that gas of practically equal quality with that which it has been customary to make in Manchester may be supplied with the use of less cannel than has hitherto been carbonized. The difference between 18½ to 19 candle gas and 20-candle gas is practically inappreciable to the consumer; but a drop of one to one-and-a-half candles means a considerable saving of cannel. To change from 20-candle to 16-candle gas would, on the other hand, cause universal discontent among the consumers, and would certainly not be compensated for by the reduction in price which it would permit.

Manchester, July 31, 1895. G. E. STEVENSON.

The Lighting of the Victoria Embankment.

SIR,—I have noticed with much interest, in recent issues of the JOURNAL, that the above subject is engaging the attention of the London County Council. It is a subject which I am confident will prove of great interest to a large number of your readers; and for this reason, and in the interests of gas, I beg to draw attention to a few of the disadvantages put upon the illuminant when used for incandescent lights in the existing and utterly unsuitable form of lanterns.

In the first place, there is the heavy unsightly framework, with its horizontal and downward shadows—bad with any system of lighting, but much aggravated by any concentrated light like the incandescent gas-light. Secondly, the very bulky or roomy lantern is much out of place and keeping with this concentrated light. It loses much of its lighting effect thereby, and has the appearance of something wanting; giving a far from satisfactory or pleasant result when compared with the same lantern having its usual consumption by open flat flames therein, for which it was designed and constructed. Then the pilot-light at present in use with the incandescent system needs careful attention, for at least 10 per cent. will persist in failing their purpose. An unfailing pilot-light, or the means of lighting from the ground, and without opening the lantern, or requiring the aid of a ladder, is an essential much required.

With these serious disadvantages and drawbacks removed, and fair play allowed as to the cost of each system, electric or gas, few doubts need be entertained by the gas engineer or the gas company as to the success of the latter.

July 27, 1895. OBSERVER.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, July 30.

(*Before Justices* CAVE *and* LAWRANCE.)

Southwark and Vauxhall Water Company v. Evershed.

This case, which was argued before the Court on the 9th of April last,* raised a question as to the interpretation to be put upon the words in regulation No. 21, made by the Board of Trade under the Metropolis Water Act, 1871, which provided that every water-closet service-box should have an "efficient waste-preventing apparatus, so constituted as not to be capable of discharging more than two gallons of water at each flush." The Magistrate held that the waste-preventer in use was not capable of discharging more than the specified quantity, unless it was deliberately caused to do so; and from this decision the Company appealed.

Justice CAVE said he had had very great doubt about the case; but, on the whole, he thought the Magistrate had decided rightly, though he could not agree with the reasons he had given for his decision. The addition the Magistrate made to the rule, "unless done deliberately," was not warranted by anything in the regulations or in legal principles. The case only stated that the cistern was capable of discharging water so long as the chain was kept at a certain tension. If there had been any evidence of the existence of a nail or a hook by which the chain could be fastened down, or of any weight attached to the chain so as to hold it down, he should have thought that the occupier had violated the regulation, and incurred a penalty. But if there was no evidence of such apparatus intended to hold the chain down in the absence of any person, in accordance with the maxim "*De minimis non curat lex*," the fact that a little water in excess of the two gallons would escape so long as the chain was held down by the hand was not sufficient to bring the case within the regulation.

Justice LAWRANCE said he entirely agreed with the result at which his learned brother had arrived; and he did so without having ever felt any doubt upon the matter.

The appeal was accordingly dismissed, with costs.

* Referred to in the JOURNAL for Dec. 4, 1894 (p. 1067).

* See JOURNAL, Vol. LXV., p. 853.

CROYDON QUARTER SESSIONS.—Friday, July 26.

(*Before Mr.* R. G. GLENN, LL.B., *Recorder, Alderman* MILLER *and Dr.* STRONG.)

Croydon Gas Company v. Assessment Committee of the Croydon Union.

This was an appeal by the Croydon Gas Company against the assessment of their property by the Assessment Committee of the Croydon Board of Guardians.

Mr. BALFOUR BROWNE, Q.C., Mr. DANCKWERTS, and Mr. BARNES appeared for the appellants; Mr. LITTLER, Q.C., and Mr. E. PAGE represented the respondents.

Mr. BALFOUR BROWNE, in opening the case, remarked that, as far as he could see, there would be no complications. The Company were incorporated by an Act passed in 1847; and they obtained another Act in 1860. The capital had been increased; and the Company had lately amalgamated with the Carshalton Gas Company, so that a portion of the undertaking was under the jurisdiction of that Court, while a portion would also come under that of the Court of Quarter Sessions for Surrey. In Croydon the initial price of gas per 1000 cubic feet was 4s. 7d.; and the charge, 2s. 9d. In Carshalton, the initial price was 4s. 7d.; and the charge, 3s. 6d. Some time ago, the Company's undertaking was valued by Mr. H. E. Jones, who fixed the amount at £21,170. On this being appealed against, the Assessment Committee seemed to take the view that their contentions were wrong; and they reduced the figure from £21,740 to £21,170. The only item with which he had to deal was one of £18,343, which included the whole of the property of the appellants within the jurisdiction of the Court. The principle followed was the one usual in these cases. They had to ascertain what rent a tenant would be reasonably expected to pay for the property, and what he would look for in the way of profits. The usual allowance was 10 per cent., which, added to 5 per cent. interest on capital, made 15 per cent. Then there came in the question of casualties, which had generally been estimated at about 2½ per cent. Consequently, they had as the occupier's share of the profits 17½ per cent. Then they had to deduct a sum that would be necessary to maintain the hereditaments in a condition to command the rent; and when this had been taken off, it represented the amount which was to be the basis of the rateable value. Taking everything, therefore, into consideration, it brought out a total rateable value amounting to £12,573. Dividing this up, and apportioning the amount which related to the borough of Croydon, they arrived at a sum of £11,717, as against the amount standing in the rate-book—viz., £18,343. He thought that, on the whole, the Court would come to the conclusion that the figures he had put forward fairly represented the rent a tenant might be expected to pay from year to year.

Evidence was then called on behalf of the appellants.

Mr. *E. Ryde* said he had made a survey of the Gas Company's property; and he brought out the rateable value of the whole concern at £12,573. This figure had been arrived at from the Company's audited accounts. The gross receipts amounted to £78,688; and deducting working expenses, &c., the net receipts were £33,609. The amount of the tenant's capital was £64,000, from which the usual 17½ per cent. had been deducted.

In cross-examination by Mr. LITTLER, witness admitted that the Company had largely increased their business—the quantity of gas sold having augmented by 85 per cent. since 1883—that the dividends had gone up 2 per cent., and that the meter-rents were higher by 41 per cent. He said the rateable value of the property was, no doubt, considerably out of proportion to this. He was not attached to the 17½ per cent. which had been allowed for tenant's profits.

Mr. LITTLER: At present, good securities have dropped to 2½ per cent.

Witness: Yes; that is in real property or in the Funds.

Is it not a fact that, in large trades and businesses, people are now compelled to put up with much less interest than formerly?—I have no doubt that is so.

If a man desired to invest his money, he would be told he must expect a less return than was the case fifteen years ago?—As a general proposition, I will not deny that. But 17½ per cent. is not too much in the present case, considering the increased fluctuation of prices, strikes, and so forth.

Re-examined by Mr. BALFOUR BROWNE, witness stated that, taking the amount of the profits alone, the rateable value of the property might be a little over £15,000; but it would not be justifiable to put it at £18,000. The tenant coming in would look at the profits actually earned, and not at the dividend paid.

Mr. *H. E. Jones*, M.Inst.C.E., said he had gone into the circumstances of the Company, and examined their works; and he brought out the rateable value of the entire property at £12,800. He estimated the gross profits at £32,162; but he thought the amount received for sulphate would fall off this year something like 15 per cent. He estimated the gross future profits at £26,981. The price of tar had dropped considerably. The 17½ per cent. which had been referred to was a matter of course. This amount was given universally; 2½ per cent. was the usual allowance for risks and casualties. He was entitled to get 10 per cent. allowance on the rental value for maintenance, which would make his total valuation £500 less than the sum he had named. His calculations were based upon the actual working of the appellants. He could not find any other case in which the assessment was so high in proportion to the price charged as in Croydon—being equal to 3d. per 1000 cubic feet.

In cross-examination by Mr. LITTLER, witness said gas was being made at Croydon cheaper than at Carshalton. In making his calculations, he had not taken into account that coal carriage would cost less at Croydon than at Carshalton, as the difference in distance was only about half a mile. The residuals in Croydon fetched more than those in Carshalton. By the amalgamation of the Croydon and Carshalton Companies, a considerable saving had been made in the cost of administration. He considered that a saving of £111 had been effected in establishment charges. Witness then compared the average cost of working in the cases of the Croydon, Lea Bridge, West Kent, Mitcham, and Bedford Companies—the rate for Croydon being 1·79d. per 1000 cubic feet of gas manufactured; for Lea Bridge, 2·93d.; for West Kent, 3·18d.; for Mitcham, 2·92d.; and for Bedford, 1·95d. He considered the Croydon Company was among the first-rate gas companies of the kingdom. An allowance of 2½ per cent. should be made for risks. There were 8413 consumers on the books of the Company, with 8869 meters in use, at December last. In regard to the value of the meters, he had taken a list, from which he had deducted 10 per cent., and then taken 25 per cent. off that for depreciation. He did not allow for any depreciation in respect of the new meters. For heating-stoves let on hire, he allowed £9733. Witness gave further comparative figures.

Mr. *Corbet Woodall*, M.Inst.C.E., one of the Directors of the Company, said he attended before the Assessment Committee, and expressed his views on the matter before the Court. The net rateable value on which the Company paid was £10,801; but the new assessment had been fixed at £19,904. His own valuation worked out at £12,825 for the whole undertaking. Up to June last, the price of gas was 2s. 10d. per 1000 cubic feet; and it had now been reduced to 2s. 9d. The Company had been enabled to lower the price of gas in consequence of the saving effected in the management expenses. Had the Directors acted up to their powers, they could have shared the extra profits in dividend; but instead of this, they had given the consumers the benefit of it. To provide for maintenance, repairs, and renewals, he had taken 7d. per 1000 cubic feet as a fair rate to be expended from year to year. He considered that £6400 would be a very reasonable return to a man working the concern as a tenant.

In cross-examination by Mr. LITTLER, witness said that, if an application had been made to him by the other side to inspect the books, he should have refused to accede to it.

Mr. LITTLER then called Mr. *W. J. Russell*, the Company's Secretary, to produce the cash-book, as he wished to see how the revenue came in; and the further hearing of the appeal was adjourned.

Saturday, July 27.

On the resumption of the proceedings to-day,

Mr. *Corbet Woodall* was further cross-examined. He stated that the Company had no book in which the receipts for each month would be shown; but, if desired by the Court, the exact amount collected month by month might be ascertained.

Mr. LITTLER said he wanted the amount of each month's payments on revenue account, and each month's receipts. He would also like to have the balance for or against the Company in their banking account on the last day of each month.

Questions having been put in regard to meters,

Witness said it seemed to him that, in the interests of the inquiry, general principles should be accepted as to what was fair depreciation. This appeared to be far more satisfactory than trying to unravel the intricacies of the case. In further cross-examination, he said he thought that, in producing the accounts, they would be able to distinguish between ordinary repairs and the cost of maintenance and renewals. With regard to the collection of the accounts, he admitted it was effected in a shorter period than five months; and in four months of the year, they had what represented the expenditure of five-twelfths of the entire year. Although the business of the Croydon Company was growing, he objected to admit that the rateable value of the property was increasing. If they had made up the amount they had lost by reducing the price of gas 1d. per 1000 cubic feet, they would have to spend it on the other side. It was consequently strictly a set-off to the rateable value being increased, because, in order to get the amount back, they would have to spend more money.

Mr. LITTLER: In a table here, showing the price of gas and net receipts, I find that the receipts go up almost in proportion to the decrease in the price of gas.

Witness: Of course, it seems almost inevitable either that the net receipts must go up or the dividends drop if the price of gas is lowered.

In further cross-examination, witness gave particulars as to the price of residuals; remarking that at the present time the prices of tar and ammonia were low, while the value of coke had fallen considerably. With regard to what took place before the Assessment Committee, he virtually confirmed all he then said. Though the 17½ per cent. had been "crystallized," the tenant did not appear to have more than he was entitled to.

Mr. LITTLER: Does it not strike you that the business of gas making throughout the country is a steady-going and attractive one?

Witness: Yes; but it is subject to fluctuations.

Re-examined by Mr. BALFOUR BROWNE, witness said his valuation was carefully made, with the hope of securing an amicable settlement with the Assessment Committee; and he was glad to find it had been completely supported by such experienced men as Mr. Ryde and Mr. Jones. With the exception of the coke, which he had corrected, the valuation laid before the Court was the same as that submitted to the Committee. Before he put forward that statement, he went into all the figures he thought essential in order to get at the true rateable value. The amount collected each month, and the sums spent each month, were not, to his mind, necessary to arrive at a conclusion as to the amount of tenant's capital. If there were a month that showed no tenant's capital was required, and another month that it was, he repeated that, with his experience, he could not work with less than five-twelfths of the whole year's capital receipts.

This closed the case for the appellants.

Mr. LITTLER then addressed the Court for the respondents. He said this was a matter of considerable importance to the Overseers, as it was, no doubt, to the Company. But he might remind the Court that the present was a rateable value that had been attributed to the concern for twelve years; and one would suppose that the time had arrived when some reconsideration was due. In London, it was regarded as absolutely necessary that this should be done once every five years. Taking such undertakings as water, railway, and gas companies, the variations were far larger and far more important than in other directions; and the appellant Company were not the only people whose assessments had been revised in Croydon. The great Railway Companies running into the town had had theirs reconsidered; and fair principles had been applied. In 1883, the rateable value of the

Gas Company's property was put in the first instance at £11,200, but was reduced to £10,180 by the Assessment Committee; and, as he learned from Mr. Ryde, this was the figure which was arrived at by agreement between the parties as a compromise. If this were a fair amount, then it was quite clear that there must have been a great increase in order to raise the figures to anything like £15,000 on a rule-of-three sum on profits. But if it were taken on profits alone, he should say the sum ought to be much greater. Though they did not rate profits, they were compelled, in these commercial concerns, to have regard to what the profit probably would be, in order to arrive at what the tenant carrying on the undertaking would have to give for the property one year with another. Taking the published accounts of the Company, he would compare the year 1883 with 1894, on which the rate in dispute was made. The gross receipts for 1883 were £61,750; and for 1894, £103,195—an increase at the rate of 67 per cent. There had not been the same increase in the net profits, for the simple reason that, in the interval, the price of gas had been reduced from 3s. 3d. to 2s. 10d. per 1000 cubic feet. It was a very striking affirmation that, in lowering the price of gas, they got such an enormous extra consumption that, though they had to provide more coal, the net profits went up from £18,273 to £27,204, or 49 per cent. They found how very much more advantageous the lower prices were; for, even with the reductions he had named, the dividends paid had jumped up from 12 and 9 per cent. to 14 and 11 per cent. So that the tenant and landlord together were now getting something like one-sixth more for their money than they were formerly. Then the total receipts on the capital expended had duly risen from £212,000 to £310,000, or an increase of 46 per cent.; so that for 46 per cent. more money invested, the Company were making 49 per cent. more profit. In the quantity of coal carbonized, there had been a rise to the extent of nearly 94 per cent.; and in the gas sold, of 85 per cent. There had also been an increase of 52 per cent. in the number of consumers, and of 41 per cent. in the gas-rental.

The Recorder: The point you make is that it has become a larger concern, requiring a larger expenditure, which increases in proportion to the growth of the business?

Mr. Littler said it was. He went on to adduce figures to show the stability of the concern. He said, in 1885, the receipts were only £52,000, and the price of gas was 3s. 3d.; but they rose to £56,000 the next year. Then in 1887, though the Company reduced the price to 3s. 2d., they reached £57,000. In 1888, they lowered the price by 2d.; and, as would be expected, they lost £1000. In 1889, they took off another 1d.; and, notwithstanding this, they more than recovered their position in 1887, when the price was 3s. 3d., and received £57,480, as against £57,700 in that year. In 1890, they reduced the price another 1d.; increasing the receipts by £1600, and bringing them up to £59,339. In 1891, they jumped up by £3000; in 1892, by £3700. In 1893, however, they were all but stationary in their gross receipts; that being the strike year. In 1894, they rose from £65,000 to £75,000; but this included £5000 for Carshalton. What, he asked, was the use of talking of this being a risky business? It was as secure and reliable as anything could be; and there were very few traders but would be only too glad to be making such profits. The Croydon Company had been so successful under the sliding scale that they were actually dividing on each class of their capital 4 per cent. more than they would have been entitled to do under the old scale when they were compelled to reduce the price of gas, keeping under the standard price, instead as now under the initial price. It ought to be looked upon as a safe, secure, profitable, and prosperous business, that could bear to pay a large rent to the landlord; and the amount of rent to be so paid, subject to statutory deductions, was the question which had to be decided by the Court. There was scarcely another instance where the andlord would expect to find a larger interest for his capital. The only test of the value of the property was what, considering its history and its prospects, a tenant would be willing to pay for it. The other side said that, notwithstanding the history of the Company for the past fourteen years, the tenant would not be willing to pay to the landlord more than Mr. Woodall's figure of £13,378, though in 1883 the sum was fixed by agreement at £10,180. Having dealt with a number of other statistics, Counsel contended that a business such as that of the Croydon Gas Company could get any number of tenants who would be perfectly contented if they could secure 15 per cent. all round to cover risks and everything else. This was how the respondents dealt with the matter in arriving at their assessment.

At the close of the learned Counsel's address, the further hearing of the appeal was adjourned until the 1st of November; it being intimated that, in the meanwhile, some arrangement might be arrived at which would lead to a settlement of the case.

Assessment of the Australian Gas Company's Mains.

The Australian Gaslight Company recently appealed against an assessment by the Parramatta Borough Council in respect of soil occupied by the Company's mains under the public thoroughfares of the borough. The appeal came before the Parramatta Bench; and it was submitted by the representative of the Council (Mr. J. E. Bowden) that they had no power to deal with it, the question not being one of value, but of the legality of the assessment, and therefore one which should be determined by the Supreme Court. The Bench, however, decided that they had authority to hear the issue as far as the value was concerned. For the Company, Mr. B. R. Wise argued that the mains were not property, and could not be rated, inasmuch as they were under the public streets, which could not be assessed. Under the Municipalities Act, there were but two methods of levying rates—viz., on the capital value or on the annual rental. The capital value of the lands through which the mains ran was *nil*, because they were public streets, and there could not be any rental value, for none was received. Mr. Bowden contended that the pipes used a certain portion of the ground which came under the designation of "lands and hereditaments," as provided to be vested in the 166th section of the Municipalities Act. The Council had nothing to do with the ground—the Company having independent occupation. The Bench held that the mains were not rateable.

MISCELLANEOUS NEWS.

THE GASLIGHT AND COKE COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held at the Company's Offices, Horseferry Road, Westminster, on Friday last—the Governor (Colonel W. T. Makins) in the chair.

The Secretary and General Manager (Mr. J. W. Field) read the notice calling the meeting; and the report of the Directors, which was given in the Journal last week, with the accounts for the six months ending June 30 last, was taken as read.

The Governor, in moving the adoption of the report and accounts, said he would only trouble the meeting with a few comments, in addition to what had been set forth in the report itself. If they turned to the capital expenditure account, they would find that during the half year there had been expended £83,116. The principal items were for purifying-houses, purifiers, and stoking machinery at Beckton, which amounted to £16,500. The tar and alkali works, the cyanogen works, and other chemical plant, amounted to £5000; and pipe-laying to £8200. And then came the larger figures in the capital outlay, which were about £34,900 for meters. This item included a large number of automatic meters. Then came £24,700 for stoves—which also included automatic stoves. The Kensington show-room—the Company's new premises in High Street, Kensington—had cost the Company, to fit and furnish, £2650. He looked upon this as a really substantial and profitable outlay for the Company. Ever since they had had these premises, they had been able to get their money in much better, as it was in a more easily accessible position; and they had also been able to sell a great many more stoves, because they had them arranged for lighting up on the premises, so that everybody who desired to see what a stove could do, could see it at work, order it, and have it sent home at once. The only other item was buildings and machinery, which came to £4296; these items making together £96,245. Off that, however, had to be taken: For depreciation of meters, £4775; and for stove depreciation, £8355—making together £13,130, and leaving, as he had said, a net capital outlay for the half year of £83,116. The very large amount of £60,000 for stoves and meters, the meeting would agree, was a very satisfactory feature, because it pointed to an increase in the Company's business, in regard to both lighting and heating. Now £48,000 of this amount represented the capital expended during the present year on stoves and meters; but, in addition to that, there was a sum of nearly £50,000, which had been charged to revenue. This did not properly form a capital charge; but, as it was too large an amount to take out of the revenue of one half year for an installation like that of the automatic meters, it would be carried to a suspense account, and a proportion of it would be charged for several half years till the whole was liquidated. Another very satisfactory item in the accounts was the amount of capital per ton. He was glad to say that the capital expenditure for the half year, per ton of coal carbonized, stood at £5 19s. 1d., as against £6 5s. 7d. in the corresponding period of last year. As the works and plant of the Company were now sufficient to do a great deal more business than they were doing, he thought, with the continual increase, they might look forward to this figure being likely to be still further reduced. It was not contemplated to call up any capital during the present half year. In regard to the gas-rental, the quantity of gas sold during the half year was 9841 million cubic feet, as against 9227 millions in the six months ending June, 1894. The increased quantity—614 millions—at the price charged in June, 1894, before they made their last reduction, would have yielded an additional rental of £92,379. But the 3d. reduction in price, which had taken place last year, had given the consumers an abatement of £109,553 in their gas bills; and this had converted the addition of £92,379 into a reduction of only £17,174. During the present half year, this £17,174 was all that had fallen upon the rental in consequence of the reduction—it was all that they had suffered in regard to rentals. Then the rate of increase, which was stated in the report as 6⅔ per cent., was, as the proprietors would naturally imagine, mainly the result of the severe Arctic weather which prevailed in the later months of last winter—March, February, and the end of January. But he was happy to say that, though they had, for the half year, this increase of 6⅔ per cent., due mainly to exceptional causes, the increase still continued; and for the month of July, which was just concluded, the augmentation in the sale of gas amounted to more than 4½—nearly 4¾—per cent. No doubt the attention of the proprietors had been called to the extension of the incandescent gaslight. Many people had rather condoled with him, saying that it must be a very bad thing for the Company, because the incandescent burners consumed so much less gas than the ordinary flat-flame and Argand burners. But in a district like theirs, which had been more or less laid hold of by the electric light, the substitution of incandescent burners for electric lighting, which was largely taking place, and the increase in the consumption of gas through the introduction of incandescent burners themselves, showed that the incandescent light was really a good friend of, and not an enemy to, the Company; and they hoped to see the number of incandescent burners largely increased. They trusted the County Council would make some experiments in street lighting with these burners before they committed the public to the very large expense which would be involved by the introduction of electricity instead of gas on the Embankment. This would amount to some £16,000; and the annual outlay would be about three times as much as they paid for gas. If they were to adopt incandescent lighting, he was quite certain they would have a much more brilliant light; and it would cost them no more, if not something less. Another feature of the past half year had been the abolition of meter-rents. He thought the Directors had been fully justified in that policy. It had been a further benefit to the consumers during the past year to the extent of £20,000. So that, together with the reduction in the price of gas, the consumers in the North of London were

obtaining gas at a total reduction of 3·76d. per 1000 cubic feet, compared with the June half of last year. The abolition of meter-rents, as the proprietors were aware, only affected the district outside the City, as they had no meter-rents in the City prior to their abolition elsewhere. Then with regard to the question of price, the way in which it affected the public might be shortly stated as follows: During the past twelve months, the Company had made remissions to the consumers of 3d. per 1000 cubic feet on the private lighting north of the Thames, which amounted to £210,000 per annum; they had also made a remission of meter-rental, which amounted for the year to £58,500—making a total of £268,500 per annum. The little addition to the dividend only amounted to £42,300; and the addition, after remitting to the public this £268,500, and paying the proprietors an extra ¾ per cent., would leave a small addition of £20,100 to be carried to the reserve fund. This showed that they had not been moving too fast. At the same time, he hoped the proprietors would agree with him that it was most undesirable to move too quickly in the reduction of prices. They had burned their fingers over this before. It was so much easier to knock down a penny than to put up a penny; and the policy he advocated would be to have a strong, safe fund at their backs, to provide for a reduction of profit, before they entered on any reduction in price. He did not mean to say that any further reduction was very remote. He hoped it might come; but he distinctly declined to promise any further reduction at present. They certainly would not make any reduction until they were convinced that their funds would amply suffice to bear it. With regard to coke, though the price had been somewhat low during the past three months, it was very satisfactory to find that the saving in the fuel account had yielded such an increased revenue as to be more than sufficient to meet the slight loss on the price obtained for coke. This, of course, pointed to good working in the retort-house. For this they were indebted to their Engineers, as they were for much more of their good fortune, for their assiduity and zeal. He thought this tribute was due to the Engineers; and he was quite sure the shareholders would endorse it. They were in rather an awkward position with regard to their coke, as they were not so well situated as other companies were in being able to dispose of it. The bulk of their coke was taken down the river, and had to be sold to the cement manufacturers. This placed the Company, to a certain extent, at a disadvantage; and the recent depression in the cement trade had, no doubt, contributed to keeping the price of coke low. He was happy to see, from a document recently issued by the largest cement manufacturers in their district, that there was now a considerable increase in the hopes of their trade, and at the same time they were able to secure higher and better prices. This being so, he was quite sure that the depreciation in the sale of their coke was not likely to be very long and very pronounced. Tar products had not only brought in an increased revenue, but the yield per gallon was well above the average for 1894. The exact price which had been realized per gallon of tar had been 1·95d., or as nearly as possible 2d., per gallon. This would compare favourably with the price obtained generally in the market. With regard to sulphate of ammonia, the market had been abnormally dull and lifeless. This, as the proprietors were aware, arose from the bad agricultural season of last year, and the late sowing season of this year, which put it entirely out of the power of the farmers to sell their corn, and to spend a portion of the proceeds in artificial manures. The same cause had acted very unfavourably on the traffics of the railway companies. All the feeding-stuff grown on the land, with the exception, perhaps, of barley, which was used in malting, had been consumed at home; and the same cause had affected the sulphate market. They had, of course, a considerable stock; and their policy had been not to sacrifice it by forced sales at a low price (because the pouring of a large amount on the market would tend to depress the price), but to value it in their books at a lower amount than the ruling market price, and to wait for better times. He was quite sure that, as a general commercial policy, this was the proper one to pursue under the circumstances. If they had a good harvest this year, they might look forward to a good demand for artificial manures during the coming autumn and winter. He would next turn to the expenditure side of the account, from which it would be seen that, as to coals, they had expended £82,600 more than in the half year ending June, 1894. Of this amount, £52,900 arose from the increased price the Company had had to pay—viz., about 1s. per ton. The contracts just completed would have the effect of relieving the Company of this extra charge for the current twelve months; and he sincerely hoped—and he had no doubt others engaged in the gas industry would agree with him—that they would not have in the future such serious fluctuations in the price of coal. A steady and reasonable price was far better for their requirements, and he believed far better for the coal owners and producers, than a constantly fluctuating price. He did not often prophesy, but he did two years ago, that the coal combination, from which they had long suffered a considerable rise in the price of coal, would not, in the long run, effect any good. This prophesy had been fully justified, because at the present moment the Coalowners' Combination, if it had not ceased to exist, at any rate had ceased to extend any practical influence in any part. Artificial methods of raising prices against the consumer were bound to end in failure. On the labour account, there had been a small saving, which had arisen partly from the increase in the quantity of gas made, and partly from extension of mechanical stoking appliances. He would say, in regard to the stoking, that the men throughout the Company's stations were working exceedingly well. There was no fault to be found with them, and nothing but praise to give. This was evidenced by the larger make of gas per ton of coal, which, if there had been negligence or bad work, would not have been increased. He himself believed that the men were now beginning to appreciate their position in the Company's service. This was as it ought to be; because everything that could be done for their comfort and benefit, which the Directors were entitled to do as trustees for the shareholders, and as prudent managers of a public company, was done by the Board. The men were all paid good wages, and were well cared for in every way. Their benevolent fund, to which the shareholders subscribed annually £3000 or £4000, enabled them to lie by in time of sickness or accident; and when they arrived at the age of 65, or thereabout, if they had a good record, they were allowed to retire on such a pension—which was governed, of course, by the length of their service under the Company—as enabled them to pass their old age in comfort. All these things, taken together, were better than the flatulent promises of agitators; and their workmen, with that common-sense which characterized all English workmen, had begun to see it. He thought they had, at any rate in the immediate future, little to fear from agitating raids such as had been carried on in the past. It was some little comfort to see what had taken place in the country at large lately—that those who were, from a gas point of view only, termed by him the "common enemy," had fared very badly. Their friends Mr. Rowlands and Mr. Naoroji were "out in the cold." They were very sorry for them; but they were very glad for themselves. The item of wages, as would be seen from the accounts, was now divided into two parts—showing, first, the total cost in labour for carbonization, which amounted to 3s. 1½d. per ton of coal; and, secondly, the wages paid to the watchmen, valve men, and others engaged in the Company's works. The amount of these wages had hitherto been lumped together. This was done in accordance with the requirements, or the desire, or the suggestion, of the late Mr. Parkes, who was the Official Auditor. But it was not quite clear that this division was observed generally; and, therefore, they had thought it better to show clearly what was due to carbonization itself, and what was due to miscellaneous services. It was a method that cleared the accounts—at any rate, it did not confuse them. With regard to the wear and tear in manufacture, this was less than in the corresponding half of last year. In that period, some very heavy expenses were incurred for the reconstruction of purifiers. The lateness of the winter this year had prevented their Engineers getting on as fast as possible with the ordinary repairs. Therefore, for the current half, this item might possibly be somewhat heavier. He was sure the shareholders would support the Directors in their determination not, for the sake of fractionally reducing the price of gas, or selling it at a cheaper rate, to neglect keeping the works in a proper state of efficiency out of the revenue for the year. This had been their policy; and they intended to stick to it. He only mentioned this because it was somewhat unusual that the amount should be so low at this time of the year. The expenditure on distribution during the half year showed an increase of £20,545, mainly caused by the fitting up of small dwellings with automatic meters and gas stoves and fittings. The initial outlay was too large to be charged to any one half year; and the part that belonged to revenue would be carried to a suspense account. With regard to the automatic meters, as far as they could they had followed the lead of Mr. Livesey, who made such a grand *coup* with this trade two years ago. This only applied to a part of their district, because it was only in the north and east that they did this trade; and it had been extended very rapidly indeed. The number of meters had increased during the year by 7108; and the lights, by 56,152. Up to that day, they had 13,429 automatic meters; and the trade was only begun within the last ten or twelve months. On their books, beyond what had been already fixed, they had some 6000 people waiting to be supplied. The arrangements that had been made by Mr. Foulger, their Distributing Engineer, were such that in a short time they would be able to supply all the requirements without any delay whatever. He thought they might look to the extension of the automatic meter system to broaden the basis of their operations, and to give a continuous consumption, which, though it might not be so profitable as private lighting, would tend to lighten their load factor by keeping it in operation. With regard to the extension of gas appliances for cooking, he might mention something he heard a few days previously in connection with another industry, and that was that there were great complaints from the bakers in the East-end of London, who had been in the habit of baking artizans' dinners. Now they said they did not use so much coal, because they had not so much baking to do; and they explained that the reason of this was that so many people now did their baking at home. This was not only a straw that showed which way the wind blew, but it also showed it was blowing in the right direction. The other extra cost of distribution arose from the severe frost. The additional cost to the Company on that account was something like £7000; and it represented a sensible reduction from the extra amount of gas sold in consequence of the severity of the weather. While they regretted the inconvenience caused to the consumers by the accumulations of naphthalene with which it was absolutely impossible, with their staff, to cope all at once, because they were abnormal in number, the Company's outdoor men did the very best they could. They exerted themselves to the utmost of their ability; and the consumers, even those who at first were very angry, wrote to express their satisfaction with the way in which the difficulties had been met by the Company's officers, and the courteous way in which they had relieved them from their troubles. As he had said a word in praise of the Engineers, he thought the outdoor men were equally to be praised and thanked for the way in which they had met this difficulty. The next item was that of rates. The Company were long suffering on that point. The increase amounted to nearly £8000; and it was mainly the result of the ever-increasing amount of the rate in the pound. It would be remembered that this time last year they had to complain of an addition of 2¼d. in the pound in the rates. This year they had a further addition of 4¾d. The rate last June was 5s. 10¾d. in the pound. For the last half year it was 6s. 3½d.; and, as far as could be seen, there was no sign of any abatement. On the contrary, the School Board were going to put on another penny, and the County Council another penny. There would consequently be no reduction on that head; and they would have to be prepared to face an increase. This extra penny of the School Board and of the County Council would amount to £25,000 to be contributed by the Company yearly. As he had said before—and he did not think he could repeat it too often—the public burdens imposed on the Company in the way of rates by the Local Authorities, caused the consumers to pay 2½d. per 1000 cubic feet more than they would have to pay if those burdens were not so imposed. That was to say, 2½d. paid for gas went in the shape of rates. His friend Sir Arthur Arnold, the able Chairman of the London County Council, made some very pertinent remarks the other day in his annual address to that body; and they were so important that the

meeting would forgive him if he quoted them *verbatim*. Sir Arthur said, referring to the work of the County Council:

In regard to finance, the practice of Imperial and of local government is somewhat opposed. In the former, the general rule is to allow expenditure to be controlled by revenue; in the latter, the general rule is to make income to be controlled by outlay. The Treasury often meets applications from departments of State with refusal on account of insufficient revenue; and the disappointed Minister has no appeal save in or to the Cabinet. But, speaking roundly of our system, we make a grand total of our estimated expenditure, and then proceed to levy the necessary rate. I do not propose that we should abandon that system; but I am sure the Council will gladly learn that our Finance Committee are considering proposals for more careful observation, and for closer control of our expenditure. We vote our annual estimates *en bloc*. It may be better that we should take those of each Committee separately. In principle, the control of our Finance Committee resembles that of the Treasury; in practice, the Council vote considerable sums for estimates before the figures have been considered by the Finance Committee, and subject to the formality of an estimate being presented by the Committee in accordance with law.

He was very glad to hear Sir Arthur Arnold say that they were going to reconsider this system, for a more rotten, a more hopeless, he might almost say a more wicked system of finance, more tending to extravagance and leakage, could not possibly be devised. It was very small wonder that the rates were increasing, if this was the system on which the public money was dealt with by the municipal authorities. If it were to be adopted in their Company, the dividend would soon decrease, if not disappear. During the year, there had been a very satisfactory reduction in the cost of parliamentary charges. There had been no oppositions to make, nor any Bills to promote; so that this item was very much smaller. The result of all this was that the net revenue for the half year came to £361,516. Of this, £1546 was added to the undivided profit from 1894, which was £255,254. This made together £256,800, which, with the amount of the reserve fund—£127,344—came to £384,144. The reserve fund, as he said at the commencement of his speech, was a guarantee against any fluctuation in the dividend, and a guarantee for the maintenance of it at its present rate, and also a fund which, as it grew, would enable them further to reduce the price of gas. The question of the photometric standards had been dealt with in the report; and he did not know that he need add anything to what was stated there, except an assurance that the Board would watch very carefully any legislation which might be the outcome of that report, which mainly dealt with the substitution of the pentane burner for the ordinary candle in testing gas. This was a very important matter. But it was not everything; and when that step was taken, it would only be the first one towards placing the testing of the Company's gas on a basis which would be alike fair to the consumer and to the Company. He did not wish them to be unduly elated. No doubt, as he said a year ago, they had turned the corner; and he hoped they would keep on the right side of it. The Company's operations were satisfactory in every particular. They would look in due course to a further reduction in the price of gas; and, in the meantime, they would endeavour to conserve their interests in the same way as they had hitherto done. He hoped the report which had been presented this half year, and the very satisfactory price at which the Company's stock stood in the market, would cause the shareholders to think that the Directors' endeavours in the past half year had not been in vain.

The Deputy-Governor (Mr. H. C. Ward) seconded the motion.

Dr. Wild wished to congratulate the Board upon the splendid report they had presented. The Governor had mentioned, in his remarks, that the County Council had been appealed to to test the incandescent gas-light on the Embankment. His experience was that they had difficulties with bodies of that character; for some years ago he attempted to induce the Kensington Vestry to test their gas on the best possible principles, but his motion was rejected. With reference to the question of lighting the Embankment, unless the Board bestirred themselves actively, they would find the same result. The electrical influence was very powerful. It was well known that the great weakness of the incandescent light was the fragile nature of the mantles; and if they had such a light on the Embankment, no doubt the heavy waggons passing along, creating very perceptible vibration, might often be sufficient to fracture them. He would therefore suggest to the Company that they should take the matter in hand, and see whether they could not reduce the vibration to a minimum. There was one other question he should like to ask, and that was whether the Engineers had made any experiments with fine platinum gauze for the incandescent lights. This gauze would not be very expensive, if it were made very fine; and it would be very enduring. If they demonstrated that there could be produced a mantle that was indestructible, the incandescent light would take enormous hold.

Mr. Frazer said he had followed with much interest the incandescent light at Brighton, where they had an embankment on rather a large scale. The Brighton and Hove Gas Company had asked permission to put up some incandescent lights. A certain number had been erected; and the success was as near perfect as could be. He was applied to by the Hove Commissioners, who talked of extending the electric light; but he told them not to do anything of the kind until they had seen the result of the experiments of the Gas Company. The outcome had been that the whole of the remainder of the lighting was to be on the incandescent system, which he thought put the electric light in the shade. Decidedly the reports brought home by the sailing vessels and fishermen were that these lights were easily to be distinguished, and gave a better effect than the electric light which was alongside them. He agreed with the Governor that the incandescent light was one of their best friends; and it would check the enemy—the electric light—to a very considerable extent.

The Governor, in reply, said he quite agreed with Dr. Wild that the experiment he referred to ought to be tried; and he understood that it would be tried, and probably by the London County Council. The Company had already shown what could be done with gas; but he thought if they took up the question of burners they would be travelling out of their sphere. There were so many competing burners that they sedulously avoided favouring any particular form, or any special kind of light. With reference to what had been said about vibration being a great drawback, he understood that there had been invented a spring which held the mantle (which was now a very much tougher article than it used to be) in suspension in such a way that vibration did not injure it. He had no doubt the lights which Mr. Frazer referred to, at Hove, were held by a spring.

Mr. Frazer said he believed they were.

The Governor then put the motion, and it was carried unanimously.

The resolution approving of the dividend was next put, and was also unanimously passed.

A cordial vote of thanks to the Governor for presiding closed the proceedings.

SOUTH METROPOLITAN GAS COMPANY.

The Directors' Half-Yearly Report.

The following is the report of the Directors of the above Company for the half year ending June 30 last, which, with the accounts for that period (to be given next week), will be presented at the general meeting of the Company on the 14th inst.:—

In accordance with their policy to reduce the price of gas whenever they can safely do so, the Directors have the pleasure to announce that from the Midsummer quarter it has been reduced 1d., to 2s. 3d. per 1000 cubic feet. This reduction will benefit the consumers to the extent of £29,000 a year.

They regret, however, to state that the present very low prices of coke and ammonia (the latter never having been so low) will in the ensuing half year cause a considerable reduction of revenue. The price of coal has fallen to the figure of 1893; but this saving will meet only a portion of the loss on coke and ammonia.

The favourable state of the accounts for the half year is due mainly to a very exceptional increase, at the rate of 13 per cent., in the consumption of gas over the corresponding period, or about three times the average increase, in consequence of the prolonged and severe frost in January and February. On the other hand, the exceptional expenses occasioned by the frost amount to upwards of £7000.

The number of consumers continues to increase. The "penny-in-the-slot" or automatic meters fully maintain their popularity—6817 having been fixed in the half year; bringing up the total number in use on the 30th of June to 32,333.

The Directors propose to continue the policy, repeatedly approved by the proprietors, of building up the reserve and insurance funds, which were almost entirely absorbed by the losses sustained in the years 1889 to 1892. In reference to the insurance fund, the Official Auditor required its restoration as soon as possible. The profit is sufficient to pay, and the Directors recommend the payment of, the usual nominal dividend of 13 per cent., to be apportioned in accordance with the Scheme of Amalgamation, except £500 due to the "A" stock to be added to the reserve fund, together with the odd ½ per cent. of dividend to which the shareholders are entitled under the sliding-scale. This will increase the reserve fund by £5896 14s. 3d., to £73,611 14s. 4d.; the insurance fund by £5396 14s. 3d., to £42,184 2s. 8d.; and the undivided balance by £6187 3s. 10d., to £34,473 18s. 5d.

The Committee of the House of Commons having refused to sanction the conversion of the Company's stock from a nominal 10 per cent. into double the amount of 5 per cent. stock, the Board thereupon withdrew the Bill. In these circumstances, the Directors desire the opinion of the proprietors as to the expediency of re-introducing the Bill next session.

The Directors have again to express their satisfaction with the good and loyal spirit that animates their officers and workmen.

BRENTFORD GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Charing Cross Hotel—Mr. Howard C. Ward in the chair.

The Secretary (Mr. W. Croxford) read the notice convening the meeting; and the Directors' report and accounts, of which an epitome was published last week, were taken as read.

The Chairman said the report and accounts which the Directors had to produce that day were such as the shareholders ought to be very satisfied with; and for this reason especially: Comparing the past half year with the corresponding period of 1894, when the price of gas was 4d. per 1000 cubic feet dearer, the Directors were enabled, notwithstanding this reduction (which amounted for the half year to the sum of £8000), to increase the dividend by ½ per cent., and to commence the formation of a reserve fund, which he believed would be of great service to the Company. In addition to this, they would carry forward a sum of £37,273, as against £29,367. The dividends recommended were at the rate of 5 per cent. per annum on the 5 per cent. preference shares, of 12 per cent. on the consolidated stock, and of 9 per cent. on the new 1881 stock. With reference to the proposed reserve fund, the Company had never had such a fund. He had been a Director of the Company 44 years; so that he knew something about this matter. Their capital, as compared with the business done, was very large in the old days; but it had been going down from time to time. The Directors had thought it very good policy to hold as large a sum as they could in undivided profits, in order that they might not unduly increase the capital per ton of coal carbonized. The capital per ton had been going down to a considerable extent. It now amounted to £6 13s. 4d.; while ten years ago, it was £8 1s. 6d. Such a heavy load factor as £8 1s. 6d. per ton, made a great deal of difference to the way they were able to conduct the business, and the price they charged the consumers. The Directors' report referred to the progress of the inclined retort system at the Southall and Brentford works. The Company were the pioneers of inclined retorts in England. A great controversy had been going on as to who first introduced them; they had been so successful that people in all directions wanted to claim the credit of having introduced them. He would tell the shareholders a simple, unvarnished tale respecting this matter. Their Engineer (Mr. Frank Morris) said to him and the other Directors one day in 1890: "I have heard that in one town in

France—a town of great historic interest, but not a large town—they have a system of carbonizing by inclined retorts." Now this happened at the time when they were much worried with labour; and, of course, they were casting about to see how the labour trouble was to be met. He (the Chairman) always said the mechanical engineer would be too great for the labour agitator. With the consent of his colleagues, he told Mr. Morris to start at once for Rheims. He went, and came back with the drawings showing the operation of these retorts. They then put some up at Southall; and these were the first inclined retorts that were erected anywhere in England. They had been improved from time to time, until they had been brought (mainly by Mr. Morris and his assistants) to what he might say was almost absolute perfection. The Directors had lately had the pleasure of seeing these retorts at work. He (the Chairman) was an old gas hand; and he had never witnessed anything working more beautifully than the way these retorts were charged and discharged. They were now completing a new house on this system at Southall; and one of the other houses at Brentford was being converted from horizontal to inclined retorts. He mentioned these things because people had almost tried to take away from their Engineer and officials the credit of the introduction of this system. It belonged to them, and to them alone. Their half-year's business had been very good indeed. The sale of gas had increased by 11½ per cent. This was mainly due to the severe weather at the beginning of the year; but although there was this great increase in consumption by reason of the cold, it must be remembered that it was not all gold that glittered, and that the increase was not earned for nothing. The Company had considerable coal storage at Brentford and Southall; but with the quantity of coal they were consuming week after week, it was necessary that it should be added to almost, he might say, daily. But during the frost, the river was stopped for five weeks; and the canal at Southall for about six weeks. They could get into the Southall works by railway, because they had a siding in connection with the Great Western Railway; but for the Brentford works, they were obliged to cart a large quantity of coal from the Kew Bridge Station. This had caused an increase of 3d. or 4d. per ton in the cost of the coal used in the half year. Adding this to the additional price they had had to pay under their contract, made the cost of the coal 13s. 4d. as against 11s. 11d. per ton in the corresponding period of 1894. Besides this, they had suffered considerably from breakages of mains and services through the frost. Looking at the revenue account, it would be seen that the repair, maintenance, and renewal of mains and service-pipes had increased by nearly 50 per cent.—from £2310 to £3447. There was another feature in the accounts to which allusion had been made by the JOURNAL OF GAS LIGHTING, and that was the great advance in the rental of meters and stoves, which meant a large augmentation of business. In the June half of last year, the rental for meters and stoves amounted to £4100; while it was now £4908. A large portion of this was due to the meters and stoves they had fixed on the prepayment system. The number of ordinary meters fixed on June 30, 1894, was 16,567; and on June 30 last, 16,770—the year's increase being 203. This was about the normal rate. The automatic meters fixed on Dec. 31, 1894, numbered 2837; on June 30 last, 3887, or 1050 more. The increase of ordinary stoves was 508; but the stoves used with the automatic meters, which numbered 855 a year ago, had gone up to 2742. The result of the whole business of the half year was this—that they made the dividend, and carried over the sum of £37,273. They had had however, one or two things to regret. One was the illness—he hoped only the temporary illness—of their colleague, Mr. J. Orwell Phillips, who, he was pleased to say, was now a little better. They had also lost their valued and respected friend, Sir Hugh E. Adair, who was a man of very great practical experience, and had had an extensive parliamentary experience. He had now arrived at the age of 78 or 79 years; and he thought the time had come when he ought to retire. Regarding the vacancy on the Board, the Directors had considered (without any special desire being expressed on the part of Sir Hugh) that it would be to the advantage of the Company—he being a large shareholder—for Mr. R. S. Adair to be placed in his father's position. The Chairman then moved the adoption of the Directors' reports and accounts.

Sir R. H. WYATT seconded the motion.

The CHAIRMAN, in replying to questions, said they charged depreciation upon gas-stoves very liberally every half year. [The ENGINEER: 15 per cent.] The badness of trade, coke and ammoniacal liquor being cheap, and, worse than all, the local authorities threatening the Company with higher rating on the quinquennial assessments, prevented the Company reducing the price of gas so frequently as they would do otherwise.

The motion was unanimously carried.

Resolutions were then passed, declaring the dividends recommended, and placing to the reserve fund account £1475, being a sum equal to ½ per cent. per annum in respect of dividends on the consolidated and new stocks for the half year ending June 30.

A vote of thanks to the Chairman and Directors and the officers terminated the meeting.

INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Wednesday, at the Offices, Palmer Street, Westminster—Major-General BERESFORD in the chair.

The SECRETARY (Mr. L. de Fonblanque) read the notice calling the meeting; and the Directors' report and the statement of accounts, which were summarized last week, were then submitted.

The CHAIRMAN said the report and accounts told their own story; and he did not think there was any necessity for him to take up time by explaining what, he hoped, all the shareholders understood. A business the turnover of which increased fifteen-fold in two years was not one that they came across every day. That this rate of progression would be maintained, could scarcely be expected; but they could confidently anticipate that next year's business would be as much in advance of this year's as this year's business was of last year's. The trade they were doing this summer all pointed that way; and the Company were now opening up in street lighting a field which practically they had not touched hitherto. When they considered the conditions of lighting in this country, the enormous consumption of gas, and the large number of the class of the population who were in a position, and would have the inclination, to improve their lighting system, the possibilities of the trade the Company could do were almost boundless. There was absolutely no exaggeration in saying that, as yet, they had not touched the outside fringe of the business lying before them. It rested pretty much with themselves as to whether they were to make this business one of the largest, soundest, and most flourishing corporations in the kingdom. To do this, however, they must pull together amicably. It was a matter of congratulation to all, he thought, that recent internal litigation had been put a stop to. Good sometimes came out of evil; and, in this case, the formation of the English Incandescent Gas Share Company was, he considered, an advantage, and gave strength and stability to the concern. No less than 97 per cent. of the old shares had been exchanged; but the Directors hoped that all the shareholders would have applied to have their shares exchanged for those in the new Company. It was somewhat astonishing that any of the shareholders should refrain from doing what was so manifestly to their advantage. The new Company had every prospect of obtaining a Stock Exchange quotation; so that the new shares would be readily marketable, whereas the small number of shares in the old Company would be practically unsaleable. He hoped even now that a large number of those who had stood aloof would come in. The shareholders were doubtless aware that litigation was pending with respect to certain other incandescent gas-light burners which had been brought out, and which the Directors considered constituted infringements of the Company's patents. They had every confidence that these lawsuits would be brought to a satisfactory termination; and they hoped the shareholders would not allow themselves to be alarmed when they heard of such litigation. It was the penalty of success; and it was not surprising that such an unprecedented success as this business had been should tempt others to follow in their footsteps. Putting aside, however, the whole question of patents, what the Directors wished the shareholders to understand was that, the business being on such a sound basis, the manufacture had, by close attention to detail, been brought so near perfection that even when the time came when the patents lapsed (and this was a long way off), they would still be in a far better position than any new Company or firm. It was really only those who had full experience of this industry who could appreciate the many difficulties which occurred in the manufacture. The difficulties arose at every point; and it was only a long experience, and the education which was only to be gained in having followed the evolution of incandescent gas lighting from its embryo state, that could successfully meet and overcome such difficulties. The very failures they had had in the past had been their most valuable lessons. It was their principle to give the public the best they could supply; and as long as they did this, they would maintain their position. The Company would have no difficulty whatever in selling a burner at less than half the price they now charged if they were content to supply mantles and burners of inferior quality. But such a policy would be, in the long run, ruinous. As shown in the balance-sheet, there was a total profit of more than £90,000 for the past year. This, after payment of the commission due to the Manager and Chemist, was reduced to about £70,000, the whole of which could have been applied to the payment of dividend. The Directors, however, did not think it would be wise to divide the whole of it; and they recommended the writing off of the £4330 of preliminary expenses incurred in establishing agencies, and the carrying forward of £14,455 to next year's accounts. In this sum was included the reserve for paying off the debentures; 25 per cent. having been put aside every year. After referring to the increased responsibilities and duties of the Board, and the nomination of Mr. F. Williams and Colonel E. P. Pigott as Directors (the former of whom was one of the original Directors, and the latter one of the Directors of the Irish Company), the Chairman moved the adoption of the report and accounts.

Major C. JONES seconded the motion, which was carried.

It was then agreed that £51,883 should be applied for the purpose of dividend, free of income-tax, as follows: £5 on each preference share, and 2s. 6d. on each ordinary share.

Resolutions were also passed confirming the appointment of Mr. Julius Moeller as a Director; re-electing Major-General Beresford; and electing Mr. Williams and Colonel Pigott members of the Board. The Auditors were also re-appointed.

English Incandescent Gas Share Company, Limited.

The Statutory General Meeting of this Company was held on the same day. Major-General BERESFORD presided. His speech at the meeting of the parent Company covered to a large extent his remarks at this one. He said that the bulk of the shares of the Incandescent Gas-Light Company had been exchanged for shares in this Company; but all shareholders who had exchanged had ceased to be members of the old Company. Of course, had all the shareholders in the old Company availed themselves of the opportunity of exchanging their shares, that Company would have died a natural death; and the new Company would have been its legal successors. As it was, they were actually the possessors of 97 per cent., or thereabouts, of the earnings and assets. Next year the shareholders of the new Company would participate in the amount of the commission now paid to the Manager (Mr. Julius Moeller); it having been assigned by him to them. The tremendous increase in the business of the Company was being steadily continued; and the sales since March 31 were more than double [The Secretary: Very nearly treble] what they were for the corresponding period of last year. As an example of the wonderful development of this business, it was sufficient to point to the fact that in one summer month they had done as much trade as they did in the whole year ended March, 1893; and the average sales during this summer were about double the winter sales for the year ended March, 1894. He also referred to the considerable additions which the old Company had had to make to their buildings through the development of the business.

A number of questions were asked by Colonel Mundy and others as to financial matters and the relations of the old Company and the new. The Chairman subsequently said it was a curious fact that the bulk of the shareholders in the old Company who had not come into the new were ordinary shareholders, who only obtained 2s. 6d. a share and one-tenth of the profits. The preference shareholders had nearly all come in. There were 105 preference shares and 2287 ordinary shares still standing out, held by 13 preference and 45 ordinary shareholders. There were no resolutions before the meeting; and a vote of thanks to the Chairman and Directors concluded the proceedings.

PROVINCIAL GAS AND WATER COMPANIES.

We commence to-day our usual half-yearly record of the results of the working of Provincial Gas and Water Companies whose reports and accounts are received.

Gas Companies.

The Calverley and Horsforth Gas Company's accounts show that the receipts of the past half year totalled to £4351, of which £3416 was for gas, £899 for residual products, and £35 for sundries. The expenses amounted to £3079; leaving a balance of £1272 to carry to profit and loss account. During the six months, 2662 tons of coal were used. An additional sum of £500 has been borrowed, making the total amount received in shares and loans £37,500.

The Cambridge Gas Company have had a singularly prosperous half year. This prosperity, the Chairman (Mr. Dennis Adams) stated at the recent meeting, had been produced mainly by the long and severe frost of last winter, which caused a great consumption of gas, and necessarily raised the demand for coke, which also brought in a large amount. This great difference enabled the Directors to put by for the reserve fund above £1000; while twelve months ago they had to take out of reserve £2000. Dividends of 10 and 7 per cent. were declared.

The Directors of the Dorchester Gas Company will report, at the meeting of the Company next Tuesday, an increase in the consumption of gas to the extent of 1,179,800 cubic feet in the six months ending June 30; the greater part being due to the severe weather experienced in the early part of this period. The total revenue was £3229; the expenditure, £2199—leaving a profit of £1030. The amount available for division is £1132, out of which the Directors recommend the payment of dividends at the rates of 10 and 6 per cent. per annum (the former free of, and the latter less, income-tax); and the carrying of £20 to the credit of the reserve fund.

The Marlow Gaslight Company, at their annual meeting on the 22nd ult., declared a dividend of 6 per cent. The shareholders afterwards held an extraordinary general meeting to consider a proposal to reconstruct the Company. The Directors had decided that it would be advisable for the Company to undertake the management of the works, instead of leasing them; and they recommended that fresh capital should be raised to carry out necessary improvements and alterations. Reports were read from authorities on Company Law, and on the management of gas-works; and resolutions were eventually passed appointing Liquidators. The new Company will be formed forthwith, under the same Board of Directors.

The York United Gaslight Company show a balance on the past half-year's revenue account amounting to £7516. Of this sum, £338 has been paid for interest upon money borrowed on mortgage; leaving £7177 available for the half-year's dividend, amounting to £7000. The Directors recommend that the usual rate of dividend be declared of 5s. per share. They regard the financial result of the half-year's working as satisfactory, and especially so when it is remembered that the period named has had to carry the recent reduction of 2d. per 1000 cubic feet in the price of gas, bringing the minimum charge to 1s. 10d. The Directors have recently concluded their principal coal contract for next year's supply at a reduction upon the prices paid under the contracts now running. Their anticipation of better trade to improve the value of the residual products has not yet been realized. Tar, one of the most sensitive products to the fluctuations of trade, has barely altered in price; while the value of sulphate of ammonia has been exceptionally low during the whole of the six months. The consumption of gas has been well maintained; the return for the half year showing an increase of 4 per cent. over the corresponding period of 1894. The report announces the death of the Vice-Chairman (Mr. Wilberforce), and the election to the vacancy of Mr. L. Foster.

Water Companies.

At the meeting of the Pontypridd Water Company last Tuesday, references were made to the difficulties encountered during the past half year owing to the very severe frost, followed immediately by a most exceptional drought, which largely affected the revenue account, and seriously taxed the resources of the Company. At the present time, however, all the reservoirs are overflowing. Allegations having been made by the local Council that the leakages are not followed up with sufficient rigour, it was mentioned that bye-laws of a more stringent character had nearly twelve months ago been formulated by the Directors, with the view of more effectually dealing with offenders wasting water; but owing, it is believed, to the opposition of the local Councils, these bye-laws have not been returned from the Local Government Board.

The rent-roll of the South Hants Water Company has increased during the past half year by £406; and 59 additional houses have been supplied with water. The profit and loss account shows an available balance of £2215, which, but for the unusual frost of last winter, would have been considerably increased. The Directors propose a dividend of [illegible] and 3½ per cent. on the ordinary and new shares respectively. For the better supply of the Company's extended district, a new reservoir has been completed at Timsbury, and one is in course of construction at Bitterne. At the forthcoming meeting, the proprietors will be asked to authorize the raising of additional capital to the extent of £20,000.

The revenue account balance-sheet of the York Water-Works Company shows on the credit side, including £1964 brought forward from the previous half year, a total sum of £11,864. Deducting from this the payments shown on the debit side, there is a balance of £7292. The severe frost of last winter has heavily increased the expenditure on repairs of mains and works; but although the citizens of York unavoidably suffered some inconveniences through the frost, they happily escaped the more serious misfortunes experienced in many other places. The item of rates and taxes has largely increased; the extra amount debited for the half year being £228. The Directors report that in the last session of the late Parliament the Company's Bill received the Royal Assent. After protracted negotiations with the Corporation, the Bill became an unopposed measure. The Company have now secured powers (*inter alia*) to raise share and loan capital to the extent of £75,000, to create a contingent fund of £10,000, to utilize the land recently acquired, and an extension of their limits of supply. They have also accepted a limitation of back dividends to a period of six years. The interest on the new capital is restricted to 3½ per cent.; but the auction clauses were dispensed with, so that the Directors will be enabled, as occasion arises, to issue the new share capital to the existing shareholders. At the meeting last Thursday, a dividend was declared of 5s. per share on the preference shares, of 10s. on the ordinary shares, and of 7s. on the new shares.

ELECTRIC LIGHTING NOTES.

The Special Lighting Committee of the Liverpool City Council discussed, and put into final form, at their meeting yesterday week, a report upon the negotiations which have resulted in the purchase by the Corporation of the undertaking of the Liverpool Electric Supply Company for a sum of about £400,000. As soon as it is printed, the report is to be circulated for the information of the Council and the ratepayers.

In the Queen's Bench Division of the High Court of Justice, on Monday last week, a special case was before Baron Pollock and Mr. Justice Wright, which raised the short point as to whether a contract for the lighting of the streets of Prescot by electricity was void or not (as construed by the light of the 174th section of the Public Health Act, sub-section 2) by reason of its not containing a pecuniary penalty in respect of the non-performance of any of its conditions. The plaintiffs were the British Insulated Wire Company, Limited; and the defendants, the Prescot District Council. The contract was made in November, 1892; and it was provided that the Company should efficiently light the streets within the district of the Local Board by means of electricity for a period of five years from Jan. 1, 1893. The lamps were to be stationed in the streets as approved by the Board, and were to be laid down and kept in repair at the expense of the Company. One half of the incandescent lamps were to be lit during the hours of darkness all the year round; the other half, to be lit from dusk to midnight from Aug. 25 to May 25 in each year. The arc lamps were to be lit from dusk to midnight; no notice being taken by the Company of moonlight or other causes which would tend to enable them to depart from a fixed course of electric lighting. The Board were to pay £350 a year, payable quarterly, in consideration of such lighting; and the Company were to indemnify them in respect of all actions in regard to the works and the light. The present suit was brought to recover £278, which included three quarterly payments of £87 respectively; and the balance was made up of three sums for extra lamps. The contract was duly executed; and the seal of the Board affixed. These facts were agreed; and the only point between the parties was whether the absence of a penalty clause in the contract vitiated the contract. Counsel for plaintiffs (Mr. Arkle) submitted that the clause in the Act regarding this was merely directory, and did not vitiate the contract. The point, he said, had never been decided before, though it had been raised twice. Without calling on Mr. Danckwerts to reply for the defendants, Baron Pollock said he did not see how the Legislature intended that the question of penalty should be treated as a merely voluntary matter. Sub-section 2 was not merely directory, as it specified that a penalty should be stated in the case of the contract not being performed. Mr. Justice Wright concurred; and judgment was entered for the defendants, with costs.

Last Wednesday's proceedings at the St. Pancras Vestry were exceptionally interesting; the major portion of the sitting being devoted to an animated discussion on a joint recommendation of the Electricity and Highways Committees that the Vestry refuse sanction to the application of the London Hydraulic Power Company to lay pipes to certain premises in the parish for the purpose of working lifts therein. The reason for this proposed action, as set forth in the *agenda*, was that "the Company must be regarded as competitors with the Vestry, inasmuch as the Electricity Department are prepared to supply the necessary power for the purpose required." Not content, therefore, with meeting a legitimate demand for electric lighting, the Committees sought to prevent the employment of a rival motive power to a use for which it is admittedly pre-eminently suited, in order to compel tenants to become customers of the Vestry, or go without the accommodation needed. Naturally the proposal called forth emphatic expressions of dissent; and the sequel affords food for much reflection. Mr. Purchese, the Chairman of the Highways Committee, admitted that seven members were in favour of the recommendation and six against it; that the lifts were already in course of construction; and that the Hydraulic Power Company had agreed not to supply their power for electric lighting purposes. A deputation, consisting of Mr. Saunders, the tenant who had raised the question, Mr. Galloway (representing the landlords of the property), and other ratepayers, were then called in and interrogated. Mr. Saunders said he believed that only hydraulic power was sufficiently strong to lower 25 cwt. safely and efficiently; while he questioned the reliability of electricity—the current, to his personal knowledge, having often failed altogether. On behalf of the landlords, Mr. Galloway said the two motive powers need not come into conflict, for the Vestry could limit the hydraulic system to lift purposes only. The deputation having retired, Mr. Wetenhall moved, as an amendment, that the application be granted, on the condition that the Company do not supply their power for the production of electric current. Mr. Hodgson

seconded the amendment; saying the Vestry might as well prohibit the sale of wood in the parish because fires could be lighted by electricity. Mr. Doll maintained that, if electricity as a motive power was efficient and cheap, there would be no opposition; but it seemed to him that the only advantage in electric lifts was that they used electrical power. How such an unfair and ridiculous proposition came to be put upon the *agenda*, he failed to understand. Here the closure was ineffectually moved; and the debate was continued by Mr. Macgregor, who asked how it was that the City of London Electric Lighting Company used hydraulic lifts, and the General Post Office also, whose Chief Engineer and Electrician was Mr. Preece himself, to whom the Vestry had paid large sums for advice. Mr. Markham objected to the permission being granted, on account of the damage to the roads; and Mr. Barnes agreed with him. At this point the closure was again moved, and lost. Mr. Menzies then defended the Electricity Committee, who had, he thought, acted wisely in bringing the recommendation before the open Vestry, who would be wholly responsible for whatever course was decided upon. Mr. Sweet, the Chairman of the Electricity Committee, said as a principle Free Trade was all right; but it would not apply in particular instances. The recommendation before the Vestry had been framed in the interests of the ratepayers. The current could be supplied at a rate that worked out at ¼d. per ton raised; and it was most economical. Besides, in their own pamphlets, the Hydraulic Power Company stated that "special terms can be given for electric lighting;" and if the Vestry agreed to let them lay the particular hydraulic main in question, the result would eventually be a house-to-house supply of power, to be transformed into electrical energy on the premises. There were a number of electric lifts working satisfactorily in London; and current at 3d. per unit was cheaper than steam. Why, he asked, should not the interests of the parishioners be served, rather than those of a Company? The closure was then carried; and 31 members voted for the amendment, and 27 against it. But as the former number did not constitute a proper majority of those present, a division was claimed. This resulted in a tie—32 to 32. Amidst a scene of great excitement, the Chairman of the Vestry (Mr. J. W. Thornley, J.P.) gave his casting vote against the amendment, which was therefore lost. The original motion was then carried by 34 to 25. A division was demanded, and the motion was carried by 34 votes to 30. If, therefore, any ratepayer of this enlightened parish desires to erect a lift, he must either use the electric current, or provide his own steam-engine.

The Gas and Electricity Committee of the Bradford Corporation have appointed Mr. A. H. Gibbings to succeed Mr. S. W. Baynes as their Electrical Engineer—the last-named gentleman having resigned, in order to take up a similar position under the St. Pancras Vestry.

The Finance Committee of the London County Council have agreed to lend the Electricity Department of the St. Pancras Vestry £56,100 at 2⅞ per cent.

At the meeting of the London County Council last Tuesday, it was resolved that, subject to the Council hereafter giving their written consent, under seal, to the borrowing, and subject to all necessary consents and evidence being furnished to the satisfaction of the Solicitor, the application of the Vestry of Islington for a loan of £51,000 towards defraying the cost of an electric light installation in that parish, be granted, on condition that the loan be taken up at once—interest being charged thereon at the rate of £2 17s. 6d. per cent. per annum—and be repayable in 42 years on the annuity system.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Scarcity of Water at the East-End—The Proposed New Sources of Supply for London.

At the Meeting of the London County Council last Tuesday, the portion of the report of the Water Committee containing the recommendation that the Engineer be empowered to expend further money in investigating fresh sources of supply (see *ante*, p. 248) came up for consideration. It gave rise to several questions addressed to Mr. Idris, the Chairman of the Committee, with regard to the position of the water supply in East London.

Mr. M'Kinnon Wood directed attention to a statement issued by the Secretary of the East London Water Company (*ante*, p. 194), practically throwing on the Council the blame of the lack of sufficient supply.

Mr. Idris replied that his attention had been called to the matter; and, in order to give the full facts of the case, he had obtained two reports—one from the Parliamentary Agent of the Council (Mr. H. L. Cripps) and the other from the Engineer (Mr. A. R. Binnie, M.Inst.C.E.). He would read extracts from the former; and the Clerk would read the latter *in extenso*.

In his report, the Parliamentary Agent stated that the suggestion that the Council's opposition in Parliament to the East London Water Company's Bill of 1893 had any relevance to the Company's insufficient supply, was absurd. That Bill sought power for the Company to create a large amount of additional capital in debenture stock, and to impose most onerous and arbitrary conditions on the consumers of water with respect to their service-pipes, cisterns, and fittings. There was no opposition on the part of the Council to the Company making additional works. He personally offered to the Company, under instructions from, and on behalf of, the Council, that their Bill should be allowed to pass unopposed if they would withdraw the clause imposing arbitrary restrictions on the consumers, and limit the amount of capital to what would be necessary for the next two years, which would have carried them well over the time during which the Council would have to consider what steps they would take after the issue of the report of the Royal Commission. This offer, which he personally, on more than one occasion, urged on the Company's Solicitor that they ought to accept, was declined.

The Clerk (Mr. H. De la Hooke) then read the Engineer's report, as follows: "I have been endeavouring to discover, if possible, the cause of the shortness of water in the East-end; and I think that I have detected the cause. I have had tables prepared, founded on the Official Water Examiner's reports, showing the total quantities supplied by the East London Company during the years 1892, 1893, 1894, and the first five months of 1895. During 1892, the average daily supply was at the rate of 43,500,000 gallons; varying from about 41,000,000 gallons in November to 46,500,000 gallons in January. In 1893, the average supply was at the rate of 41,900,000 gallons; varying from 37,500,000 gallons in October to 51,600,000 gallons in January. In 1894, the daily average was 41,400,000 gallons; varying from 37,600,000 gallons in October, when there was shortness of supply, up to (say) 44,000,000 gallons in January. During the first five months of 1895, I find that the average supply has been at the rate of over 53,000,000 gallons a day, varying from 45,000,000 gallons a day in January up to 59,000,000 gallons a day in February. Since then they had drawn during March, 54,400,000 gallons; April, 55,300,000 gallons; and May, 51,162,000 gallons. From this we see that the month of January in the years 1892, 1893, and 1894 was the month during which the heaviest demands were made on the Company. During January, 1895, 45,000,000 gallons were consumed—a not unprecedented amount during that month; but during the months of February, March, April, and May, the quantities supplied to the district have exceeded any previous record. From our inspection of this increase, my belief is that what the Company are now suffering from is not an insufficiency of supply, but that their pipes became so shattered during the frost of February last as to become so leaky that the water is wasted, and does not reach the consumers. The tables show that in no month during the years 1892, 1893, 1894, or 1895 have the Company ever availed themselves to the full extent of their power to draw the water which they have boasted before the Royal Commission, either from the Thames or wells in the Lea Valley. On a previous occasion, I drew attention to the fact that during last year the New River and East London Companies abstracted from the River Lea about 52,750,000 gallons a day. During the present year, the draft from that river by these two Companies has been as follows: January, 59,800,000 gallons; February, 71,900,000 gallons; March, 67,200,000 gallons; April, 69,200,000 gallons; May, 61,000,000 gallons. This is decidedly antagonistic to the reports of both the Royal Commissions—of the Duke of Richmond in 1869, and of Lord Balfour of Burleigh in 1893. As I have pointed out, a large increase of water, amounting to 28 per cent. of that in 1894, or 26 per cent. in excess of the supply during the remarkably dry year of 1893, can only be accounted for by some sudden alteration in the rate of the consumption in the district supplied, or by an enormous amount of leakage."

Mr. Idris replied to further questions, and said he was prepared to have the two reports printed and copies sent to the Company and the members of the Council.

The Council authorized the expenditure of £2500 between the present time and March next, for making further surveys and obtaining the necessary information with regard to a supplementary source of water supply for London, with the following rider, moved by the Earl of Onslow: "It being understood that, in authorizing the expenditure, the Council in no way pledges itself to proceed further in the matter, or further to consider the whole subject."

The Committee presented a report, which was considered as a matter of urgency, to the effect that, having regard to the numerous complaints of defective water supply, especially with respect to the East London Company's area, and the necessity which might arise for dealing with the matter during the recess, they recommended—"That any action which it may be necessary to take in consequence of the present condition of the water supply be referred to the Water Committee and the Public Control Committee, sitting jointly, with power to act during the recess, notwithstanding any resolution of the Council."

Mr. Beachcroft could not see what powers the Committee proposed to exercise. Under the Act of 1852, the Council had no power to take any action in view of the defective supply of water. The course to be adopted was for any twenty aggrieved householders to petition the Local Government Board, who would forthwith have to inquire into the matter.

The recommendation was adopted, with the addition of the words "with regard to meetings during the recess."

After transacting other business, the Council rose for the recess.

A City Electrical Laboratory.—The Commission of Sewers are now in possession of a well-equipped laboratory situated in Basinghall Street, for carrying out the provisions of the Electric Lighting Acts, the rules and requirements of the Board of Trade in regard to meter testing, and the supervision of lines and mains vested in the local authority. Meter testing will be the principal work of the laboratory; and for this purpose complete arrangements have been made.

Sales of Shares.—A number of £10 shares in the *Uxbridge and Hillingdon Gas Company*, carrying a maximum dividend of 7 per cent., have been sold at £14 15s. each; and £10 (10 per cent.) original shares, at £21 2s. 6d.——At Durham, yesterday week, 24 "A" shares in the *Hartlepool Gas and Water Company* were disposed of at prices ranging from £10 12s. 6d. to £11 each; 48 "B" shares, at £10 10s. and £10 11s.; and 24 "C" shares, at from £8 12s. 6d. to £9. On the same occasion, four (1875) shares in the *Weardale and Shildon Water Company* sold at £37 2s. apiece.——At Boston on Tuesday, 74 £25 shares in the *Boston Water Company* realized from £51 15s. to £52 per share; 100 £10 original shares in the *Boston Gas Company* produced £18 10s. and £18 15s.; and 100 new £10 shares in the same Company fetched £15 7s. 6d. to £15 10s.——Shares to the number of 172 in the *Swinton and Mexbro' Gas Company* were sold last Wednesday at Mexbro'. First issue £5 shares obtained purchasers at £9 and £9 5s.; second issue £5 shares realized from £8 17s. 6d. to £9 2s. 6d.; and third issue £5 shares were bought at £7 5s. each.——At Laker's Hotel, Redhill, last Wednesday, Messrs. Lees and Burchell sold by auction shares and stock in the following Gas Companies: 100 fully-paid £5 shares in the *Redhill Gas Company*, for £1206 5s.; 65 shares in the same Company with £3 10s. paid, for £553 2s. 6d.; 10 fully-paid £10 shares in the *Eastbourne Gas Company*, for £237 10s.; £275 of consolidated stock of the *Maidstone Gas Company*, for £660; and £100 of ordinary stock of the *Tunbridge Wells Gas Company*, for £240.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. John S. Gibb, the Treasurer to the Edinburgh and Leith Gas Commission, has prepared his annual abstract of the accounts of the Commission for the past year, a document which, whether it serves a useful purpose or not, must entail an immense amount of labour upon the Treasurer. It appears that, in the manufacturing department, coal cost £90,896; purifying materials, oil, water, &c., £7018; salaries and wages and charges at works, £37,231 (of which workmen's wages amount to £33,146); and repairs and maintenance of works and plant, £8241. In the distribution department, salaries and wages of rental clerks, surveyors, inspector, and fitters amounted to £8806; repairs and maintenance of main and service pipes, to £5066; and repairs and maintenance of meters, to £4439. The Treasurer's department cost £1751; and the collectors', £2998. The general establishment charges amounted to £2461; feu duties and rents, to £250; rates and taxes to £10,017; law and parliamentary expenses, to £733; pensions and allowances, to £750; discounts and abatements, to £3078; bad debts, to £575; and gas used in works and offices, or supplied free of charge, to £1369. The cost of coal was 12s. 10·14d. per ton; 1s. 2·65d. per 1000 cubic feet of gas made; and 1s. 3·87d. per 1000 cubic feet sold. The whole manufacturing charges amounted to £143,388; and they were at the rate of 20s. 3·15d. per ton of coal carbonized, and 1s. 11·10d. per 1000 cubic feet of gas made. The total cost of distribution was £18,313. It was at the rate of 2s. 7·05d. per ton of coal carbonized, and 2·95d. per 1000 cubic feet of gas made. The total management charges amounted to £7211. They were at the rate of 1s. 0·23d. per ton of coal carbonized, and 1·16d. per 1000 cubic feet of gas made. The gross cost of gas made was £185,688; and it was at the rate of 26s. 2·87d. per ton of coal carbonized, and 2s. 5·92d. per 1000 cubic feet of gas made. The receipts for residuals amounted to £26,496, or at the rate of 3s. 8·93d. per ton of coal carbonized, and 4·27d. per 1000 cubic feet of gas made. The net cost of gas was £158,848; being at the rate of 22s. 5·36d. per ton of coal carbonized, and 2s. 1·60d. per 1000 cubic feet of gas made. The total revenue was £218,891, or at the rate of 30s. 11·18d. per ton of coal carbonized, and 2s. 11·27d. per 1000 cubic feet of gas made. The gross profit amounted to £60,043; being at the rate of 8s. 5·82d. per ton of coal carbonized, and 9·67d. per 1000 cubic feet of gas made. The annuities payable amount to £34,000; which are at the rate of 4s. 9·65d. per ton of coal carbonized, and 5·48d. per 1000 cubic feet of gas made. Interest paid amounted to £4467; being at the rate of 7·58d. per ton of coal carbonized, and 0·72d. per 1000 cubic feet of gas made. The quantity of gas made was 1,489,309,000 cubic feet; the yield of gas per ton of coal, 10,522 cubic feet; and the gas unaccounted for amounted to 7·67 per cent. The average illuminating power of the gas was 25·48 candles. The price of gas was 3s. 4d. per 1000 cubic feet from May to October, and 3s. 2d. from October to May. The Engineers have also issued abstracts showing the working of their department; but the principal figures are to a large extent contained in the Treasurer's statement.

At a meeting of the Edinburgh and Leith Gas Commissioners on Monday, it was reported that, during the first month of the current financial year, there had been an increased output of gas amounting to 2,527,000 cubic feet. The Commissioners, in disposing of the surplus of £60,043 from last year, on the recommendation of the Finance Committee, placed £8582 to the sinking funds, and carried forward £50,536. Last year they transferred £17,142 to the sinking funds; and carried forward £37,489. The contribution to the sinking funds last year were double the statutory requirements. This year, Bailie Kinloch Anderson said, they had done what the statute required in respect of contribution to the sinking fund. In some former years, they had done better; but in view of the large expenditure impending, which was to be charged to revenue, they had thought it better just to give the statutory contribution. Moreover, there was a great advantage in having a large balance at the credit of the Commission, for with it they did not require to overdraw from the bank at the time that the collection was not being made. In recent years they had saved large sums through not requiring to overdraw. Speaking of the output of gas, Bailie Kinloch Anderson said they had a very satisfactory state of matters in respect of the reduction of the leakage. Last year at the Edinburgh works the leakage was 10·23 per cent.; this year it was 8·79 per cent. That was still a good deal higher than the leakage in the Leith district; but there was a reasonable explanation of the difference. The situation of the works in Leith was lower than the whole area they supplied; and, moreover, they had no undulating area in Leith such as there was in Edinburgh—the gas rising without much pressure to the highest point. In the Edinburgh area the gas rose, but had to be forced down again; and the greater the pressure, of course, the more the leakage. In Edinburgh the length of the pipes was double that of the pipes in the Leith district; and they extended over far outlying districts. With the advantage of the new service-mains, there was every reason to expect that there would be a reduction in the leakage in Edinburgh in future.

Sheriff Berry, of Glasgow, has this week given his decision in an action which determines the powers of a Corporation owning gas-works to cut off the supply of gas when payment is not made of a sum due for supply. The pursuer raised his action in the Small Debt Court, before one of the Sheriffs-Substitute; but the question was considered of such importance that the Sheriff-Principal was asked to hear it. Prior to the 5th of January last, the pursuer, Mr. David Campbell, occupied a shop at No. 197, Castle Street, Glasgow. On that date, he transferred his business to another, and began business at No. 95 in the same street. The gas supplied at No. 197 had not been paid for; and the Corporation declined to supply gas for the new shop. In this action, Campbell sought to recover £12 as damages for failure to supply. He said he had arranged with the new occupier of No. 197 to relieve him of the charge for the gas supplied to that shop; and he offered to pay, or to find security for the payment for, any gas which might be supplied to him at No. 95. The Sheriff has decided that the Corporation are not bound to give a supply; and he has granted them absolvitor. The judgment is based upon section 18 of the Glasgow Gas Company's Act of 1817, in which power is given to cut off the supply of gas to any house or houses occupied by a defaulter, which power was transferred to the Corporation by their 1869 Act. Section 64 of the later Act confers the same powers. In the Sheriff's opinion, the Corporation are entitled to decline to supply gas to anyone who fails to pay a charge for gas supplied to him, without regard to whether the premises to which the refusal applies are or are not the same as those in respect of which the charge had been incurred. The earlier enactment, by the use of the plural number, seemed to authorize a refusal, in regard to all buildings, of the person in default. It was by the person in arrear, and not by any particular premises, that a forfeiture of the right to require a supply of gas was incurred. It mattered not, in a question with a defaulter, whether the default had been incurred in regard to one set of premises or another. A similar question was decided in the same way in 1883 by his predecessor, Sheriff Clark; but he had formed an independent judgment in this case, though he was glad that, in the result, he agreed with Sheriff Clark. I should say the Sheriff could not have come to any other decision than that he has given. The Corporation had no contract with the new tenant of No. 197 for the supply of the gas which was unpaid for; and they could not have recovered the amount as against him. Their only course, therefore, was to proceed against the man who incurred the debt to them; and the step they took against him was clearly within their right.

I have this morning (being obliged to send off my "Notes" earlier than usual, on account of the Bank Holiday on Monday) received, through a courtesy which I desire to acknowledge, a copy of the accounts of the Glasgow Gas and Electricity Department. I have already given a summary of the more salient features of the accounts. There are, however, matters contained in them which I would like to call attention to; but I cannot find time to prepare a note upon the subject this week, and consequently it must be held over. I may, however, add my tribute this year to what I have formerly written on the subject, regarding the admirable manner in which the undertaking is managed, both in the works and in the finance department.

The Institution of Mechanical Engineers have met in conference in Glasgow this week, under the presidency of Professor A. B. W. Kennedy, of London. The first paper was a description by Mr. A. S. Biggart, of Glasgow, one of the assistants to Sir William Arrol, M.P., the co-inventor with Mr. William Foulis, of the Arrol-Foulis stoking machinery, of hydraulic stoking machinery and labour-saving appliances in modern gas-works. The paper was an important one; and it was followed by a discussion of some interest. Among other papers was one on hydraulic supply in towns, by Mr. Edward B. Ellington, of London, in which special allusion was made to the recently inaugurated hydraulic water supply in Glasgow.

Very curiously, on the occasion of the dinner to the Institution, on the evening of the first day of the meeting, the electric light in the dining-hall went out. By a cruel irony, the Chairman was Professor Kennedy, the Engineer of the Glasgow electric light installation.

The Carluke Gas Company have paid a dividend for the past year at the rate of 6s. per share, and have reduced the price of gas from 4s. 2d. to 3s. 9d. per 1000 cubic feet. The Coatbridge Gas Company have paid the maximum dividends of 10 and 7 per cent. on the original and new stocks of the Company, for the past year.

Representatives of the Scotch Oil Companies met in Glasgow this week, and fixed the price of burning oil during the coming season at from 6¾d. to 7d. per gallon. This is slightly easier than recent prices. As I have said before, the price of oil for gas-making purposes has advanced comparatively little—only a few shillings per ton. The rise in burning oil, which is at the rate of nearly 2d. per gallon, amounts to, I think, over £2 per ton.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 2.

Sulphate of Ammonia.—In the closing days of last month, the market hardened appreciably; there being July contracts to be covered. But at the opening of the present month, the necessity for immediate purchasing has disappeared; and the tone is again weaker. Speculators are now directing their attention to depressing values for August. Makers are not offering for forward delivery; but there are sellers in the field who are offering over the next three months at a moderate premium on spot prices—no doubt relying upon the larger production which may be expected as the winter is approached, and upon the less firm attitude of some of the large makers who, it is reported, have been accepting current prices for apparently more than their current make. The quotation at the ports is £9 10s. f.o.b.

Nitrate of Soda is quiet at 8s. 3d. per cwt. for fine quality on spot. Autumn shipments are worth 8s. 1½d. to 8s. 4½d. per cwt., according to test and position.

LONDON, *Aug.* 2.

Tar Products.—Pitch continues to enjoy a firm market; and business for forward delivery is being booked at prices quoted below, notwithstanding the protest of fuel makers that the present prices of pitch leaves them a loss. Benzols and solvent naphtha are weak, with a tendency to still lower prices. There is a better feeling in respect to carbolic acid products; and both picric acid, salicylic acid, and other phenol derivatives are unquestionably improving both in demand and value. Creosote oils are practically unsaleable; and many distillers, even now, during a period of short production, are compelled to burn them as fuel. Anthracene is firm, with a little more business doing. Crude naphthalene is also moving off at slightly improved rates. Business during the week has been done at the following rates: Tar, 18s. to 20s. 6d. Pitch, West Coast ports, 35s.; East Coast ports, 37s. 6d. Benzols, 50's and 90's, 11d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, ¾d. Naphthalene salts, 21s. Cresylic acid, refined, 1s.; brown, 10½d. Carbolic acid, 60's, 1s. 6½d. Anthracene, "A" quality, 1s. 1d; "B," 10d.

Sulphate of Ammonia continues to show great lassitude. The very life seems to be knocked out of this market; but it is hoped, with the advance of the autumn, that larger business will be forthcoming. From a

nitrogen value point of view, sulphate is very cheap compared with nitrate. Transactions during the week have realized £9 5s. to £9 10s., less 3½ per cent., according to port of shipment. Gas liquor is quoted at 6s. 9d. to 7s. 9d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—One or two gas-coal contracts are still pending—that for the Salford Corporation being not yet settled; and for the present matters seem to be in abeyance. The excessively low prices at which the commoner descriptions of round coal are now being forced upon the market is probably inducing buyers of gas coal to wait further developments. As regards gas-coal prices, there is no quotable change. The average figure for good Wigan four-feet remains at 6s. 6d. per ton at the pit; partially screened Arley gas coal, at about 7s. In the better qualities of round coal, quoted prices are also nominally unchanged; colliery owners generally preferring either to stock or to restrict their "get," until the supply of winter requirements brings an increased demand upon the market, rather than attempt to force sales now at lower figures. At the pit mouth, best Wigan Arley remains nominally at 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; and common house coals, 7s. to 7s. 6d. The lower descriptions of round coal, for steam and forge purposes, are, however, being pushed upon the market at all sorts of figures; and to clear away surplus supplies promptly, colliery proprietors in some cases are evidently prepared to accept almost any price that buyers offer. Good ordinary descriptions of Lancashire steam and forge coals do not average more than 6s. to 6s. 6d. per ton at the pit for inland sales; while for shipment, as low as 5s. 3d. to 5s. 6d. is being taken—representing 7s. to 7s. 3d. delivered at the ports on the Mersey—although some of the better qualities are still being held firmly at 7s. 6d. to 7s. 9d. per ton. The very limited output of slack, helps to keep up prices of engine fuel; and with their present get, some of the collieries are short of supplies to meet the requirements of their customers. There are, however, still large stocks on the ground at some of the collieries; and these prevent any upward move—3s. to 3s. 6d. per ton being still the average for ordinary descriptions, with 4s. 6d. to 5s. quoted for better qualities of engine fuel.

Northern Coal Trade.—There has been an improved demand both for gas and steam coal during the last few days, but more especially the latter; the shipments having shown a satisfactory increase, in the expectation of a larger demand at the Baltic ports. Best Northumbrian steam coals are quoted at 9s. per ton f.o.b.; and the collieries are now well employed. The enlarged production of steam small coals is rather tending to bring down the price for that kind of fuel; and about 3s. 3d. per ton is now the current quotation. Manufacturing coal is in rather better request; and there is a decided increase in the consumption of railway coal—traffic on the local lines being larger. In regard to gas coal, there are now much larger deliveries, though they are far below those of the later months of the year. Still, the quantity taken both to distant gas companies by sea, and to the local companies by land, are increasing satisfactorily; and with an average export, the work at the gas-coal collieries is now growing fuller, though short time is still needful at many pits. The price of good Durham gas coal varies from 6s. up to about 7s. per ton, though one or two collieries occasionally ask a higher price. The coke trade is decidedly firmer, there being a larger quantity sent to the north-western furnaces; so that, with Baltic exports, the output is more readily taken up. The price is still from about 12s. 6d. to 13s. 6d. per ton f.o.b., according to quality. Gas coke maintains its price steadily, with small stocks; production being limited to the winter make, though now increasing.

Scotch Coal Trade.—Trade appears to be reviving. This week there has been a better tone in the market. Steam and splint are unaltered as to price; splint being very abundant. The other varieties are in better demand. The prices quoted are: Main, 5s. 10d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. (full); splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 166,256 tons—an increase upon the quantity in the preceding week of 38,401 tons, and as compared with the corresponding week of last year of 141,181 tons. For the year to date, the total shipments have been 3,911,235 tons—an increase over the quantity in the same period of last year of 220,115 tons.

Electric Lighting at Derby.—Included in an application which the Derby Corporation have made for certain loans for various objects, is a sum of £13,000 for electric lighting. For this purpose, the Board have already sanctioned £35,000; and the additional £13,000 now asked for is really to make up the actual expenditure over and above the sum previously granted. This was explained by the Town Clerk to Colonel W. M. Ducat at an inquiry held by him last Wednesday; and it was also stated that the extra expenditure was very necessary—alterations to the adjoining premises and the erection of additional boilers being the principal items.

The Inclined Retort System at Huddersfield.—At the last meeting of the Huddersfield County Borough Council, a reference in the minutes of the Gas Committee to the royalties the Corporation had to pay the Automatic Coal-Gas Retort Company, Limited, caused the Mayor (Alderman Brook) to inquire what was the amount of the royalties, as he did not know they had subjected themselves to any. Alderman Stocks replied that there were certain patents in connection with the inclined retorts upon which royalties existed, and which the Committee had entered into an agreement to pay some time ago. If the Council could oblige the Company by paying at once, they would allow them a certain discount. The Council could borrow money at 3 per cent.; and, by paying the Company, they could obtain a reduction of 40 or 50 per cent. Pressed by Mr. Mellor, Alderman Stocks added that the liability, which amounted to £1200, had been paid off. In answer to Mr. Gee, he also mentioned that the Council were allowed a considerable reduction by the Company when they adopted the inclined retorts, because they were among the earliest to do so. In the first place, they had a reduction of 50 per cent.; and this was on the same basis.

The Ackworth, Featherstone, and Purston Gas Company.—The Directors of this Company some time since decided upon making extensive alterations and additions at their works, in order to meet the great demands put upon them by the large increase of property recently erected in the neighbourhood. Under the direction of the Manager (Mr. Moat), the work is now well in hand. At the present time, there are four purifiers in use, each 6 feet square; and four others are being constructed, each 10 feet square. A new engine and exhauster are to be erected, also a station-meter house, lime-store, &c. The estimated cost of the proposed works is about £500; and it is expected that, when the additions have been completed, about three times the quantity of gas will be made. It is hoped the work will be finished before winter sets in.

Portland (Oregon) Water Supply.—According to a recent report of the British Vice-Consul at Portland, the new water-works supplying that city with 25 million gallons a day, and costing £640,870 are completed. The water is taken from Bull Run River, a clear mountain stream flowing from a lake near the base of Mount Hood, and brought in a pipe 24 miles long to a reservoir 404 feet above low water on the east side of the river near Portland. Thence it is carried across the river through a submerged pipe to a reservoir in the City Park, 6 miles distant, at an elevation of 290 feet above the levels of the city streets. The high-service reservoirs on the east and west sides of the river are connected with low-service reservoirs; but the water can be supplied direct to the city mains without passing through the latter. The four reservoirs have a capacity of 67½ million gallons; and the supply is stated to be inexhaustible.

An Interesting Reminiscence.—The *Belfast News Letter* publishes a short article giving an account of an event of some historical interest connected with the water supply of the borough. We gather therefrom that the supply was formerly in the hands of the Belfast Charitable Society, who held certain lands and springs in Malone; and their rights in this respect only merged in the Water Commissioners by an Act passed in 1840, under which the latter body was incorporated. Immediately after incorporation, the Commissioners proceeded to construct certain works near the Antrim Road for the collection of the waters of Carr's Glen; and in the course of time, these works have been followed by the various other schemes which the increase in the population has rendered absolutely necessary. A hundred years ago—on July 22, 1795—at a meeting of the Board of Management of the Charitable Society, the question of the water supply of the borough (which evidently had been previously under consideration) was introduced; and a Committee was then chosen to "superintend the works necessary to convey water to the town." The wonderful development since that date in the matter of the water supply is in itself a striking testimony to the marvellous progress of Belfast.

The Proposed Auxiliary Water Supply from Wales.—Commenting, a few days ago upon the address of Sir Arthur Arnold on the work of the London County Council, noticed in the JOURNAL last week, *The Times* alluded to the confidence manifested by him as to the capability of the Council to manage all the gas and water arrangements of the Metropolis. Sir Arthur cannot conceive any difficulty in the case which could not easily be overcome by enlarging the Council. "There is a charming simplicity," remarks our contemporary, "about the implication that the fitness of a body of this kind to undertake the whole industrial work of the community is limited only by the physical powers of its members." Sir Arthur, it may be remembered, lately inspected the intakes of the Water Companies; and he feels certain that no one who has done so can doubt the urgency of drawing a wholly new supply from Wales. "This grandiose and enormously costly scheme," said *The Times*, "has singular charms for those who love to magnify their office in the County Council. Yet what concerns the people of London is not the character of the water at the Thames intakes, but its quality as delivered in their homes. Drinking water is a manufactured product in all save rare cases; and the manufacture in the Thames Valley has been brought to a high pitch of excellence. Soft water from Wales might save Londoners something in soap, which they would never feel; but it would mean an enormous addition to rates and to capital burdens. It might also turn out, as soft water has in other cases, to involve perils of its own, more subtle and more difficult to deal with than the impurities present at the Thames intakes. Water questions are not to be settled by sentimental preferences for Welsh valleys."

The Payment of Wages during Periods of Sickness.—This was the subject of a long discussion at the last meeting of the Gas Committee of the Oldham Corporation. It was introduced by Mr. Harrop, who said he had framed a resolution which he wished to be the basis of a new rule. It was—"That this Committee decide that any official being away from work for more than a month, his wages be paid at the rate of one-half, and this rate continue at the option of the Committee for three months, at the expiration of which time the wages shall cease altogether." Mr. Harrop explained that he did not move this resolution with the idea that the period or the rate stated should be unalterable; but so that the Committee should have some ground on which to proceed. To his mind, it was very unsatisfactory and inconvenient that they should have no fixed rule on which to work when cases of sickness arose. The resolution did not commend itself to the mover's colleagues. Alderman Hall pointed out that circumstances materially altered cases. For instance, a man might be ill through working excessive hours, or he might meet with an accident of some kind; and he thought the better plan was to leave these matters in the hands of the Committee, to deal with as they arose, and to take each case on its merits. The Chairman (Alderman Smith) concurred with the remarks of the last speaker; and Mr. Johnson instanced a case where a man might have a leg broken, and be compelled to be absent from work for twice the length of time mentioned in the resolution. Mr. Harrop said he did not firmly adhere to his resolution; what he wanted was a rule put in force, so that all employees could be dealt with alike. In case of an accident on the works, he would certainly not propose to stop the man's wages. What he meant was to apply this rule in cases where the men were away through illness arising from something over which the Committee had no control. The resolution was seconded; but it did not receive any additional support.

Incandescent Gas-Burners for Public Lighting.—The Directors of the Needham Market Gas Company have decided to substitute incandescent burners for the ordinary ones in the public lamps.

Reduction in Price.—The Hoylake and West Kirby Gas and Water Company, Limited, have given notice that after Sept. 30 next the price of gas will be reduced from 4s. 2d. to 4s. per 1000 cubic feet. The charge for gas used for cooking and heating purposes is 3s. 9d.

Serious Explosion of Gas at Lodz.—According to a telegram, dated last Saturday, received through Reuter's Agency, from Lodz, a Polish town situated some 75 miles to the south-west of Warsaw, an explosion of gas which occurred there caused the fall of a house, resulting in the death of three persons, and injury to a number of others.

The Public Lighting of New York.—The city of New York is lighted by 25,123 gas-lamps, and 2725 electric lights. In the course of a year, each gas-lamp burns for a total of 4000 hours. The electric lights burn for 3950 hours annually. The estimated cost of lighting the city streets this year will be $980,000. The city has now more street lights in use and in preparation than ever before.

Improvements at the Shepshed Gas-Works.—Messrs. R. Dempster and Sons, Limited, of Elland, are carrying out for the Shepshed Gas Company, under the direction of their Consulting Engineer, a new holder, to contain 30,000 cubic feet, and a brick tank. They are also erecting new retorts on the regenerator principle, and putting down an exhauster and pumps driven by a gas-engine made in accordance with Messrs. Crossley's latest patent.

The Finances of the Manchester Corporation Gas Department.—The report of the Gas Committee of the Manchester Corporation for the year ended March 31 last, states that the revenue was £579,277, or £10,246 more than in the previous year. The sum of £54,044 goes to aid the city rates, and, in addition, £15,000 has been voted for the same purpose for the year ending next March. The revenue of the electric lighting department for the twelve months has been £28,640, the available balance being £5709.

Colne Water Supply.—For some time past, the local authority of Colne, in consequence of the increasing population, have found it difficult to provide an adequate supply of pure water. After being disappointed in their boring operations for an increased supply at Rudshaw Moss, three miles distant, they have turned their attention to the Wycollar district, four miles away; and the report of the Engineers is that there is such a supply of good water in that neighbourhood as will serve the town for several years. A new compensation reservoir will have to be constructed.

The Ossett Town Council and the Gas Question.—At a special meeting of the Ossett Town Council last Wednesday, eight members voted for a resolution to promote a Bill in the next session of Parliament for the compulsory purchase of the gas undertaking which supplies the borough and Horbury. Five members voted against it, and two were neutral. Nine votes being required to pass the resolution, it fell to the ground. The Directors of the Company have given notice of a reduction of 3d. per 1000 cubic feet in the price of gas—from 3s. to 2s. 9d.

Gas Affairs at Ripon.—At the meeting of the Ripon City Council yesterday week, the Mayor (Mr. Baynes) made a report with reference to the recent laying of new gas-mains in a portion of the city, which will tend to reduce the amount of unaccounted-for gas. The leakage over the 14¾ miles of mains in the district of supply amounted to 3,503,777 cubic feet, the value of which, at 2s. 1d. per 1000 cubic feet—the cost of production—was £365 per annum. It was also stated that in four years £16,000 on gas-works capital account would be paid off; and a saving of £900 a year effected.

The Purchase of the Rastrick Gas-Works by the Brighouse Corporation.—These works have now passed into the possession of the Brighouse Corporation, by agreement with the Rastrick Gas Company, at a price of £50,300. The purchase of the works was sanctioned in the Brighouse Corporation Bill passed last session; and on Wednesday last a cheque for £48,523 16s. 11d. was handed over by the Corporation to the Gas Company in payment for the works—the balance between this sum and the purchase price agreed upon being made up of liabilities taken over by the Corporation in connection with the works.

Sick and Funeral Society of the Leicester Corporation Gas and Electric Lighting Department.—The sixth annual meeting of the members of the Sick and Funeral Allowance Society in connection with the Gas and Electric Lighting Department of the Leicester Corporation was held last Friday week; the President (Mr. Alfred Colson) in the chair. The report showed that during the past twelve months £388 was received in subscriptions, and £28 in levies. The total receipts were £458. A sum of £285 was paid to sick members, and £38 for the funeral allowances of four members and two members' wives. The total expenditure was £354. The balance in hand was £505, or a gain of £103 on the year.

The Price of Gas for Public Purposes at Swansea.—A Sub-Committee of the Streets Committee of the Swansea County Council lately had an interview with the Directors of the Gas Company, at which they asked for a reduction in the price of gas supplied to the public lamps and the various police stations. The Secretary of the Company (Mr. Thornton Andrews) has forwarded a reply to the Committee, in which he says the Directors regret they are unable to make any further reduction than already exists, having regard to the large capital expended in many districts solely for the supply of gas to the public lamps, the consequent unremunerative return per mile of main, and, in addition, the heavy cost of maintenance and repair of the lanterns. At a recent meeting of the Council, Alderman Tutton described this answer as decidedly unsatisfactory, and said he considered that steps ought to be taken to bring the Company to a reasonable frame of mind. They had always paid their maximum dividends; and now that coal was cheap and labour plentiful, they ought to have conceded the request of the Corporation.

Polluting Lancashire Rivers.—At the Blackburn County Court last Tuesday, the Accrington and Church Outfall Sewerage Board were sued by the Ribble Committee for disobeying an order to carry out a sewage scheme within 18 months. Judge Coventry said there had been unjustifiable delay by the defendants in spending seven months in experiments, instead of adopting a scheme. He imposed a penalty of £250 (at the rate of £10 daily), with costs on the higher scale.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 281.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest. ment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	22–23	..	4 11 4
100,000	10	,,	7½	Do. 7 p. c.	10	15½–16½	..	4 10 11
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	28 Feb.	12†	Brentford Consolidated	100	257—262	..	4 11 7
180,000	,,	,,	9†	Do. New	100	205—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
888,500	Stck.	28 Feb.	5	Bristol	100	125—130	..	3 16 11
320,000	20	28 Mar.	11¼	British	20	54—56	..	4 0 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7½—8	..	5 0 0
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	100—103	+1	5 16 7
150,000	20	11 July	8½	Cagliari, Limited	20	28—30	..	5 10 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	299—304	..	4 8 9
165,000	,,	,,	10½	Do. New	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	265—275	+5	4 14 6
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26*	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18*	+½	4 14 3
5,646,590	Stck.	14 Feb.	12¾†	Gaslight & Coke, A, Ordinary	100⅔	290—295	+2	4 6 5
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	+2	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190—195	..	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	130—133	..	3 0 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	200—205	+2½	2 18 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	252—257	..	4 13 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	16½—17½	+½	5 14 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
420,000	100	2 May	6	People's Gas of Chicago—1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	..	5 7 3
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	302—307	..	3 18 2
290,000	,,	,,	13	Do. C do.	100	310—315	..	4 2 6
775,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172—176	..	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	230—235	−3	3 8 1
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	114—118	..	2 19 4
708,000	Stck.	14 Feb.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—264	..	2 16 9
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Feb.	12¾	New River, New Shares	100	390—400	..	3 3 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143-148*	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157—163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,666	Stck.	12 June	10	West Middlesex	100	288—293	..	3 8 3

* Ex div.

† Next dividend will be at this rate.

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EDITORIAL NOTES.

The Prospects of Improved Street Lighting for London.

It would be a good thing if the passing interest in the important subject of the lighting of the streets of London that has been aroused by the recent proceedings in the London County Council respecting the lighting of the Thames Embankment, should have the result of leading to a reconsideration of the whole system by the principal Metropolitan authorities. The greatest hindrance to any complete and comprehensive reform of the London street lighting lies, as we point out elsewhere, in the subdivision of the duty among so many independent highway boards. The County Council have no authority over the lighting of any portion of the thoroughfares of the capital except the bridges and one or two special lines of new roadways, such as the Albert and Victoria Embankments, which are committed to their care by Acts of Parliament. Over the rest of London, the Corporation of the City, and outside the City the parish Vestries, have exactly the same rights and responsibilities in the matter of public lighting as appertain to all independent local authorities. So far as the Corporation are concerned, it must be acknowledged that the new streets made from time to time by this much-abused body are provided with neat and not inelegant gas-lamps and posts, placed, as a rule, quite thickly enough for all practical purposes. It is the ancient highways, and the new centres of market, postal, and newspaper traffic which are continually being created by the exigencies of the development of the business of the capital, that fare worst at the hands of the Corporation, as well as under Vestry management. It is an old story that the Corporation especially have preserved an attitude of indifference, if not of hostility, towards all suggestions for the improvement of the gas lighting of the City streets. Several successful experiments in this direction have been carried out for the edification of the City authorities; but not one of them has met with the official approval that its merits deserved. One after another, the improved sets of gas-lamps were removed from the City streets; and it was only when, after years of waiting, the City became possessed of an electric lighting service, that anything was done to remove the reproach of dinginess that clung to the streets. And then the work of improvement was set about with an irritating disregard of the real necessities of localities. The large and open thoroughfares which, crowded all day like the entrance to a beehive, are deserts by night, were provided with powerful lights for the delectation of the solitary policeman and the infrequent cab-driver; while the places where most night-work is carried on were left in primitive obscurity. The Corporation spent so much money upon their "fancy" arc lighting, that they would not afford an extra gas-lamp or a more liberal gas consumption where anybody could see it was sorely needed.

The position of the parochial authorities outside the City is peculiar. Once out of the City of London limits, proceeding westerly, one enters what is called the City of Westminster; and this is perhaps the busiest night city in the world. Yet there is no central municipality to look after the public lighting; but parish succeeds parish without visible boundaries. Every such parish has its own thickly-populated back regions to light and otherwise care for; but, in addition thereto, it has also more or less of arterial street-lines to maintain in all essentials, not for its own local purposes, but for the convenience of the whole world. Why should it do this? One reason may, no doubt, be found in the fact that it is the universal traffic that makes the rateable property bordering on, and in the vicinity of, the arterial streets so valuable as it is; so that as the parishes represented (say) by the Strand Board of Works, levy rates in proportion to the Imperial and cosmopolitan character of the great thoroughfare from which the Board take their corporate title, they must perform suitable services in return. Still it is incontestable that the street lighting of the capital of the British Empire partakes of the character of everybody's business; and its quality suffers accordingly.

It may be confidently hoped, however, that better things are in store in respect of London street illumination. The glamour that has surrounded electric lighting these many years past is beginning to disappear before the influences of familiarity and the revival of confidence in the permanence of the gas industry. It was impossible for urban

local authorities, constituted as they are, to trouble themselves overmuch about the improvement of the public lighting service in connection with a system which all the fuglemen of public opinion were agreed in describing as moribund. Here and there energetic gas engineers succeeded in forcing improved gas-lamps upon the public notice; but the results they achieved were necessarily of a sporadic character, and could not make much headway against the prevailing drift of public opinion. People looked for the electric light, and they would not look at gas, in more than one sense; and now they know more about the whole matter. The new system of public and private lighting is no longer a novelty. It has come among us "to stay," as the catch phrase has it; and nobody wishes to drive it away—least of all gas engineers, to whom its presence has given an opportunity and an impulse unknown before its advent. To the public in general, however, the word "electricity" is no longer the conjuring name it once was. It still covers a multitude of shortcomings, and induces a relaxation of purse-strings impossible to be effected by any other agency; but it does not blind the public eye to the existence of different means of performing service to the community. So gas is gradually coming to its own again, on its merits; and electric lighting is also being put upon its merits, which is a good thing for both systems. We ask for nothing more; and the public are showing signs of not being willing to rest content with anything less. So far as the lighting of the streets of London is concerned, a reformed municipal disposition may ere long remove the initial obstacle to improvement; but when the London County Council admit that gas is still to be reckoned with for this service, there is much ground for hoping that a mischievous illusion will speedily be cleared away.

The South Metropolitan Accounts.

Last week we published the report of the Directors of the South Metropolitan Gas Company upon the past half year's work of the undertaking; and in another column we now reproduce the statement of accounts referred to in the report. They are of a highly satisfactory character. Notwithstanding the remarkable increase of 13 per cent. in the gas consumption, the expenditure of capital upon new buildings and plant in extension of works is only £4396, while upwards of £34,000 has been spent in providing new and additional mains and services, meters, and stoves. The South Metropolitan Directors certainly know how to take care of their capital. In the revenue account, it is shown that the gas-rental amounted to £427,049, as compared with £384,771 for the corresponding half of 1894, with gas 1d. per 1000 cubic feet dearer up to Lady-day. The accounts now state the numbers of the Company's meters and stoves at rent; distinguishing between the "ordinary" and "automatic" classes. It is worthy of notice that already the number of automatic meters is nearly half of that representing the older connection; and that whereas the Company have 27,120 ordinary stoves at rent, there are already 20,817 stoves on the automatic system. Residuals returned £167,196, as against £171,611, though larger quantities had to be disposed of. Coals and enrichment cost £223,528, as against £189,424. Wages (carbonizing) cost £49,437, which works out to 2s. 5d. per ton. Altogether, the cost of gas manufacture amounted to £363,479, as compared with £317,254 for the June half of 1894. In the charges for gas distribution, the new entry for "gas-fittings (labour)" again appears. This is for the equipment of artizans' dwellings under the Company's gas-popularizing system. Rates and taxes show a small increase. There are no law charges; and bad debts are somewhat largely diminished—two highly satisfactory points. The balance carried to the net revenue account is £177,002. At the same time last year it was £186,920. By the carbonizing accounts, it appears that during the half year the Company returned in a certain degree to the use of cannel, besides employing a great deal of petroleum spirit. There seems to have been some little difficulty in keeping up the illuminating power. The quantity of unaccounted-for gas went up from 171,490,000 to 207,461,000 cubic feet, which is about the least gratifying entry in the accounts under notice. The unaccounted-for gas is less than 5 per cent. of the output; but the troublesome consideration about it is that the actual gross waste is greater. Moreover, there was an increased "use" of gas on the works, which mostly means loss. In the balance-sheet, the amount of workmen's bonus and savings deposited with the Company stands at £41,212. This is worth more than any reserve fund of equal amount. No less than £25,680 is entered as due to the Company for automatic gas-fittings. There is not a great deal in these accounts for the Chairman to explain to-morrow; but he will have plenty of other matter in which to interest the proprietors, as we indicated last week.

The Gas Supply of Glasgow.

The condition of the gas undertaking of the Glasgow Corporation is fully revealed by the facts and figures reproduced in another column. It cannot be too often repeated that this great undertaking is administered upon the only sound principles of municipal supply enterprise. It stands quite independently of corporation finance—paying its own way, and giving to the citizens the utmost benefit obtainable from current industrial and commercial circumstances. Speaking broadly, if all municipal gas departments were worked as is this of Glasgow, there would be little objection to the disappearance of every gas company in the United Kingdom, and the municipalization of all the undertakings. The Glasgow Gas Committee have brought the price of gas down to 2s. 4d. per 1000 cubic feet; and it must continue to fall, other things being equal, as the capital burden upon the undertaking is reduced. The Committee treat their people well, and conduct all their affairs with a high degree of practical wisdom. There is no inducement to adulterate the Glasgow gas supply with politics, to "sweat" the undertaking in the interest of extravagant and incompetent spending departments of the Corporation, or to tyrannize over outlying contributory districts. It is only necessary to recall to remembrance the names of some half-dozen notorious municipalities to comprehend the character of the eminence on which the Glasgow Gas Department stands in these respects. Nor is it difficult to trace the source of most of the difference in this regard between Glasgow and those places. The personality of the ruling authorities goes for a great deal, of course; but it is not necessary to assume that Glasgow people naturally possess less original sin and more wisdom than the others. The chief consideration is the fundamental difference between Scottish and English municipal gas polity. Most unfortunately, as the event has abundantly proved, English municipalities, as a rule, have been permitted to exploit their gas undertakings for the benefit of the local rate fund. In Scotland this is not permitted. And now we can see the consequences of the operation of these principles. Unhappily for themselves, English municipalities owning gas property have been placed between two conflicting interests; and in too many instances the best men belonging to these bodies have become so moulded to their environment as to be unable to perceive rights from wrongs. How are such men to do justice to the gas undertaking, to the consumers (and through them to the local industry and commerce), to their employees of all grades, and at the same time wring the last penny out of the concern to subsidize the rates withal? Recent parliamentary decisions go to indicate that this subsidizing process is likely to be brought under stricter regulation than was deemed necessary in the case of English municipalities; but in Scotland the gas-works are happily put beyond the reach of this mischief. There is nothing very remarkable about the Glasgow report and accounts for the past year. It may be noticed as curious that the twelvemonth's figures in this instance do not very greatly differ in scale from the half-year's return in the case of the South Metropolitan Company, whereby some interesting parallels are suggested.

The Incandescent Gas-Light System.

It seems very likely that within a brief period the fortunes of the incandescent gas lighting system in this country will exhibit a great change. The proprietors of the Welsbach patents and of others that have been taken out to cover them, according to the usual practice in such cases, are being threatened with rivalry on all sides. Of course, we do not propose to raise any question whatever as to the validity of the weapons of either side in this impending conflict; but it is pretty obvious that the Welsbach property is just now in jeopardy. It is impossible to say how many lawsuits there are at the present moment in progress in the chief manufacturing countries of Europe

to determine the issue of whether the Welsbach patents are good or bad; but it is certain that the number is large—perhaps larger than has ever been known in regard to a similar issue. This circumstance shows the estimation in which the prospects of incandescent gas lighting are held in this part of the world. Curiously enough, the multitudinous assailants of the Welsbach monopoly do not appear to realize what would be the effect upon the whole trade of the success of any one of the litigants who are attempting to destroy it. The fact of the Welsbach Company being able to command for their productions a price altogether superior to the ordinary commercial value of such articles, has been the principal attraction for the alleged infringers to enter the field; but this excess price is simply the benefit derived by the Company from their patent right. The moment this is taken away, the Company will cut their selling price to the bare commercial margin; and as they have been strengthening their position in every way during the last few years of plenty, it will be their own fault if they are not able to cut the margin closer than any rival with a connection to make. How much profit will remain in the business for all those who will be in it if it is thrown open, is a question easier to ask than to answer. Whenever this stage in the development of the system is reached—whether this happens next term or in a few years' time, as Fate and the fortune of the Welsbach Company may determine—the gas industry will find itself in possession of a variety of burners selling at a shilling or so apiece, and developing a duty which a few years ago would have been regarded as fabulous. This is the prospect which the rivals of the gas industry will have to face, sooner or later, as we have already had occasion to observe in an earlier issue. The fortunes of particular trading companies are nothing to us; but the future of the incandescent gas-light, as a principle, is a very great subject of consideration for everybody concerned with the gas industry. The value of the principle has been established; but there is plenty of room for improvement in the methods of applying that principle for common use in lighting.

No Legal Right to Air.

A remarkable lawsuit was recently decided on appeal by Lords Justices Lindley, Lopes, and Kay, in which the "bone of contention" was a presumed right to air. The case first came before Mr. Justice Cave, at the Exeter Assizes, when a perpetual injunction was granted restraining the defendant from so raising a building upon his own land as to interfere with the access of air to the house next door. No such decision had ever been given in a Court of Law in a matter of the kind; and the Judge's declaration that the plaintiffs had a right to the passage of air coming over the defendant's property to them was such an important extension of the law relating to lights, that it is satisfactory to know that the matter was not allowed to rest as he left it. It is evident that, if such an interpretation of the law were to hold good, enormous difficulties would be put in the way of any freeholder who might have occasion to erect a lofty structure, such as a gasholder, upon his own land. The judgment of the Court of Appeal, however, was adverse to Mr. Justice Cave's decision; and the injunction was accordingly dissolved with costs. The opinions expressed by the Lords Justices on the issue were very clear, and, it may be added, reasonable. It had been argued that the defendant's new buildings interfered with the natural ventilation of the adjoining premises, and this was not denied; but Lord Justice Lopes, for himself and Lord Justice Lindley, laid it down that, while every man has a natural right to enjoy fresh and pure air, so that whoever sends noxious vapours or foul air into his neighbour's premises ought to be restrained, the Court could not impose upon his neighbour the obligation to keep away noxious smells. It was contended that, irrespective of any nuisance, the plaintiffs had a right to the free passage of air over and above their premises, and to have every disagreeable smell carried away by the current of air that would pass over the premises. It was held, however, that, inasmuch as there was nothing to prevent the defendant from building on his own land, such a right as was sought to be set up could not be supported, and that a man is not bound to see that his neighbour has proper ventilation. Lord Justice Lindley further remarked, in view of the importance of the case, that no one has a right to complain of his neighbour building on his own land, even though it might diminish the flow of air on the land adjoining, unless there was an immemorial right to the user, or an agreement binding the owner not to build. Thus what might have proved a fruitful source of vexatious lawsuits has happily been removed. The law of "ancient lights" is troublesome enough on occasion; but a right to ancient natural ventilation would have lent itself to intolerable abuse.

WATER AND SANITARY AFFAIRS.

One of the most striking incidents connected with the recent history of the East London water supply is to be found in the visit paid to the East-end last week by Mr. Chaplin, the President of the Local Government Board, who sought thus, by personal inspection, to satisfy himself as to the facts of the case. It were much to be wished that this "come and see" principle were more generally adopted by imperial and other authorities, who form conclusions founded on report, and on a distant view of facts which can only be rightly estimated by a process of close examination. Mr. Chaplin found the East-end neither so dry nor so dirty as common report would make it appear. There was water, and there was also soap, for it seemed to be a general washing-day. The part visited was St. George's-in-the-East, which may be described as the very antithesis of St. George's, Hanover Square. But cleanliness was by no means an absent virtue, even among Poles, Germans, and Jews. This would imply that water was not altogether deficient; and it is stated that, at the time of Mr. Chaplin's visit, the "famine," so far as it ever existed, was "a thing of the past." It is further stated that "there were practically no "complaints." One must go to the Vestries and to Mr. Kyffin to hear anything of these. One feature which probably impressed itself on Mr. Chaplin was the "utter "absence of any system of domestic storage of water." This is the weak link in the chain of constant supply; and it has been the immediate cause of the late trouble. Additional value was given to Mr. Chaplin's visit by the circumstance that he was accompanied by Sir Hugh Owen and Major-General Scott, and was met on the ground by several of the local officials, as well as by Mr. Bryan, the Engineer of the East London Water Company, together with some of his staff. Much has been said of a great increase in the mortality where the water supply has been deficient. But there is the fact that the death-rate of the area served by the East London Company has not risen during the period of the intermittent supply. The inspection is said to have left an impression that a drought protracted much longer than that which has happily come to an end "might bring about an exceedingly serious "crisis, and one which might demand extraordinary "remedies." But the contingency has passed away, and is not likely to repeat itself. "We can only live in "hope," says the account in *The Times*, "that no further "drought may come until the new storage works are "completed." All will not be ready at once; but enough will be finished by next May to secure the safety of the population until further progress can be made.

We referred last week to the admirable letter in which the Directors of the East London Company, through their Secretary, Mr. Crookenden, had replied to the interrogative communication which they had received from the London County Council. A plain array of facts is thus adduced in proof that the Council are responsible for the late deficiency in the supply of water to the Company's district. The Directors state that the Council, "in pursuance of their avowed hostility to the Water "Companies, thought fit to do their best to wreck the "measure of 1893, on its second reading in Parliament. "They succeeded; and the public are suffering accord-"ingly." A remarkable confirmation of the truth of the charge brought against the Council by the East London Directors, is afforded by a letter which appears in *The Times* from Mr. R. A. Read, jun., a solicitor who was engaged in the opposition to the Bill of 1893. This gentleman, writing from Parliament Street, deals with the argument held by Mr. Cripps, that the Council are not responsible for the insufficient supply of water, seeing that they offered, on certain conditions, that the Bill should be allowed to "pass" unopposed. "With great respect to Mr. Cripps,"

Mr. Read contends it is "idle" for that authority to say: "We are not responsible because we offered you the Bill "in a certain form." Mr. Read rejoins by saying that the Company, as promoters, were right in introducing the Bill in the form they considered necessary for their purposes. He pleads for the direct responsibility of promoters to Parliament, not to opponents. In this case, Parliament, influenced by the County Council, rejected the Bill on the second reading, so that it never reached Committee, and no evidence was given on either side. On this ground, Mr. Read pronounces the Council "responsible, so far as the parliamentary proceedings of "1893 affect the question, for the delay in taking up "works which now would appear to have been necessary." Such a declaration from a professional opponent of the measure, carries with it especial weight. But there is yet further evidence on the point, in the shape of a letter from Messrs. Bircham and Co., the Solicitors to the East London Company. We have thus evidence from both sides, leading to the same conclusion. Messrs. Bircham meet the allegation of Mr. Cripps, that "there was no opposition "on the part of the Council to the Company making "additional works." The distinct rejoinder is made that "this statement is not correct;" and the Solicitors for the Company go on to say: "(1) That the Council did oppose "the additional works. (2) That the clause imposing the "arbitrary restrictions [on the consumers] was withdrawn "by the Company, and was not treated as a ground of "opposition by the Council. (3) That the offer to with-"draw the opposition was made conditional on the Com-"pany abandoning the capital for the storage reservoirs "and pumping machinery." The facts brought forward fully demonstrate the accuracy of these statements; and nothing could more completely show that the Council actually opposed the construction of works which would have prevented the recent dearth of water in East London. Evidence to this effect comes in on every hand; and it is marvellous that the Council should attempt to disown the part which they have so palpably taken in opposition to the proposed works, and for which opposition they have claimed credit in the past.

A second article from "Our Special Correspondent" has appeared in the columns of *The Times*, on "The Water "Supply in East London." The writer declares that the Company are not to blame for being "too late with the "additional storage." The County Council opposed the Bill of 1893 on the plea that the proposed works were unnecessary. The Special Correspondent says on this point: "The facts of the present emergency, however, "prove the contrary beyond the possibility of denial." The Council are accused of making "a very great "blunder;" and it is remarked, therefore, that the present Council show "no little hardihood in venturing to take the "Water Company to task, and particularly in suggesting "that the Council's Engineer should come to the rescue of "Mr. Bryan." After dealing with some other parts of the question, and remarking that "we have clearly gone too "far in abolishing cisterns," the writer concludes by saying: "Finally, public confidence in the London County "Council as a possible substitute for the Water Companies "has not been increased by this striking exposure of its "capacity for blundering."

The biassed and bitter attitude of the Press towards the London Water Companies has so often been the subject of notice in the JOURNAL, that it is positively refreshing to be able to refer to journalistic comment of a juster character. The *Morning Post*, in a leading article, has taken a line on this question which affords a notable contrast to the unfair and impulsive methods of some of its contemporaries. Referring to the persistent opposition of the County Council, the writer of the article in question touches in particular upon the facts connected with the defeat of the East London Company's Bill in 1893, and proceeds to declare that it is plain that the action of the Council in 1893 and 1894 was dictated by the persistent policy of the Progressives to wage an irreconcilable war against the Companies. Our contemporary says truly that the Council's avowed object has been to "depreciate the "Companies materially and morally. In the particular "course they pursued with reference to the Bills of the East "London Water Company, it is patent that they were more "anxious to prevent an increase in the assets of that under-"taking than to safeguard the health and comfort of the "consumers." This is a statement of unusual frankness; and, as we have just said, it is absolutely well founded. The onslaught on the East London Company's Bill was simply a move in party politics, of the probable results of which, already experienced at the East-end, the then Chairman of Committees expressly warned the House of Commons. Is it not time, asks the *Morning Post*, for the Progressives to abandon this attitude of reckless and indiscriminate hostility? And is it not time, we, for our part, may ask, for the Press to follow the example of our contemporary, and teach the Progressives a saner policy? After all, it would be little more than making a virtue of necessity; for experience shows that the former tactics of the party referred to were absolutely mistaken. The decision of Mr. Plunket's Committee has made it abundantly clear that Parliament will never sanction the compulsory purchase of the water undertakings by the Council on terms of a confiscatory character. While uttering this warning to the restless spirits of the County Council, the *Morning Post* also makes an appeal to the Companies—urging them to formulate proposals either for a fair purchase or for such modifications of their statutory powers and for such a measure of public control as would put an end to the present injurious strife between the water interest and a public authority. Of the spirit of this suggestion, no one can complain; but it is to be feared that the appetite of the irreconcilables could not thus easily be appeased. Nothing that the Companies, with a due sense of what is owing to their shareholders, might propose, would be likely to commend itself as a "fair" basis to the rapacious county councillor. But, then, it is true that, for the time being, this particular type of councillor is not in the ascendant. If the householders who have changed the balance of parties have made up their minds that any purchase of the water undertakings must be on equitable terms to the present proprietors, and that the controlling authority of the future must not be the County Council, then, indeed, the prospects arising from a renewal of negotiations will not be without some elements of encouragement.

It was with considerable hesitation that Mr. Justice Cave gave judgment in favour of the consumer who has been in litigation with the Southwark and Vauxhall Water Company on the question of what constitutes an efficient waste-preventing apparatus. The point turned on the construction of regulation No. 21 made by the Board of Trade pursuant to the Metropolis Water Act, 1871, which requires every water-closet to have an efficient waste-preventing apparatus so constituted as not to be capable of discharging more than a specified quantity, unless it be deliberately made to do so. The case originally came before a Police Magistrate, who decided against the Company, though on grounds which Mr. Justice Cave did not adopt. If there had been any evidence of the existence of a nail or a hook by which the chain could be fastened down, or of any weight attached to the chain so as to hold it down, the learned Judge would have ruled that the consumer had violated the regulation, and rendered himself liable to a penalty. But, in the absence of such evidence, his Lordship (with whom Mr. Justice Lawrance concurred) considered that the fact that a little water escaped in excess of the two gallons when the chain was held down by the hand was not enough to bring the case within the scope of the regulation. It may be questioned, however, whether this is not a rather dangerous application of the maxim "*De minimis non curat lex*," inasmuch as "a little water" escaping on one occasion in the manner suggested means a great deal of water when the occasion or the possibility is multiplied by the number of days in the year, the number of persons in one house, and the number of consumers in a vast area of water supply.

Mr. G. J. Roberts, who was for 35 years in the service of the Dover Gas Company, and for many years filled the position of Indoor Manager, died recently in his 68th year, after a very brief illness.

The Management of the Grantham Gas-Works.—Mr. W. Barratt is retiring from the post of Manager of the Grantham Gas Company on account of the unsatisfactory state of his health. In their half-yearly report, the Directors acknowledge that, for 21 years, he has served the Company faithfully and well, and has placed the concern in its present sound condition. The Company will not entirely lose his services, as arrangements have been made by which he will now act as Consulting Engineer. Mr. R. G. Shadbolt, the Manager of the Low Moor Gas-Works, has been appointed to succeed Mr. Barratt.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 357.)

With the reopening of the Stock Exchange on Tuesday after the Bank Holiday, business was resumed with a fair degree of activity, all things considered. But this rate of going did not increase as the week progressed; but rather tended to relapse into considerable quietude. Prices on the whole did not effect any marked change, but remained pretty steady. A good deal of speculative operating in South Africans made them lively as an exception; while, on the other hand, home railways were about the weakest, owing to bad weather and poor prospects. The Money Market showed no change, nor any prospect of a change. Business in Gas stocks was a very fair average for the time of year; and, although one big issue had a slight relapse, the general tone showed no abatement in public favour, and several nice advances were made in the quotations. The general advance, however, was dwarfed by the great stride effected by Gaslight "A," which opened at 293½, and closed at the "record" figure of 300. Nothing at all was done in any of the secured issues. But all the 10 per cent. preferences rose freely; and the 4 per cent. debenture improved a point. South Metropolitans were a quiet market; but very strong—the "B" touching 310. Commercials were firm and unchanged. Very little business was done in the Suburban and Provincial division. But high prices were readily obtained; and the quotation of Alliance and Dublin was advanced. There was not much doing in the Continentals, except Imperial, and that underwent a slight relapse; but European and Union were very firm. Among the rest, the only noteworthy point was the further recovery in Buenos Ayres issues. The Water Companies were almost stagnant; and the only change was a good rise in West Middlesex. Kent meet to-morrow to declare their 12 per cent. dividend, which suffers no abatement from the great frost.

The daily operations were: The Gas market re-opened very bright and buoyant on Tuesday; and though transactions were not very numerous, some capital prices were obtained. Gaslight "A" advanced 1½; and ditto 4 per cent. debenture, 1; Alliance and Dublin, ½; Buenos Ayres, ¼; and ditto debenture, 1; but Imperial Continental fell 2. Business on Wednesday was about the same pitch; and prices were equally strong. All the Gaslight 10 per cent. preferences rose 3 each. Thursday's transactions were a little quieter. But there was no abatement of values generally; while Gaslight "A" advanced another point. In Water, West Middlesex rose 2. The condition of the market on Friday was much about the same, with excellent prices. South Metropolitan "B" advanced 3; and Alliance and Dublin, ½. West Middlesex Water had a further rise of 2. Saturday was the most conspicuous day, when Gaslight "A" took a big jump of 5 more; and for the first time the stock changed hands at the great price of 300.

ELECTRIC LIGHTING MEMORANDA.

The Proposed Lighting of the Thames Embankment—The Common Sense of Street Lighting—The Electric Light in Manchester—Transfer of the Liverpool Electric Light Undertaking.

A good deal of interest has been aroused by the recent proceedings of the London County Council in regard to the lighting of the Victoria Embankment, which have drawn attention to the generally poor lighting of the streets of London. The absurdity of the proposal to set up a costly independent electricity supply station for this particular service has struck everybody but the Progressive party in the Council, with whom it originated; and the estimated working expenses of the proposed system of arc lighting have induced several newspaper writers to pay increased respect to the known cheapness of gas. With regard to the larger question of the better lighting of the main thoroughfares of the Metropolis, which is recognized to be much more needed than a show illumination of the Embankment, only the *Engineer* seems to have hit upon the principal obstacle in the way of improvement, which is the absence of any united highway authority for London. The Metropolitan Board of Works was originally created to deal with a variety of matters, such as the main drainage, in which London as a whole is interested; but the care of the main roads, including their lighting, was still left to the Vestries and other local bodies through whose districts these arteries of traffic pass. Our engineering contemporary suggests that "some central fund should be used to assist Vestries to improve the lighting of their more important streets;" and it is not to be doubted that some radical alteration of the system of main thoroughfare administration must precede the improvement of the principal streets in this and other respects.

The difficulty in getting a question of street lighting reasonably settled is the uncertainty that prevails among members of highway boards as to where to look for trustworthy guidance in the solution of problems of the kind. The debate in the London County Council which ended in the adoption of a motion referring the question of the Embankment lighting back to the Committee for further inquiry of the nature already reported in this column, was a remarkable illustration of the way in which a sensible resolution may be the outcome of an unintelligent and rambling discussion. One honourable gentleman spoke on this occasion because he often strolled along the Embankment, and liked the existing lighting; while another had a say because he was more interested in other thoroughfares. Hardly one of the unofficial speakers gave, in his remarks, evidence of having looked into the question much more carefully than "the man in the street;" and yet, on the whole, the Council came to a decision of which even the electrical journals approve. Now, the man in the street very often manages to form correct opinions regarding matters brought within his cognizance; and his objection, shared by the County Council, to the spoiling of the Embankment for the sake of giving electricians another job, is eminently creditable to his taste and common sense. It would never do to trust to either of these qualities in the case of an electrical expert. Immediately after the County Council debate, the *Electrical Review* published, "with a view to aid the Council in its deliberations," a view of the Embankment showing arc lamps and an electric tramcar, with trolley wires, in the middle of the roadway. This illustration was described as proving that "neither the arc lamp standards nor the electric tramcar interfere in the slightest degree with the beauty of the surroundings." As somebody was made to observe in a popular play, "a man who will say that will say anything."

The Gas and Electric Light Committee of the Manchester Corporation have reported to the City Council upon the working of the electric light undertaking for the past municipal year. The installation has done well, and received increasing support; the total revenue for the year amounting to £28,640. The cost of generation, distribution, and management was under £11,000; the cost on capital account was £7938; and £4000 was transferred to renewals account. There was thus left a profit balance of £5709; and finding themselves for the first time in funds, the Committee promptly decided to hand over a subsidy of £5140 to the city treasury in aid of the rates. Thus the newest of the commercial undertakings of the Manchester Corporation is made to share the same fate as the oldest, of conversion into an agency for the indirect taxation of the community. Additional plant, to cost £100,000, is to be laid down forthwith to cope with the growing business of the department. The price of the unit has been reduced from 8d. to 6d.; and a largely increased consumption of electricity at the cheaper rate is anticipated. The St. Pancras Vestry might with advantage note the circumstance that in Manchester it has not been deemed necessary to strangle hydraulic power distribution in order to give the Electric Lighting Department a chance.

The City Council of Liverpool, as will be seen from a report in another column, have adopted the proposals of the Electric Lighting Committee for the acquisition by the City of the undertaking of the local Electric Supply Company. The agreed transfer price is £400,000, with which the parties to the bargain profess to be equally satisfied. The share capital of the Company is £250,000, besides an additional sum of £16,000 expended upon capital account; and the shareholders have received 6 per cent. dividends since June last year. There is no getting over the fact that the Corporation are paying a heavy premium to the Company for having been first in the field; and this consideration seems to greatly trouble some members of the Corporation. On the other hand, if the City wants the property, it can only be had for such a price as the owners are willing to accept. The partisans of the municipalization of everything usually argue as though the moment an undertaking can be shown to be worth anything, the local authority should be empowered to acquire it upon their own terms. The case of the Liverpool electric light undertaking will serve to show that this notion of the "divine right" of municipalities to expropriate the adventurers in new enterprises the moment they succeed in bringing their business into a prosperous state, does not work in practice. We shall not discuss here the delicate question of whether or not the Liverpool electric supply undertaking is worth the price at which it is to change hands.

THE RIGHT AND WRONG OF INVENTING.

At the opening meeting for the past session of the Institution of Junior Engineers, Mr. Alexander Siemens, the President, delivered an Inaugural Address which was briefly mentioned in the Journal at the time. We now desire to return to the consideration of Mr. Siemens's remarks on that occasion, with more particular reference to those which he addressed to the subject of inventions and inventors, because they are in the highest degree instructive, and should be reported far and wide for the benefit of that very large section of the community which dabbles in patents. There is no subject of general interest to civilized humanity—not even political economy—in regard to which erroneous opinions are more generally rampant than that of inventions and inventors. We are specially concerned to spread the truth in reference to this subject, because the gas industry is peculiarly afflicted with inventions of a mischievous kind, as our volumes abundantly record; and large sums of money are continually being wasted, and valuable time thrown away, upon the exploitation of "wild cat" patent gas schemes which crumble at the first touch of an experienced hand. It is impossible for a technical journalist to get at the multitudinous

fools who constitute the never-failing support of the schemers of all lands; for the simple reason that these people never look into any of the authorities upon the art or industry which they fancy themselves commissioned to improve. But we can at least make an attempt to reach those young aspirants to gas engineering knowledge and experience who are liable, either in their own persons or on behalf of others, to be carried away by the inventor's mania. It is precisely these young "hopefuls" Mr. Siemens had in view when he observed that "the success which has attended the efforts of many inventors, and the constantly widening field for the utilization of natural forces, exert an ever-increasing fascination over our imagination; and when a young engineer enters practical life, it is not to be wondered at if he dreams of the improvements he may introduce, and of the reward he will earn for his ingenuity." This is an eminently right and proper spirit, as the speaker went on to admit, with which to enter upon one's life-work; for all true progress proceeds from genuine enthusiasm and proper self-confidence, enabling men to bring to their studies that earnestness and thoroughness without which no real advancement is possible.

The point to be specially noted here is that this enthusiasm and proper self-confidence are to be applied to studies. That is just what the popular fallacy prevalent on the subject, and encouraged by certain predatory patent agents, does not admit to be the necessary preparation for successful invention. As Mr. Siemens said, upon this head: "It is a popular superstition that inventors are heaven-made, and that they can produce useful novelties to order in any branch of manufacture where a want exists, if only their attention is drawn to it." In illustration of his teaching, Mr. Siemens mentioned the popular legend of Watt and the kettle, in which an accidental observation is supposed to have straightway suggested the steam-engine. The truth of the matter, which is ignored in the popular version of this story, is that Watt made himself thoroughly well acquainted with all that had been done before; and then he had to work hard before he brought his invention to a successful issue. Hence, said Mr. Siemens, "we may generally say that, in order to approach a problem with the most certain prospect of success, it is necessary (1) to define, as accurately as possible, the want that exists, or the particular object that is to be attained; (2) to be well acquainted with the scientific principles that come into play; (3) to know how the want is met, or the object attained in practical life; and (4) to find out what proposals have been made by others in the same or in a similar case." Mr. Siemens went on to describe several leading inventions. He also gave a sketch of the trials and vicissitudes of their authors, which led up to the lesson he wished to convey—that the advancement of any industry is most hopefully attempted by those who have learnt all about it and are expert practitioners of it; and, conversely, that those people have the worst chance in the race who are not well acquainted with the branch of industry in which they wish to introduce improvements, and who do not study the technical literature bearing on the subject. Yet this latter class of people are precisely those who clamour for cheap patents, and who inundate the Patent Office with their so-called inventions.

Nobody who has had the smallest experience of Patent Office business can fail to agree with the truth of Mr. Siemens's description of the common or "heaven-sent" inventor, as a man who ignores everything and everybody, and scorns all science that does not square with his own crude notions. Summing up the moral of several entertaining stories relating to the projects of persons of this class which had come under his personal observation, Mr. Siemens said it is certain "that a numerous class of people exist who are under the impression that they can advance a branch of industry by suggesting ideas that are plausible to them, quite irrespective of existing experience or of natural laws. As a rule, very little is heard of them in public, because these ideas are seldom of any value. But if by chance an outsider makes a useful suggestion, the most is made of it, and the example is quoted by everybody as a proof that special knowledge is by no means required." The truth is that for one "outsider" who makes a happy hit with an industrial invention, or even with a patent of the extensive class known as "notions"—to produce which no mechanical or scientific training is necessary—thousands of patentees fail, and lose money, time, and heart for honest work of any kind.

Having done our best to repeat and lay stress upon the sound doctrine of Mr. Siemens in this matter, we will proceed to show how the evil is spread. In a certain periodical conducted in the interest of a firm of patent attorneys, which purports to be "scientific," and is certainly "American," there recently appeared a brief article with the heading "Invent Something." It began with the assertion, ascribed to an unnamed "self-made millionaire," that "one of the best opportunities for a young man to make money quickly in these days is to rack his brains until he has invented something useful or that the public wants." Observe the idea—to get rich quickly, without work, by "inventing something." This guide, philosopher, and friend of youth went on to refer to an example. "You know how difficult it is to pick up small coins from a wooden counter. Yet the whole civilized world has growled at and endured it since coins were stamped and counters made, until the other day a young fellow invented a rubber mat with little bristles of rubber standing up thickly all over it. Coins thrown on the mat are as easily picked up as if they stood on edge. The public was quick to appreciate it; and *the inventor need not work for a living any longer.*" The italics are ours, and they are used for the purpose of giving full prominence to the grand ideal. Such advice is about as immoral in its tendency as the tales in sporting newspapers about the fortunes made by stable-boys by backing the right horses; and it is published with the same motive. We should like to hear what a real American inventor of the best type, such as Mr. Hiram S. Maxim, would say about this glorification of guesswork and its rewards.

Far be it from us, as it was from Mr. Siemens, to discourage young students of engineering from trying their hands at inventing, or even to hold up to ridicule the honest endeavours of people who may be mistaken, but who have worked in many instances hard and earnestly enough to deserve a better fate. We know by painful experience, however, that the greed of the outsider, and the covetousness of the hunter after "notions" that may strike the public fancy, are very apt to pass the narrow margin that separates the speculator—that is to say, the gambler—from the thief and the conscious impostor. Men who have followed a profession all their lives are, of course, not very likely to be taken by promises and professions of strangers with a "process;" but for younger gas managers there is an insidious temptation, to be guarded against, in the idea of being connected with something "progressive."

With regard to the attempts of young engineers to invent things, Mr. Siemens himself would probably approve of such enterprises on their part, provided they are not the outcome of presumptuous vanity and disinclination to search out the reasons for established practice. As a rule, however, youth is not the season of life when men create things that are worth creating. It is only when they are well past the student age that young men should venture to strike out fresh lines for themselves. Genius, of course, is above all rules; but geniuses are rare, and even more rarely to be envied. And when a man who knows what he is about deliberately sets his face towards the Patent Offices of the world, on his own account, he will be a fool if he thinks that this is the short and easy way to wealth and a life of laziness, as the American—unworthy of the name—whom we have quoted would imply. For, in truth, he who has an invention worth the attention of the technical world to bring out and perfect, has a long furrow to plough. The most successful inventions more often open out a life of hard work than a life of leisure for their authors. There is nothing the world resents more than improvement; and whoever presumes to set up for the instructor of his fellows is lucky if he escapes stoning. We do not care to speak here of the Stock Exchange variety of inventor. Sometimes a shrewd combination of the mechanician or chemist with the financier succeeds in exploiting himself and his inventions without having to endure the labours and pains of a probationary period. But such good fortune, again, is of the rarest. Once and for all, let it be said that whoever is attracted to the idea of "inventing something" as a way of becoming rich without labour or anxiety, in order to live happily and lazily ever after, had better take to the Turf or go to Monte Carlo instead, and so save himself from wasting his pains upon a peculiarly unpromising kind of speculation.

Mr. T. Glover, who has lately succeeded Mr. W. Littlewood as Manager of the West Bromwich Gas-Works, has received an addition of £50 per annum to his salary, with permission to reside away from the works, the situation of which has been found to considerably affect Mrs. Glover's health.

Sudden Death of Mr. T. Lightbody.—On the evening of the 5th inst., Mr. Thomas Lightbody, the Manager of the gas-works at Kilbarchan, Renfrewshire, died suddenly of heart disease. He had been in his usual health during the day. Mr. Lightbody was a native of Lanark, and settled in Kilbarchan 22 years ago. He was in his 67th year; and he leaves a large grown-up family of sons.

A Memento of The Gas Institute Excursion.—Our Scotch Correspondent writes: "I have been favoured by Mr. R. F. Hislop, of Paisley, with several snap-shot photographs which were taken by him on board the steamship *Glen Sannox*, on the occasion of the excursion of The Gas Institute in June last. They are excellent, and contain portraits of quite a number of well-known members of the Institute. They form a very pleasing remembrance of a very enjoyable event."

Presentation to Mr. H. Seagrave.—The position of Chief Accountant to the Sheffield Gas Company (which was recently advertised in the JOURNAL) has been secured by Mr. Herbert Seagrave, who, for nearly a quarter of a century, has been associated with the Gas Department of the Nottingham Corporation. His colleagues in the Accountant's offices would not allow this lengthened service to terminate without some tangible mark of their friendship; and accordingly last Friday week they presented Mr. Seagrave with a beautiful oak stationery cabinet. The gift was handed to him by Mr. W. Garton, who paid a high tribute to the zeal and ability with which he had discharged his duties. Mr. Seagrave thanked the contributors for their kindness, and remarked that he trusted his future business relations would be as cordial as those that had existed between the staff of the Nottingham Gas Department and himself.

NOTES.

Acetylene as a Standard of Light.

It is reported that M. Violle, the proposer of the so-called absolute platinum standard of light, has been engaged in a research with the object of ascertaining the capabilities of acetylene for furnishing a practicable standard of light. M. Violle claims to have succeeded in adapting the new illuminant to this purpose, by burning the acetylene under a somewhat high pressure in a burner to which air has free access, and which gives a flat flame. The light obtained in this way is described as very steady, brilliant, and white. Before the flame of acetylene, M. Violle places a screen, pierced with an opening of a given size; and in this way he thinks that he has obtained a standard of light which for constancy, whiteness, and brilliancy is comparable to his absolute platinum standard, and which, he considers, ought to make a safe and convenient secondary standard. Our information respecting these proceedings of M. Violle is derived from the *Electrician*, which does not give the original authority. As it is quite possible that M. Violle's new proposal may be hailed, like his former one, as a triumph for French science, it will not be superfluous to point out that the method followed by him for burning acetylene in air was first used and described by Professor V. B. Lewes, and that the adoption of a perforated screen to convert the flame so produced into a standard of light is simply the Methven principle. Given an acetylene flame and a Methven screen, and the suggestion for combining these elements into a standard of light does not call for much originality. Nor does it appear that the correlation of the value of such a standard to that of the futile platinum standard adds anything to its intrinsic worth.

Cox's Pipe Computers.

An ingenious device calculated to be of use to gas engineers has been patented by Mr. William Cox, of Stapleton, New York. It is called a gas-flow computer, and is a mechanical aid to the solution of problems relating to the flow of gas in horizontal mains. The construction is based upon Dr. Pole's well-known formula—namely discharge in cubic feet per hour $= 1350 \sqrt{\frac{\text{diam.}^5 \times \text{pressure}}{\text{sp. gr.} \times \text{length}}}$; where the pipe diameter is taken in inches, the pressure in inches of water, the length in yards and the specific gravity refers to air as unity. The formula is tedious to work out, especially when it is transposed for the purpose of ascertaining a suitable diameter of pipe for a given discharge. Cox's computer not only solves immediately either of these aspects of the problem, but also shows at a glance the effect of the smallest modification of either the pressure or the specific gravity of the gas; so that the most suitable combination of all the factors entering into any problem of the kind is at once ascertainable. The instrument consists of a foundation plate, with a graduated outer circle or dial, within which a disc, similarly graduated on its outer edge, revolves on a common centre. The graduations are scales of discharge and pipe diameter respectively—both covering a wide range of values. At the bottom of the instrument there is also a short moveable arc, having the same centre as the disc, bearing scales referring to the other factors of the problem; and the whole is so arranged that, by revolving the disc and combining certain divisions or quantities of any four scales, the resulting value of the fifth quantity appears. The appliance is mounted on a board, measuring 12 inches by 14 inches, and provided with brass swivels and nuts for locking the disc and arc in any desired position. Briefly, therefore, the instrument can be described as a means for showing at a glance the discharge of gas from pipes of from 1 to 48 inches diameter, and from 10 to 10,000 yards long, for any pressure from 0·7 to 4 inches of water, and any specific gravity from ·40 to 1·00. When the required discharge and the length of pipe are given, the diameter corresponding to any pressure is shown; and when the required discharge and the length of pipe are given, the pressure corresponding to any diameter is disclosed. A separate scale, called a "section scale," is also provided, by means of which the diminished pressure and the increased discharge are at once ascertained, when the gas is distributed in equal quantities at two, three, four, or any given number of equally distant points along a line of pipe, as in the case of street connections. Another form of the instrument is made for water-pipe computations.

The Comparative Cost of Hydraulic and Electric Power.

At the recent meeting in Glasgow of the Institution of Mechanical Engineers, Mr. E. B. Ellington read a paper on hydraulic power supply in towns, which brings the available published information on the subject up to date. The character of the paper forbids its publication in our columns; but it contains one passage, relating to the comparative cost of hydraulic and electrical power supplies, which deserves to be recorded, on account of its bearing upon the recently reported monopolist policy of the St. Pancras Vestry. It so happens that the materials are available for a comparison between the cost of a public supply of hydraulic power and that of electricity obtained from a central station on almost the same scale. Mr. Ellington gives particulars taken from the records of the London Hydraulic Power Company and of the Westminster Electric Supply Corporation for the year ending Dec. 31 last. In making the comparison, 1000 gallons of water, at a pressure of 750 lbs. per square inch, is taken as equivalent to 6·518 Board of Trade units of electricity. Mr. Ellington's analysis shows that the station cost of the hydraulic power is 5·172d. per 1000 gallons, pumped at the pressure of 750 lbs. per square inch; while the corresponding cost of an equivalent amount of electric energy reduced to the same hydraulic standard is 9·014d. per 1000 gallons; or on the electrical standard of Board of Trade units, 0·793d. and 1·383d. respectively. The output during the year, the capital employed, and the average rate received for both supplies, are nearly the same. The coincidence of the figures is extraordinary, Mr. Ellington remarks, except in the cost items, in which their divergence is equally remarkable. No other conclusion can be drawn than that for some reason or other, not hitherto explained, hydraulic power is much less costly to produce than electricity. The Westminster electric supply is one of the largest in the country; and its cost is one of the lowest. The London hydraulic supply is the greatest anywhere, and is produced no doubt very cheaply. In neither, however, has the minimum cost been reached. The figures of other electric supply undertakings having a better load-factor than the Westminster show a similar difference of cost as compared with the hydraulic supply. Yet Mr. Ellington does not think there is anything to be gained by employing steam-generated hydraulic power to generate electrical energy for lighting. He holds that hydraulic power is clearly much the most economical for those applications where the direct pressure can be utilized, as for lifting and pressing. Where rotary motion is needed, the special circumstances of each case will determine what power shall be used, and all are now more nearly on a par as regards cost. In London hydraulic power costs after the rate of 1s. 6d. per 1000 gallons, which is equivalent to 2·76d. per Board of Trade unit; or, say, 3d. per brake horse power per hour.

Quick Foundation Work.

According to the *Engineering Record* a novel method of sinking foundations in treacherous soil was successfully employed for the Johnston Building, New York City. Some 27 feet of mud and water charged with sand had to be passed through before the solid rock could be reached. It was therefore decided to adopt the well system of foundations. The diameters of the wells varied from 5 ft. 5 in. to 13 feet, according to the load to be carried; and in all 44 of them were sunk. They were built of ¼ inch to ⅜ inch steel plate, in 6 feet lengths. The shoe at the bottom consisted of a number of hollow cast-iron segments, having a serrated cutting edge. Each segment was connected with a supply of high-pressure water, which was allowed to issue from small perforations in the shoe. The soil around the foot of the cylinder was thus loosened; and there was no difficulty in forcing it down to a firm foundation by loading it. The maximum water pressure required was 150 lbs. per square inch. When the wells reached firm ground, the enclosed material was dug out from the top; triangular struts being used to keep their shape. It had been anticipated that quicksand would flow in under the shoe, in which case grout would have been pumped down through the water-pipes; but this precaution proved to be unnecessary. The interior of the cylinders was filled with concrete. The work was done very rapidly; some of the wells being sunk to their full depth in three hours.

Incandescent Gas v. Electric Lighting at Vancouver.—A further exemplification of the fact that incandescent gas lighting is ousting the electric light in some of the places where the latter has been much favoured, has just reached us from Vancouver (British Columbia). It seems that electric lighting was introduced there about eight or nine years ago; and both arc and incandescent systems have since been employed. Some twelve months later, gas put in an appearance—the Company starting with two consumers, and gradually increasing till they now number six hundred. Things would probably have gone steadily but for the advent of the Welsbach system. This appears to have captivated the City Council; for we learn that, at their request, the Gas Company have put up some powerful street-lamps containing clusters of incandescent gas-burners. The effect has been marvellous. There are no shadows whatever; the light is perfectly steady, and so good that a newspaper can be read 60 yards away in an open space—no other light being near, or interfering in any way. The general public freely admit that the new burners are far superior to the present system of arc lighting, which is supposed to furnish the light of 2000 candles per lamp; and the Council will, no doubt, adopt them for street-lighting purposes. We are informed that the Welsbach burners are replacing arc and incandescent electric lamps for private lighting throughout the town, notwithstanding the fact that the Incandescent Lamp Company refuse to sell, but charge a yearly rental of 12s. per lamp, 3s. for a single mantle, and 1s. for chimney-rental, paid in advance. Our correspondent states that, if these lamps could be purchased outright, electricity would be swept from the field in two years. The action of the Council looks like "good business" for the Gas Company, as they are in a fair way to get the public lighting and the lighting of the municipal buildings. Meanwhile, they are not standing idle, as they are putting in about 16 meters and stoves per month.

TECHNICAL RECORD.

THE HEATING VALUE OF COAL GAS.

By David Vass, of Portobello.

[A Paper read before the North British Association of Gas Managers, July 25, 1895.]

Coal gas is now used so extensively for other purposes than lighting, that I think I may make bold to remark that a test of the luminosity by photometry does not sufficiently deal with the product of which we are sellers, and to suggest for adoption, conjointly with, or in substitution of, the photometric standard, a standard of comparison having a more direct relation to the calorific value of the gas, instead of remaining content with the vague assumption that the heating value of a gas varies with the illuminating power. When the question of "High *versus* Low Candle Power Gas" is discussed, it is invariably suggested that we are sellers of light, and not merely sellers of gas. I prefer to support the idea that we are sellers of energy in the form of gas. We may look upon coal gas as a convenient form of heat-energy, ready to be utilized, primarily for lighting purposes, by direct combustion, or indirectly by incandescent lighting; secondly, for domestic purposes in cooking and heating stoves; and, thirdly, for commercial purposes, in reproducing energy by means of the gas-engine. Undoubtedly, our oldest friend—lighting by direct combustion—is still our best friend; but the others have assumed such importance that they demand some consideration at our hands.

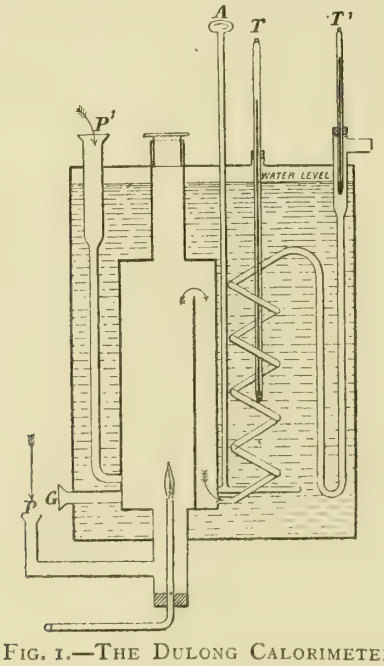


Fig. 1.—The Dulong Calorimeter.

In testing the heating value of combustible substances, the most convenient method is to transmit the heat to a measured volume of water; and I will describe some instruments specially designed for this purpose. Dulong's calorimeter (fig. 1) is an instrument designed for examining the amount of heat evolved during the combustion of solids, liquids, or gases. It is a simple apparatus, and one which only requires very slight modification to suit our purpose. It consists of a combustion chamber surrounded by water contained in a calorimeter, wherein moves an agitator, the stem of which is seen at A. The gas is conducted into the chamber through the tube, and the oxygen necessary for combustion enters by one of the tubes P or P¹. The products of combustion pass through the worm, and finally escape, but not until they have fallen to the temperature of the water in the calorimeter. Two thermometers, T T¹, are fixed—one to indicate the temperature of the water, and the other that of the products of combustion at their exit. For accurate work, these two thermometer readings should agree. The progress of combustion is observed through the opening G, which is closed by a piece of glass. The water in the calorimeter is a measured quantity; and its rise in temperature for a given volume of gas burned is taken as the datum for the results.

Taking this instrument as a basis, I designed one (fig. 2) in which the worm encircles the combustion chamber, instead of occupying one side of the cooling-vessel. This alteration was made with two ends in view—(1) to economize space, so as to have a more convenient form of instrument; and (2) to equalize the temperature of the water throughout the calorimeter, without the aid of the agitator. On the second point I have not been altogether successful. The heat of the flame striking the top of the combustion-chamber, causes more rapid heating of the overlying water at that point than at the lower depths of the calorimeter; but this I hope to overcome by introducing a bell to carry the products of combustion to the bottom of the combustion chamber before they come into direct contact with the heat-absorbing surface. The combustion chamber is made of

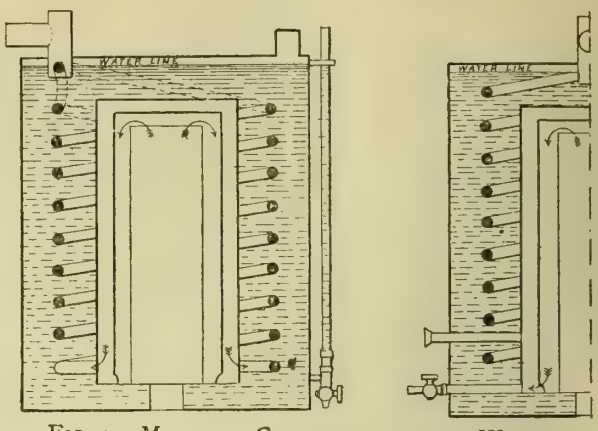


Fig. 2.—Modified Calorimeter, with Worm.

copper, and there is a partition of tin plate to cause the products of combustion to travel to the lower level of the combustion chamber, and there to enter the worms. Some difficulty was experienced in winding copper tubing sufficient in cross section to carry off the products of combustion; and for this reason two worms were used—their outlets being connected.

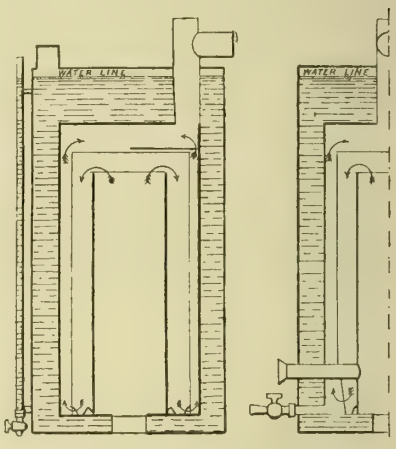


Fig. 3.—Modified Calorimeter, without Worm.

In the arrangement shown in fig. 3, no worm is used. The gases pass downwards between the tin-plate partitions, and come in contact with the cooling surface at the bottom; then, travelling upwards between the tin-plate partition and the cooling surface they pass out at the top.

I have related some of the difficulties in construction and points to be avoided for the benefit of anyone experimenting on the same lines.

An instrument known as the "Junkers Patent Calorimeter" has recently been placed on the English market,* and so far as I can ascertain, it is the only calorimeter in the market adapted for testing gases. In this instrument, the products of combustion pass downwards from the top of the combustion chamber through two rows of tubes, which are surrounded by water. A constant stream enters at the bottom of the annular water-space, and, passing upwards, is heated by the tubes already mentioned, and by contact with the sides of the combustion chamber. The rate of flow and the increase in temperature of the water are noted; and the multiple of these is the calorific value of the heat imparted to the water by the quantity of gas consumed.

There is very little difference in principle between Dulong's and Junkers' calorimeters; but one great drawback to the general adoption of the latter is the cost (£23 10s.). I am confident that an instrument as substantial and satisfactory, but less elaborate in finish, which could be put on the market at less than half the present price, would come in for more general use, instead of being kept for ornament as a highly-finished, high-priced instrument is apt to be.

The general adoption of any form of instrument would turn attention towards the perfecting of an appliance to be adopted as a standard; and such an instrument should be simple, reliable, substantial, and not too costly in finish.

Discussion.

Mr. J. M'Gilchrist (Dumbarton) said it would be most interesting to hear Mr. Vass's experience of the heating powers of different qualities of gases. He understood that the instrument Mr. Vass had designed was correct in its working.

Mr. Vass said it was with the view of ascertaining if there was a relation between the heating value and the lighting value of a gas that he began, some time ago, to make inquiries into the subject; and his first difficulty was to get an instrument suitable for the purpose. At that time, he had not seen the Junkers calorimeter. It was only advertised about November last (but at a price which, he thought, would not be acceptable to most gas managers); and he formed the idea that he would

* See Journal, Vol. LXV., pp. 71, 644.

like to make an experiment. He had found difficulties with instruments, some of which he had pointed out; and the reason he had mentioned those difficulties was that other investigators working on the same lines might know them. One difficulty was the winding of the tubes; and the other was the heating of the water at the top, owing to the flame striking at that place. Alterations on account of this had delayed the making of any experiments sufficiently satisfactory to place before the meeting; and he would prefer to have time in which to experiment with the apparatus before he could suggest anything to the members. His present communication was intended more to "draw" gas managers as to whether or not they thought it advisable that they should have a calorific test in every gas-works. He thought they should; but one drawback with him had been the expense involved.

Mr. T. D. HALL (Montrose) thought they could not but thank Mr. Vass for the paper he had just read. There was something novel in the idea of being able to tell a consumer the value of his gas for heating purposes. Most of them had consumers who did not use gas for heating or motive power; and they were occasionally asked by them the value of their gas for these purposes. Sometimes consumers would quote the illuminating power, and ask with regard to their gas which they made of higher illuminating power than their neighbours, and consequently dearer, if they would not be better with a gas of lower lighting power; and he thought that if they had an instrument like that described, they would be able to answer the question. They were assured by gas engine and stove makers that they had quite as good results from gas of low illuminating power as they did from the rich gas which they had in the North. If Mr. Vass could perfect his calorimeter, he would put an instrument into their hands which, as gas managers, they would find extremely useful.

Mr. A. MACPHERSON (Kirkcaldy) said it should not go forth to the world that they could get the same results from a low-quality as from a high-quality gas. He thought Mr. Young had made it very plain that morning that, if they had a high-quality gas, they would get an equally high value, however they used it, whether for heating or for motive power purposes. There was no doubt that in the illuminating power the carbon was what controlled the light; and it was the same with the heat and motive power.

Mr. A. YUILL (Alloa) also considered that the remarks of Mr. Hall should not go forth. He held in his hand a report from one of the largest gas-engine makers of the day. He put to him the question as to what was the difference between 16 and 30 candle gas; and the reply was that the percentage of 16-candle gas was 11, and the air volume 89. If they were dealing with 20-candle gas, the percentage of gas was 9·5, and the air volume 90·5. If they were dealing with 30-candle gas, the gas fell to 7 per cent., and the air volume was 93 per cent. This clearly showed that, the richer the gas, the less they required for motive power. When they came to Dowson gas, they required 44 per cent. of gas and 56 per cent. of air. This was going the other way; and it very clearly demonstrated, he thought, that the richer the gas the less they required of it.

Mr. D. M. NELSON (Glasgow) said the question before them was one which had been often raised—whether the blue or the white flame (meaning low or high quality gas) did the most cooking. He was in a position to state, with reference to two stoves, identical in all respects, except that to the one 20, and to the other 26 candle gas was supplied, that a joint was cooked by the 26-candle gas in a third of the time in which one was cooked by the 20-candle gas. He was satisfied of this, that the calorific power of rich gas was greater than that of low-quality gas, notwithstanding the authorities to the contrary. With a high-quality gas, they did cooking in less time than with low-quality gas, and with a corresponding saving of gas.

Mr. J. HEPWORTH (Edinburgh) remarked that, though these observations were taking them rather off the line, they were perhaps useful. He did not think anyone would dispute that high-quality gas had a high calorific power; but in the southern part of the kingdom they had gone farther, and said: "Yes; but which is the cheaper to use?" This brought them back again to the paper. He thought if they had an instrument like the one described, and observations could be made regularly with it, it would be useful to the manager of a gas-works, in enabling him to know what was the calorific value of the article he was selling, as well as he knew the illuminating power. He wished Mr. Vass had been able to give them some illustrations as to what he had found, in ascertaining the thermal value of gas. This would follow afterwards, of course; but as a matter of fact, if they had the power to make the tests alluded to, it would be of great advantage to them, by enabling them to see what was the value of their gas, now that it was so largely used for heating purposes.

Mr. HALL said he would just like to mention that, while admitting that from a rich gas they would get possibly better results than from a poor one, they at the same time all knew that the richer the gas the more difficult it was to develop heat; and the question of price had also to be looked at. Where gas was only employed for heating and motive power, he still said it was a question whether it was not very much cheaper to use gas of low illuminating value for this purpose than a rich kind which was difficult to develop, not only in stoves but also in gas-engines.

Mr. MACPHERSON said he must entirely differ from Mr. Hall in this matter. There was not the slightest doubt that this was the old bogle raised. They were told they could not burn 28-candle gas. But they all knew this to be downright "bunkum," for they could burn any quality of gas. It was said that they could not reduce the carbon—that there was a greater difficulty in getting the full value from the carbon in a high-quality than in a low-quality gas. Well, there was as much difficulty, and more, in admitting too much air to the low-quality gas, and thereby cooling the flame. If they had a little too much air, in the case of the rich gas, they did not suffer so much as they did in the case of the poor gas, because they reduced to a greater extent the heating power of the low-quality gas by the admixture of too much air.

Mr. HALL thought everybody who had had any experience of using the two qualities of gas would admit that they had less trouble with the low quality, both in lighting and heating. As gas managers, they knew very well how to burn any gas; but the difficulty was to educate their consumers.

Mr. MACPHERSON said the apparatus could be made suitable. They knew that a gas-fire made for English gas would not burn Scotch gas; but they had makers who could produce stoves to suit each. It was the same with gas-engines. The matter was regulated for them; and the consumer was only called upon to turn the tap.

The PRESIDENT said the discussion had wandered into a sort of side issue; but he thought this only showed the necessity for having an instrument such as the one described, by which to measure the heat. He could only say he hoped Mr. Vass would be encouraged to go on with his inquiries.

Mr. VASS said it was a complaint from a consumer who used a cooking-stove, that there was not sufficient pressure to do the cooking, which put him upon his inquiry. He had been using an inferior coal; and he set himself to ascertain whether there was really so much difference in the heating power of a low-quality gas as to cause such inconvenience. It was not with the view of putting forward any special system that he took up the subject; but rather with the idea that gas managers might be induced to turn their attention to experiments in that direction. One man could not arrive, in the little time he had at his disposal, at what would be the best and cheapest thing for the trade. He wished to get others to look at the question; and perhaps something more might be arrived at.

GAS MAKING FROM SPLINT AND SHALE, AND FROM SPLINT AND OIL.

By A. WADDELL, of Broughty Ferry.

[A Paper read before the North British Association of Gas Managers, July 25, 1895.]

For the past year or two, the subject of the enrichment of coal gas by means of oil has been receiving a considerable amount of attention. At our two previous meetings, the application of the Peebles process to that purpose was prominently brought under our notice; and at the "Informal Meeting of Gas Managers," held in Glasgow during the spring of the present year, the subject received a good deal of attention. Having had some little experience in the use of oil as an enriching agent, it occurred to me that I might contribute a paper giving the plain and unvarnished practical results we have obtained at Broughty Ferry during the year ended May 31, 1895, stating under what circumstances and conditions they were realized, with deductions therefrom; and I hope they may be useful to anyone who may wish to consider the advantages and disadvantages of the several systems of working, viz.:—

(1) The carbonizing of shale and splint coal, in settings of four retorts by direct fires;

(2) In settings of six retorts on the regenerative principle; and

(3) Carbonizing splint coal in the latter settings, and oil by the Peebles process.

Prior to the introduction of this oil process, we used splint coal and shale, because we had best value offered to us in these materials, owing to local circumstances.

I have given the cost of gas-making materials stored in our works, only adding the extra outlay for purification and cartage of refuse due to the use of shale. But as the price varied largely throughout the year, owing to the late coal strike, and as most of the dear coal was used during one section of the year's working, it would be unfair to that section to charge all the increased price of coal against it. Therefore, in order to make a fair comparison of the different ways of working, it is necessary to estimate what the results would have been with coal at uniform cost; and I prefer to take our contract price for this purpose.

To enable those who may desire to do so to verify the year's results, I have here our balance-sheet, from which it can be seen that the total cost for materials was as under—

Gas coal	£1774	4	6	
Gas oil, *plus* royalty, at £2 15s. per ton	442	7	2	
	£2216	11	8	
Less residuals	1075	3	11	
				£1141 7 9

To this £1141 7s. 9d. there falls to be added—

Extra cost of purifying	£53 7 9	
Trimming of coals	34 3 9	
Cartage of odd quantities of coal	24 13 3	
Cartage of shale refuse	11 3 6	
Excess of coals over invoice weight	10 2 0	
		£133 10 3
Making with the		1141 7 9
A total of		£1274 18 0

Gas made during the year 1894-5, 33,692,000 cubic feet.
Average illuminating power for the year, 26·02 candles.

These figures, so far as this paper is concerned, are all important. They are the sum of the three tables "A," "B," and "C" which follow, are half the subject matter, and must form the basis of most particulars hereafter given. According to them, the cost of gas for the year was—

Per 1000 candles . . . . . 1·71d.
Per 1000 cubic feet of 25-candle gas . . . . . 8·56

With coal at our contract price, the cost would have been—

Per 1000 candles . . . . . 1·47d.
Per 1000 cubic feet of 25-candle gas . . . . . 7·36

The materials given in Table A were carbonized from June 1 to Aug. 9 last year in settings of four retorts by direct firing; and the bench was in good order. The retorts and settings being renewed annually, is evidence that nothing was spared to keep this plant in good condition.

TABLE A.

	Tons.	Cwt.	Rate per Ton.		
Splint coal	153	14	9s. 11¼d. =	£76 8 8	£166 6 6
Shale	117	5	15 4 =	89 17 10	
Cartage of shale refuse, 70½ tons at 8d.					2 6 10
Extra cost of purification incurred on account of excess of impurities in shale = 1·33d. per 1000 cubic feet					12 8 9
					£181 2 1
Less residual products, coke *nil*, tar, and ammoniacal liquor, at 3s. 2d. per ton of coal carbonized					38 10 11
					£142 11 2
Less, calculating splint coal at 9s. 2d. per ton (the contract price), a difference of					7 12 4
					£134 18 10

Gas made from above material . . . . 2,269,500 cubic feet
Average illuminating power . . . . . 25·81 candles
Cost per 1000 cubic feet . . . . . 15·07d.
Cost per 1000 candles . . . . . 2·92d.

Taking the above splints at 9s. 2d. per ton (the contract price), the cost would be—

Per 1000 cubic feet of 25-candle gas . . . . . 13·8d.
Per 1000 candles . . . . . 2·76

It will be noticed no coke was sold while using this setting; and considering the proportion of shale carbonized, &c., the result is not unusual.

The materials given in Table B were carbonized in a good regenerative setting from Aug. 9 to Nov. 5.

TABLE B.

	Tons.	Cwt.	Rate per Ton.		
Splint coal	411	13	13s. 10½d. =	£285 11 4	£531 0 0
Shale	320	0	15 4 =	245 8 8	
Cartage of shale refuse					6 8 0
Extra cost of purifying incurred on account of excessive impurities in shale					40 19 0
					£578 7 0
Less residuals—					
Coke				£54 18 8	
Tar and liquor, at 3s. 2d. per ton of coal carbonized				115 12 9	
					170 11 5
					£407 15 7
Less, calculating splint coal at 9s. 2d. per ton (the contract price), a difference of					96 17 10
					£310 17 9

Gas made from above materials . . . . 7,303,500 cubic feet
Average illuminating power . . . . 25 candles
Cost per 1000 cubic feet . . . . . 13·4d.
Cost per 1000 candles . . . . . 2·69d.

Taking the above splint coal at 9s. 2d. per ton (the contract price), the cost would be—

Per 1000 cubic feet of 25-candle gas . . . . . 10·25d.
Per 1000 candles . . . . . 2·05d.

It will be noticed that in Table B, we had a saving of £54 18s. 8d. in coke sold, though the proportions of splint and shale were similar to those used in the direct-heated retorts.

The materials given in Table C were carbonized in oil-gas retorts from Nov. 5, 1894, to May 31, 1895.

TABLE C.

	Tons.	Cwt.	Rate per Ton.		
Splint coal	2267	13	9s. 10d. =	£1116 0 4	
Shale	40	13	15 3¾ =	31 3 0	
Oil, *plus* royalty, at £2 15s. per ton				442 7 2	
					£1589 10 6
Cartage of shale refuse					1 0 4
Carried forward					£1590 10 10

Brought forward		£1590 10 10
Less residuals—		
Coke	£468 10 0	
Tar and liquor, at 3s. 2d. per ton of coal carbonized	365 9 7	
Oil coke	32 0 0	
		865 19 7
		£724 11 3
Less, calculating splint coal at 9s. 2d. per ton (the contract price), a difference of		75 11 10
		£648 19 5

Gas made from above material . . . 24,119,000 cubic feet
Average illuminating power . . . . 26·79 candles
Cost per 1000 cubic feet . . . . . 7·1d.
Cost per 1000 candles . . . . . 1·33d.

Taking the above splint at 9s. 2d. per ton (the contract price), the cost would be—

Per 1000 cubic feet of 25-candle gas . . . . . 5·95d.
Per 1000 candles . . . . . 1·19d.

It is interesting to notice the gross and net cost of materials with the residuals sold by the various ways of working, as under:—

—	Splint and Shale in Old Settings. A.		Splint and Shale in Regenerative Settings. B.		Splint and Oil by the Peebles Process. C.	
Materials.	Actual.	Allowing Contract Price for Coal, at 9s. 2d. per Ton.	Actual.	Allowing Contract Price for Coal, at 9s. 2d. per Ton.	Actual.	Allowing Contract Price for Coal, at 9s. 2d. per Ton.
	Pence.	Pence.	Pence.	Pence.	Pence.	Pence.
Gross cost per 1000 candles	3·70	—	3·82	—	2·92	—
Residuals sold do.	0·78	—	1·12	—	1·59	—
Net cost do.	2·92	2·76	2·69	2·05	1·33	1·19
Cost per 1000 cub. ft. of 25-candle gas	14·50	13·80	13·40	10·25	6·60	5·95

At the last informal meeting of Scottish Gas Managers, when we had been working with the Peebles process for a very short period, and having (as time has now proved) just passed our initial difficulties, caused by starting the plant before it was quite complete, I then believed, and stated, that we expected to save about 1d. per 1000 cubic feet. I am pleased to-day to admit that I was then wrong. Comparing it with the results of the regenerative working, we save 4·30d. per 1000 cubic feet of 25-candle gas; and with the direct-heated retorts, 7·85d. This, with other improvements, has enabled us to reduce the price of gas 10d. per 1000 cubic feet.

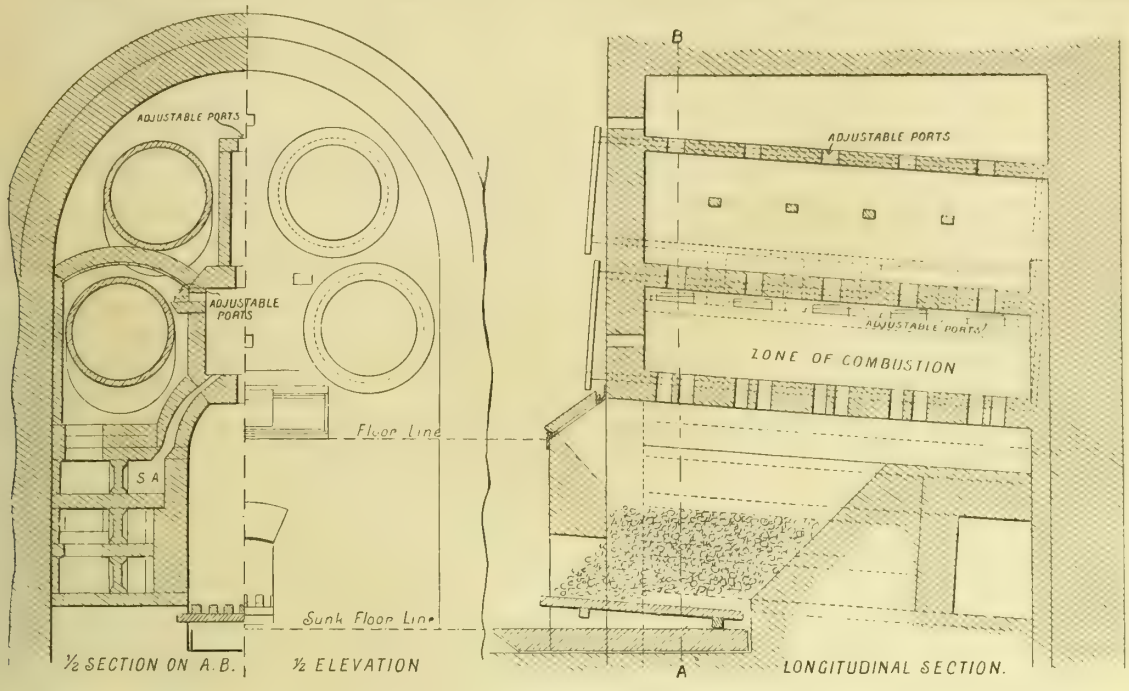
Since the introduction of the process, its simplicity has been recognized by all. We can fully confirm this. When working with two men on each shift, one man had charge of the oil, and the other the coal retorts; and when the second man went off, the coal-retort man had no difficulty in working both coal and oil retorts. At first, the men were rather averse to working the oil-gas retorts; but now they are all anxious to have that work.

When the stock of gas falls low, we find it a great advantage (by simply running more oil into the retorts) to get the lighting power largely increased; thereby giving our consumers sufficient light, if not volume, until we have gained our normal position.

It has been pointed out by others that it depends largely on circumstances what advantages will follow the adoption of this process. In our case, we can secure at a fair cost splint or coking coal, which gives us an excellent coke, for which we have a good market. We receive the same for the tar and liquor from this coal as we did from expensive coals; leaving us a low net cost for material. The Peebles process enables us to use a large quantity of this cheap coal; and the oil is at the same time by far the cheapest enriching system we can secure.

The plant is now well known to you all. It is simple and easily worked, save for one thing—viz., the tendency of the retorts to crack; and this, I understand, is being gradually overcome. We must all agree that, to keep a cast-iron cylinder red hot from without, thereby expanding it, and then to keep flowing along a line of its inner surface, in direct contact with it, a continually cold stream of oil, thereby contracting only that particular part, is surely a severe strain on the iron, and must tend to crack it. To save it from cracking, you must keep the retort, particularly along this line, as near the temperature of the body of the retort as possible, by removing all obstructions in the form of thick brick walls, or any wall at that part. I understand that, instead of a loose steel plate, there has been substituted at some gas-works a steel plate or false bottom to the retorts, held in position by fillets cast on the sides of the retorts. This has given very satisfactory results.

As uniform heating is necessary in coal-gas retort-settings, there has been special reason for saying this in connection with oil-gas retort-settings. We have worked our retorts at Broughty Ferry for more than seven months without the least sign of cracking or unevenness of any kind; the retorts looking as if they would last for four or five years. This means a very great saving in money and anxiety on the part of the manager fearing that the retorts may give way just when they are most needed without others to fall back on.



Oil Setting (Peebles Process) at the Broughty Ferry Gas-Works.

I have here diagrams of our regenerative oil-gas retort-setting designed and worked by me continuously for the past seven years, constructed on the following lines: (1) Large furnace bar area, large producer, combustion chamber, and flue capacity; hence slow travel of gases. (2) The least possible amount of brickwork about the retorts consistent with efficiency, and placed to give uniformity of support—all as thin walls not exceeding 4½ inches thick, with frequent openings immediately around the retorts. (3) Simplicity of construction; and hence economy, with greatest facility to see the interior. (4) The zone of combustion of gases parallel to the retorts, and extending from front to back of the oven; the resultant gases afterwards travelling at right angles to the zone without a turn, save as the arch and wall of the oven direct, until underneath the bottom retorts.

Discussion.

Mr. J. M'Gilchrist (Dumbarton) asked Mr. Waddell if he had saved 7d. per 1000 cubic feet by the introduction of oil—that was, comparing the charges with those of the previous year, when he was working with shale.

Mr. Waddell said the way he had given the facts was this: In the previous year, he was working with shale and splint coal; and he put the cost of the materials used in the previous year against the cost of those used in the year just closed. It might be said that, to some extent, it was in the buying of the coal, or that it was in better working; but he could admit that they had their material for gas making for 7·85d. less than in the previous year.

Mr. A. MacPherson (Kirkcaldy) asked if they paid the same price for splint coal, or if there had been any fall in the value of the coal used.

Mr. Waddell said it was pretty much the same.

Mr. MacPherson asked if Mr. Waddell obtained the same for residuals in the two years. He would possibly get about double for tar and liquor in one year that he did in the other.

Mr. Waddell said that was quite true; the figures were 1s. 10½d., as against 3s. 2d.

Mr. A. Yuill (Alloa) felt it very refreshing to get one standing up and advocating the process which he himself had been advocating all along. At the spring meeting of gas managers in Glasgow, he had to bear a severe castigation; but Mr. Waddell was, perhaps, better able to meet them. The position, so far as he understood Mr. Waddell, was this: He gave his working before the introduction of the oil process, and at the price of coal before the miners' strike. The cost of this appeared to be 15·07d. per 1000 cubic feet. In Table B, giving the contract prices of coal, the cost was 13·04d. per 1000 cubic feet; and the net cost for splint coal, shale, and oil was 7·01d. Then they found, compared with the results of regenerative working, a saving of 4·03d. per 1000 cubic feet. He understood Mr. Waddell to say that there was a saving of about 4d. per 1000 cubic feet by the introduction of the oil process; the difference between that cost and the full saving being attributable to the full saving effected by the regenerative system of heating the retorts.

Mr. MacPherson: And the increased price of tar and liquor.

Mr. Yuill said, naturally, they all had the benefit of that. There was another fact which might, perhaps, bear with Mr. Waddell, which was the large proportion of coke he had to dispose of. He understood that the price Mr. Waddell received for coke was very much in excess of what they generally obtained. He was glad to find that the costs given were very much the same as his own costs. In taking the coal, oil, and royalty, less residuals, for the full year's working, the cost equalled 7·48d. per 1000 cubic feet; but deducting the sum paid owing to the miners' strike—which came to, on the average of the whole year's working, 0·43d.—there would be left a net cost, on the contract prices, of 7·05d. per 1000 cubic feet. It was no use his going into the estimates for this year. He might, however, say that they were considerably less than what their past year's working had been. But there was one thing he might mention. In these figures, they had had presented to them as an Association the actual cost of the oil process for the past year or two; and it might assist in the discussion of questions like this if they had the actual costs to produce the same illuminating power of gas, or near it, placed alongside, so that they might see how they stood in the meantime. They sometimes imagined that they were doing better than other people; but if they kept their eyes open, they might see differently. It might be better if someone had the courage to give them the figures he obtained in the working of coal and shale.

Mr. MacPherson said that, without deducting residuals, he thought it did not cost him so much. He supposed he did not get as good a return for residuals; but, on the whole, he believed he was making coal gas of equal quality as cheap as Mr. Yuill. While he admired the Peebles system, and must allow that it was a most unique process, and one which he believed was bound to make way, there were a great number of things to be considered. For instance, Mr. Yuill said that Mr. Waddell obtained a very fine price for coke. He did not know what the price was per ton.

Mr. Waddell: I get 11s. per ton.

Mr. MacPherson said most of them would consider themselves very happy with something like half of that figure. For his own part, if he had the same amount of coke thrown upon his hands as he would have if he were to go in for carbonizing only splint coal and using oil for enriching, he supposed he would not get more than 2s. 6d. for it. There was no demand for coke; and therefore, as he had said, the benefit of the process was all according to the circumstances of the district. Everyone must consider the subject according to the circumstances in which he was placed; and in his own case he considered that, if he were to adopt oil enrichment, it would entail upon him a very serious loss. He did not say but that, in some places, it might be a very considerable gain.

Mr. Yuill said he had put the question to Mr. MacPherson if they could get the figures which his gas cost; but all his answer was: "I am doing better than you."

Mr. MacPherson said that if Mr. Waddell obtained 11s. per ton for coke, and he could only get half of that, how could he give figures? He could only say he was doing well.

Mr. Yuill said that what he asked for was the net cost of the gas—the plain facts; and they would be able to judge for themselves.

Mr. MacPherson said it simply resolved itself into the old position, that it was a question of circumstances. It was impossible for him to compare what he would do with oil, as against what Mr. Yuill or Mr. Waddell would do, when he told them honestly that he could not get 2s. 6d. per ton for the coke which would be thrown on his hands. He had to use a non-coking coal largely, so as to get it disposed of.

Mr. J. Hall (St. Andrews) said he had not intended to have said anything in the discussion; but he must own that he was very much taken with what Mr. MacPherson had said—that the circumstances of each gas undertaking must rule their preference for splint or oil enrichment. At least to him it was very strongly put. His Directors were most anxious that he should follow suit with those who had adopted the oil process. They had

heard about it, and read the statements made by Mr. Yuill and others about it, and were thinking that they in St. Andrews were not doing what they ought to do. Their place was very small; and it was surrounded on every side by Government property, so that they were obliged to make the most of every corner they had. However, he did contrive to say to his Directors: "Here is a corner in which I can erect apparatus for oil, if you wish me to do it; but I do not think it will be an advantage to you." Their retort-house was very small; and he was obliged just now to work shale, and cannel, and splint. He did not see how he could extend the retort-house—at least very much; and he found, were he to work splint coal only, and use the oil process, that he would have as many retorts working as at present, and he would not make nearly the same quantity of gas. Another thing was that they would not get their coke sold. Their locality was small. They had a demand for coke just now; but at certain seasons of the year they were obliged to sell it at a very low price. They were nearly three-quarters of a mile from a railway station; and cartage cost them nearly 1s. per ton. Then, also, they had to add the reduction in the price they obtained for their tar. Upon the whole, therefore, from what he had heard from some of his younger friends who had adopted the oil process, they had had considerable trouble, and had great doubts whether they were better off than they were before. He had had a talk with one who had been working the oil process all last year; and he had had considerable complaint from his consumers. Of course, that was owing to the burners; but he was no better than he was in the year previous. He thought that, in a locality where they were at a considerable distance from a railway, if they could sell gas of from 25 to 26 candle power at 3s. 6d. per 1000 cubic feet, they were not doing very badly. Broughty Ferry was a near neighbour; and he was naturally a little anxious at living near a gas manager who was doing so well. He thought the paper, in some respects, was not just a fair contrast between the two years—working with a change of retorts. Mr. Waddell entered lately into these works, and had made changes upon them; and the comparison did not seem, to his mind, just so fair as he considered it might be. However, he thought they might give Mr. Waddell credit for what he had done. But his main object in speaking was to confirm what Mr. MacPherson had said—that the circumstances of each case must rule their action. He could not see it otherwise.

Mr. A. Bell (Dalkeith) said that Mr. Waddell's paper was full of figures, and would require some time to look over. He himself had had no difficulty with the oil process; and they had been working it for two years. Some people, apparently, said they had had difficulty; but he had had none—not even a burnt hand in the works. It had been nothing but plain sailing all along. With regard to cracked retorts, he had them badly cracked last year, by careless working. This year he had rolled them round; and they would now serve him another season. Mr. Waddell said he believed that the steel plates would be a very great saving. They had been using a steel plate in Peebles, and probably they would get a report regarding what had been done there. His retorts, unfortunately, had deep mouthpieces; and he could not use a fixed sole plate. But he used plates which were lifted out and in at each charge. As regarded coke, in this matter they could force a sale. When he went to Dalkeith, he could scarcely get into the yard for coke; but he set himself to sell it. He showed the advantage, to bakers and others, of changing their fires from coal to coke; and he had now no difficulty in selling his coke. In fact, last year he had to send to Edinburgh for coke to supply the local people. Of course, everyone must speak for his own circumstances; but he thought if Mr. MacPherson would consent to enlighten them as to his figures, they would be able to make a better comparison.

Mr. T. Douglas Hall (Montrose) said he could not go into the figures, but he would like to go outside the works, and ask Mr. Waddell if he had found it necessary to take charge of the oil gas up to the point of combustion, or if they ever had any difficulty in burning the gas, or in dealing with the consumers.

Mr. Waddell said they would notice that their gas had never been very high, and he had never had any difficulty to speak of. For about two months in the winter time they made gas of about 28 candles. That was too high; and there was a little trouble at that time, but never since. If Mr. Hall was thinking of condensation, he might say—and he thought there were some there who could confirm him in that (at least he could speak for his own town)—that the traps had never been pumped since he went to Broughty Ferry. There was nothing in them; and he understood that they had not been pumped for the last eight years. It was rather a peculiar circumstance, but it was so.

Mr. Hall said it was the burners he referred to—the consuming of the gas.

Mr. Waddell said he had had no difficulty excepting during the two months in which he was making gas of a quality up to 28 or 29 candles.

Mr. J. Ballantyne (Rothesay) said he had not intended to take part in the discussion, for the simple reason that he had had no opportunity of doing anything with the oil process, as they had not even a corner in their works to place it in. They were soon going to have new works; and he did not know what they might then do. A great deal had been said with regard to the price of coke. He understood that the prices mentioned in the paper referred to coke from splint coal, and not to coke from oil. He wanted to ask whether those who were using the oil process found any difficulty in disposing of the coke from the oil, and at what price. He had a hint some little time ago that there was a difficulty about it, and that there was not much more than half the price being realized for this coke that they were led to expect they would get. He would like to get information upon this point.

Mr. Bell said he would like to answer the question, so far as he was concerned. Last year he sold the whole of his oil coke (he sent it to Armstrong's works at Elswick) at the price of 19s. 6d. per ton.

Mr. Waddell said it was only in the first part of the year that they had coke to sell, and they wished to sell it in the place if possible. Some of their buyers were not quite prepared to start with the oil coke at first; but they had now made a contract for the year at 16s. per ton. Since the contract was made, they had had complaints from more than one consumer in the place, that they had sold all the coke to one party.

The President said the question of coke seemed to be bulking very largely in the discussion. He did not see why the oil coke could not be got rid of. The coke from his station alone, in Glasgow, was at least 80,000 tons a year; and they got rid of it at 6s. per ton. They sent it a long way past Fife. Perhaps one of the reasons why they obtained a better price for coke was that it was of better quality, by reason of their using a better coking coal. He did not think there should be any difficulty in getting a market for coke, if it was of exceptionally good quality, when they in Glasgow got rid of what he might call their poor coke. He thought they were all indebted to Mr. Waddell for having had the courage to bring forward his figures. It was the pounds, shillings, and pence that were the root of the matter in the end. Each man had to take his own surroundings, and the circumstances connected therewith, into consideration; but there should not be such a great deal of difference due to locality, but what could be given in figures. If the figures were given as fair as possible, it would be easy to judge of the benefit to be realized from any innovation. He thought they were certainly very much indebted to Mr. Waddell for giving them the figures he had. The only mistake, he thought, was that the figures were too small; if they had been larger, there might have been a better discussion.

Mr. D. M. Nelson (Glasgow) said that no reference had been made to Mr. Waddell's setting of retorts. One of the crucial defects of iron retorts was the want of a proper setting. Now, having taken some interest in the longevity of iron retorts, he (Mr. Nelson) would say that Mr. Waddell had fallen upon a condition of matters in which the life of the retorts would be preserved. He had seen, during the last eight or ten weeks, a setting of retorts discarded because of their being burned out. Now, he thought this would not happen in the case of Mr. Waddell, because he had allowed a certain space for the flame to pass through, so as to heat the retort pretty regularly all over, which would thereby maintain its life.

Mr. Waddell said his paper was nearly altogether a matter of figures; and his desire was that the figures should have appeared more clearly. He said, in his paper, that circumstances had had a great deal to do with the matter; but it was also true that, so far as the coke market was concerned, they were largely assisted by the Peebles process in this way, that it enabled them to use a quality of coal that made a good coke. This was due, to some extent, to the Peebles process. With regard to the comparing of the past with this year's working, Table A gave a fair comparison with last year, with the same price of coal, of shale, and of splint. The circumstances were all the same in this particular case. Table B had the same price of coal again, but with regenerative settings. In Table C they had regenerative settings and the Peebles process. He thought it might be a little interesting to call the attention of the members to the changes from the one to the other. He thanked the meeting very much for the generous way in which they had treated his paper. He had been very anxious to place the matter as plainly and as clearly as he could before them; and if they thought there was anything wrong with the figures he had given, they might just turn back to the reports by others.

Mr. Waddell writes to say, with reference to his answer to Mr. MacPherson's question in regard to the price he obtained for residuals, that he believes it was misunderstood by some in the meeting. The prices he gave were a comparison between what they received at one period of the past year with what they obtained at another period; and were not a comparison between the prices in the past year and those in the preceding year.

The Incandescent Gas-Light Company and the De Mare System.—A short time ago, the Incandescent Gas-Light Company, Limited, applied for an interim injunction against the De Mare Incandescent Gas-Light System, Limited, to restrain them from manufacturing or selling. An order was made for the cross-examination of witnesses for the defendants; but Justice Day, sitting in Chambers, has ordered the proceedings to be stayed, and the application for the injunction to stand over until the trial of the action, without any undertaking on either side.

BAVARIAN ASSOCIATION OF GAS AND WATER ENGINEERS.

The proceedings at the Tenth General Meeting of this Association, which was held at Hof on the 28th of April, have recently been published in the *Journal für Gasbeleuchtung*. From that report the following short abstract is made :—

The President, Herr Horn, of Augsburg, opened the meeting. After accepting the officially tendered welcome to the town of Hof, he called for the Treasurer's report, which proved very satisfactory. At the close of its year, the Association had 95 members. The President was re-appointed for the ensuing year; Dr. Schilling was elected Vice-President; and Würzburg was chosen for the next general meeting. Herr Kullmann read a paper, in continuation of one on the same subject given by him last year, on "The Testing of Water-Mains for Impermeability;" and later on he gave descriptions of the water supplies of the towns of Biebrich and Hof. Dr. E. Schilling then related his "Experiences on the Practical Carburetting of Gas with Benzol" which were gained at the Munich Gas-Works. He considered the price of benzol the most important factor in determining its use for the purpose; and he announced that South German works would be able to obtain it during the year 1895-6 at a price of about 1s. 2d. per gallon, while in future no great rise need be anticipated, since the competition of cannel and of benzol from the English market would be felt. Though cannel was comparatively cheap in Munich, carburetting had, he said, been adopted with favourable results; and the heats of the furnaces had been raised until a gas production of 11,500 cubic feet per ton of coal was obtained—the illuminating power of the gas being subsequently brought up by means of benzol. Revivification of oxide in the vessels, by the addition of 1 per cent. of air to the gas, had been introduced, and the labour of changing vessels thereby reduced to one-third its former amount. The depreciation of illuminating power by the air was counteracted by the addition of benzol to the gas. It was found that about 7 gallons of benzol sufficed, on an average, to raise 100,000 cubic feet of gas to the statutory illuminating power. The carburetting apparatus* is in use in other towns. It is designed to produce an intimate mixture of the benzol vapour with the gas, without exposing the benzol to the atmosphere; and thus risk of fire is diminished. In the summer, it is used cold; in the winter, it is warmed by steam. In Munich, deposits in mains and destruction of flexible joints had not followed the employment of benzol. Herr Haymann, of Nuremberg, then related his experiences with syphons on mains, and recommended boxes of rectangular section for them, as more readily accommodating themselves to the paving of the streets. He said he had found enamelled metal plates better for the tops of street-lamps than the milk-white glass often used. He also spoke of furnaces for burning coke refuse, and of gas-cookers. Herr Horn, of Augsburg, next described his burner for cooking purposes, which has been extensively used in Regensburg and neighbouring towns; and he then proceeded to describe a series of experiments on the heating of the school-rooms at the latter town with gas, wood, coal, and anthracite in turn. With careful manipulation, gas was, he said, found to be as economical as other fuels for the heating of schoolrooms, owing to the frequent periods of disuse; while the temperature could be more conveniently regulated. Herr L. Haas, of Mayence, described a new automatic prepayment gas-meter; and Herr Trostorff, of Nuremberg, read a paper on the Junkers calorimeter.† Herren Teller, of Munich, and Treudel, of Berlin, referred to incandescent lighting; and the meeting was then formally brought to a close. On the following day, a number of members of the Association made an excursion to Dessau to inspect the gas tramway in that town.

Institution of Junior Engineers.—The annual summer meeting of this Institution, whose head-quarters are in London, takes place from the 17th to the 24th inst.; the *rendezvous* being Belgium. The towns to be visited include Antwerp, Brussels, Ghent, and Liége. An excursion to Verviers (where is situated the celebrated Gileppe reservoir, from which the town receives its domestic and manufacturing supply) is also included in the programme.

Mr. Allan Gillespie, who was well known to gas managers, not only in this country but abroad, as foreman in the meter-works of Messrs. W. & B. Cowan, Limited, in whose service he had been for the long period of 29 years, died at Peebles last Friday. Mr. Gillespie was born in Glasgow, at the time when his father was works foreman to Messrs. Cowan; and he went to Edinburgh with the firm when they transferred their business to that city. He succeeded his father as foreman; and in that capacity he had charge of the fitting up of many important meter appliances. He was a most intelligent and faithful employee. Mr. Gillespie's last illness is said to have been hastened by worry experienced in connection with an action he was obliged to defend in the Sheriff Court of Edinburgh, in which a workman sued him for damages for slander. Mr. Gillespie was successful in the litigation; but, of course, he was unable to recover his expenses from the workman. It is satisfactory to know that they were paid for him; but the circumstance preyed upon his mind as much as if he had borne the charge himself.

* See JOURNAL, Vol. LXV., p. 536. † *Ibid.*, pp. 71, 644.

DR. LOVE ON ACETYLENE AS AN ENRICHER.

A short time ago, Dr. E. G. Love, the Gas Examiner for New York, gave a lecture before the Society of Gas Lighting on the subject of "Acetylene as an Enricher." The substance of it was given in a recent number of the *American Gaslight Journal*, from which we have reproduced it.

The future of carbide of calcium, so far as the gas industry is concerned, will depend primarily upon its cost, the quantity of acetylene obtainable per ton of the carbide, and the value of the acetylene as an enriching agent. As to the cost of the carbide, there does not seem to be any probability that it can be produced at a price which will make it available to any considerable extent as an enricher in the manufacture of illuminating gas. There are special cases in which it will doubtless be of great value, even though its market price is altogether too high for ordinary use. Regarding the yield of acetylene and its enriching value, considerable work has already been done experimentally to determine these points; and in what follows, I give some results which I have obtained in these directions.

Theoretically, 1 lb. of pure carbide will give 5·91 cubic feet of acetylene, at 60° Fahr. and 30 inches pressure. This yield cannot be obtained in practice, however, owing to the various impurities which the carbide contains. The highest result I have obtained was 5·34 cubic feet, and the lowest 4·38 cubic feet per pound; the average being a little over 5 cubic feet per pound at 60° Fahr. and 30 inches pressure. The tests were made upon different samples; and the quantity of carbide used ranged from 2·28 oz. to 11 oz.. I see no reason why the carbide, when furnished in large quantities, cannot be expected to yield 5 cubic feet per pound, or 10,000 cubic feet per ton.

In some cases, the resulting acetylene was strongly contaminated with sulphuretted hydrogen; while in others, it was entirely free from this impurity. Its illuminating power is remarkably high—greatly exceeding that of any other gas; and in order to avoid smoking, it is necessary to burn it in small quantities. I have obtained, as the average of a large number of tests with different samples of gas, 56·22 candles for a consumption of 1·224 cubic feet, or 229·65 candles for 5 feet. The quantity of foreign gases in the samples tested in no case exceeded 1 per cent. The burner used was Bray's 0000 flat-flame, which developed a flame without smoke.

In these tests, I aimed to determine the quantity of light which would be obtained in ordinary practice. The somewhat higher result of 240 candles, which has been reported, was obtained by burning the gas in larger quantities and under especially heavy pressures.

Experiments to determine the enriching value of acetylene were made with uncarburetted water gas, carburetted water gas of low illuminating power, and poor coal gas. These were compressed in steel cylinders for transportation to the laboratory. The acetylene for these experiments was prepared with special care. After collecting in a holder, it was submitted to analysis, and none was used which contained more than 1 per cent. of gases not absorbed by bromine and caustic potash. In most cases, the gases other than acetylene amounted to from 0·4 per cent. to 0·7 per cent. No attempt was made to make any one series of tests with a single lot of acetylene.

Tests with Uncarburetted Water Gas.—This gas, which had been subjected to lime purification, had the following composition :—

Hydrogen	49·92	per cent.
Carbonic oxide	38·12	,,
Marsh gas	3·17	,,
Nitrogen	8·79	,,
	100·00	

The solubility of acetylene in water, and its high illuminating power, rendered it very doubtful whether accurate results could be obtained by the simple measurement of the gases and their mixture in a holder. But, in order to determine the extent of this probable source of error, some experiments were first made with mixtures in which the quantities of the two gases were determined by means of accurate meters, but of which no analyses were made. These results are given in the following table :—

TABLE I.—*Mixtures of Acetylene and Uncarburetted Water Gas. (Mixtures not Analyzed.)*

Acetylene. Per Cent.	Water Gas. Per Cent.	Candle Power for 5 Cubic Feet of the Mixture.	Illuminating Value of Acetylene.
19·02	80·98	12·44	65·40
20·30	79·70	15·47	76·21
21·14	78·86	18·68	88·36
23·51	76·49	24·90	105·91
24·82	75·18	26·81	108·02

Bray's standard union No. 7 burner was used in determining the candle power of all mixtures. This burner was not adapted to the poorer mixtures, and probably not to the very highest; but it was employed for all, as enabling one to make a better comparison of results. In most cases, the consumption was from 4 to 5 feet per hour—the results being corrected to 5 feet.

While the figures obtained may be considered as approximately correct, it is probable that the irregularity would have been greater with mixtures containing smaller percentages of acetylene; and the method was therefore so modified that in all other tests the mixtures were analyzed.

After effecting the mixture of the gases, photometric tests were made in duplicate; and the sample of gas for analysis was taken between the tests.

A second series of tests with uncarburetted water gas were made in the manner described, the results of which are given in the next table:—

TABLE II.—*Mixture of Acetylene and Uncarburetted Water Gas. (Mixtures Analyzed.)*

Acetylene. Per Cent.	Water Gas. Per Cent.	Candle Power for 5 Cubic Feet of the Mixture.	Illuminating Value of Acetylene.
14·36	85·64	1·14	7·94
18·38	81·62	11·65	63·38
24·66	75·34	29·45	119·42
27·84	72·16	40·87	146·80
38·00	62·00	73·96	194·63

Tests with Carburetted Water Gas.—The gas used in these experiments had received its enriching material from naphtha, and originally had an illuminating power of about 28 to 29 candles. Gas of this quality usually contains from 14 to 16 per cent. of hydrocarbons absorbable by bromine. The sample was compressed to 16 atmospheres; the method of compression being such that no condensed products could accumulate in the cylinder.

The mixtures with acetylene were not made until considerable gas had been used for other purposes, and the pressure had thereby been reduced to about 6 atmospheres. It then had an illuminating power of 13·5 candles by the flat-flame burner, equivalent to 17 or 18 candles by Sugg's "London" Argand.

It is an interesting fact that the compressed gas, having an illuminating power of 13·5 candles, contained 13·2 per cent. of gases absorbable by bromine; showing that a very serious loss in illuminating power is caused by the condensation and removal of a comparatively small proportion of the heavy hydrocarbons, doubtless composed to a great extent of benzol vapour. The gas was mixed with acetylene, and the mixture tested in the manner already described. The following results were obtained:—

TABLE III.—*Mixture of Acetylene and Carburetted Water Gas. (Mixtures Analyzed.)*

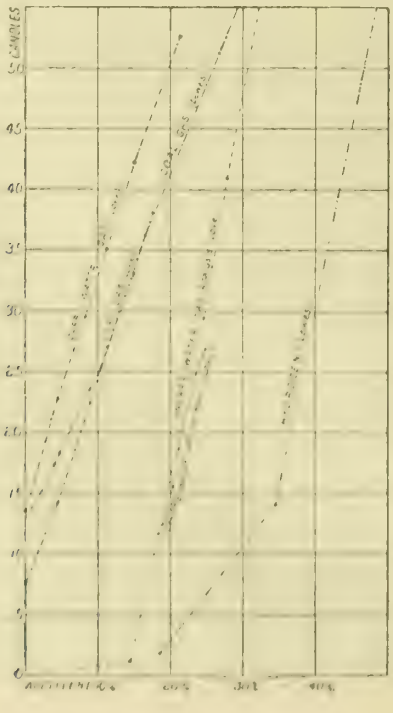
Acetylene. Per Cent.	Water Gas. Per Cent.	Candle Power of Water Gas.	Candle Power for 5 Cubic Feet of the Mixture.	Illuminating Value of Acetylene.
4·50	95·50	13·5	22·69	217·78
8·40	91·60	13·5	29·54	204·40
11·21	88·79	13·5	35·05	205·71
15·06	84·94	13·5	42·19	203·98
21·44	78·56	13·5	52·61	195·90

Tests with Coal Gas.—The gas used in these experiments was said to have had originally an illuminating power of 16 candles; but, after compression to 16·5 atmospheres, the candle power was found to be 7·59 candles in the flat-flame burner, and 10·91 candles in Sugg's "London" Argand. It contained 4·62 per cent. of hydrocarbons absorbable by bromine. The mixtures with acetylene were analyzed and tested photometrically the same as in the tests with water-gas mixtures. The results are given in the following table:—

TABLE IV.—*Mixtures of Acetylene and Coal Gas. (Mixtures Analyzed.)*

Acetylene. Per Cent.	Coal Gas. Per Cent.	Candle Power of Coal Gas.	Candle Power for 5 Cubic Feet of the Mixture.	Illuminating Value of Acetylene.
4·49	95·51	7·59	14·16	153·90
9·08	90·92	7·59	22·44	171·14
11·28	88·72	7·59	26·98	179·52
17·62	82·38	7·59	38·02	180·34

The results contained in Tables I. and IV. will be found in the accompanying diagram.



Since the preparation of this paper, I have seen some results obtained by Professor Vivian B. Lewes on the enriching value of acetylene when added to 13-candle coal gas. These results will also be found on the diagram, together with similar figures obtained by the same writer with mixtures of acetylene and hydrogen.

In order to form some idea of the cost of enrichment by acetylene, let us assume that the carbide can be had for $20 per ton, and that a ton will yield 10,000 cubic feet of acetylene. Perhaps the first use for cheap acetylene would be for the enrichment of uncarburetted water gas. From Table II. it appears that such a mixture, having an illuminating power of 25 candles, would contain 23 per cent. of acetylene; or the enriching material for 1000 cubic feet of such gas would cost 46 c.—a figure which is prohibitory. In similar manner, if acetylene were added to coal gas of 7·6 candles to bring it up to 20 candles, the enriching material would cost 15 c. per 1000 cubic feet.

It has been proposed to mix the acetylene with air, and consume it in small burners. But the danger of forming an explosive mixture is such that this plan will probably find little favour. The most hopeful outlook for acetylene as an illuminant seems to be its use, without admixture, in burners consuming from 1 to 1·5 cubic feet per hour.

Gas for Railway Lighting.—Speaking at the half-yearly meeting of the Cambrian Railways, the Chairman (Mr. J. F. Buckley) bore testimony to the cheapness of gas as compared with oil for lighting railway carriages. He said, with respect to traffic expenditure, fuel, lighting, &c., showed an increase of £309; but this was primarily due to the new gas lighting in their carriages. Gas was cheaper than oil; and, in the long run, when they had all their carriages fitted for gas lighting, they would derive great benefit from the change.

Patents in the Past Year.—The twelfth report of the Comptroller-General of Patents states that, though the number of applications for patents in the year 1894 continued upon an ascending scale (being 270 more than in the previous year), this increase was considerably less than that of the normal average of the preceding seven years. The number of applications for patents has increased from 17,176 in the year 1886 to 25,386 in 1894; being at the rate of 48 per cent. It is interesting to notice a large increase in the number of applications for patents from Ireland last year as well as in 1893; while among the colonies, the largest proportionate advance is shown by Queensland. As respects similar applications from Foreign States, Belgium, Germany, and Sweden had the largest increase; the number of applications from France having remained curiously stationary during the past ten years—being 788 in 1884, and only 799 last year. The applications from the United States, which reached the number of 2597 in 1890, have fallen off since that date, and amounted to only 2017 in 1894.

The Gas, Electric Lighting, and Water Companies' Directories and Statistics for 1895 have just been issued by Messrs. Hazell, Watson, and Viney, Limited, of Creed Lane, E.C. They appear this year with the matter presented in what the proprietors regard as the "far more clear and convenient paragraph form," instead of the tabular arrangement to which we have been accustomed. In fact, the style adopted is that of Brown's "Directory of American and Canadian Gas Companies." This alteration, besides giving all the information in regard to a company at one reference, has allowed of the combination of the whole of the particulars relating to gas and electric lighting in one volume; leaving those relating to water companies for a second volume. But, of course, the two volumes are to be had bound together. The gas and electric lighting sections furnish details, made up to the 25th of March last, in regard to about 1700 gas undertakings, of which 1500 are in the United Kingdom; and also as to 75 electric light undertakings. The book contains, as usual, reviews of the leading events of the year, as well as lists of Associations of Engineers and Managers of gas, water, and electric light undertakings at home and abroad.

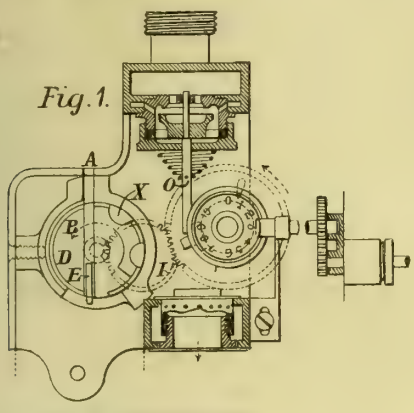
Action of Sea Water upon Concrete.—Professor Brazier, of the Aberdeen University, has made some experiments upon the action of sea water upon concrete, of which the following is a summary: Indurated Portland cement was exposed to the action of sea water and to solutions of sulphate and chloride of magnesium; and in about three months, it was found that in all cases nearly the whole of the magnesium was precipitated as hydrate, and that lime from the cement was dissolved, partly held in solution, and partly precipitated as sulphate and carbonate of lime. It is stated by Mr. J. Pattinson, County Analyst for Northumberland, with reference to an analysis of disintegrated concrete, that the chemical action between sea water and cement actually took place. The lime of the cement precipitated (as hydrate) the magnesia of the magnesium chloride and sulphate contained in the sea water, with the consequent formation of calcium chloride and sulphate. If the cement or concrete is continually brought into contact throughout its substance with fresh portions of sea water, there will be a continued deposition of hydrate of magnesia and probably sulphate of lime, and removal of lime; necessarily resulting in the disintegration and destruction of the concrete. Mr. E. Carey has shown that the addition of 5 per cent. of sulphuric acid to the water with which the cement is gauged, reduces its strength in seven days to 27 per cent. of that of neat cement.

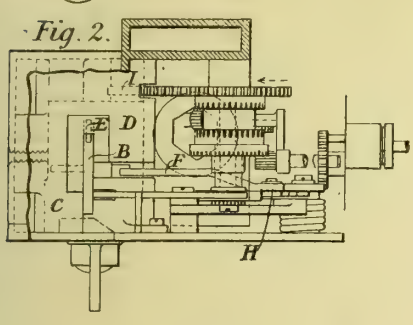
REGISTER OF PATENTS.

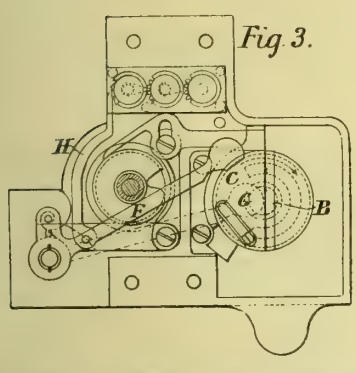
Prepayment Meters.—Thorp, T., of Whitefield, Marsh, T. G., of Manchester, and Haynes, J., of Liverpool. No. 13,022; July 5, 1894.

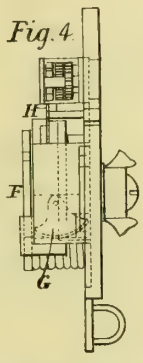
This invention consists in improved mechanism for receiving and delivering the coin and actuating the gas-valve and indices of coins inserted, and in the manner of attaching the same to a prepayment meter, with the object of simplifying the mechanism and rendering it "more readily applicable to existing meters, without disarranging the gas-consumption index connected to them."

Fig. 1 is a vertical section through the prepayment mechanism; fig. 2, a plan, with the top and valve removed; fig. 3, a view of the front plate, with parts attached thereto, as seen from the back; and fig. 4, a side view of fig. 3.









The prepayment mechanism is in a casing attached to the upper part of the meter, at the side of the usual consumption-index. The coin is inserted through a slit A into a slot B, in a hollow cylinder made in parts—one part fixed to the front plate of the casing, and the other part to the side of the back plate. The slot B is placed to one side of the centre-line of the cylinder, and is made about as long as the diameter of the coin to be used for prepayment. The bottom side of the cylinder has a wider slot, extending for nearly the full length of the bottom side. Into the cylinder are placed two solid coin-carrying cylinders C and D. The front cylinder has fixed to it a spindle, which passes through the front plate of the meter, and has a winged handle or button fixed upon it, by means of which the cylinder can be turned. The back coin-cylinder D is formed with a projecting rim, partly cut away for the greater part; so that, while the latter rests against the face of the front cylinder C, there is a space between the cylinders for the rest of the circumference. The cylinder has a pinion fixed upon its back end, which butts against the back plate, and holds the cylinder in position in its longitudinal direction. Each cylinder has a slot in its face opposite the other; the slots being to one side of the centre, and coinciding with the slot B in the top of the hollow cylinder. Thus a coin dropped into the latter passes into the slots in the cylinders C and D, when their position coincides with the upper slot. In order to prevent the coin dropping through, a tumbler lever E is provided. On the insertion of a coin of the prescribed size, this pushes back the upper end of the lever E, and lifts one end up into the cylinder, so that the lever forms a rest for the coin. A coin of smaller size will simply drop through the slot into a receptacle below.

When a correct coin has been inserted, it will connect the cylinders C and D, or act as a driver; so that when the front cylinder is turned, the back cylinder is turned with it by means of the coin till the latter is expelled after about half a revolution, which is done in a similar manner to that described in patent No. 7899 of 1894. For this purpose, the lever F is fulcrummed on a stud, on the front plate. This lever is pressed downwards by a spring of the meter, and extends into the space between the coin-cylinders through a slot in the outer cylinder. When the cylinders C and D are in their starting position. the end of the lever F rests in the notch X formed in the projecting rim part, and holds the back cylinder D in this position, till a coin is inserted, and the handle turned. The lever then rides on the rim till one end slips from under it, after the cylinders have made about half a turn. The lever is then pulled down by the spring upon the stop into the position shown in dotted lines on fig. 3, and pushes the coin out of the slots into the coin-receptacle below. This arrangement prevents frauds by the insertion of coins smeared with wax or other sticky substance, with the object of turning the mechanism round several times with one coin.

When the coin has been expelled, the connection formed by it between the front and back coin-cylinders C and D is dissolved; and the back cylinder D would remain in the position it then occupies while the front cylinder is turned further round, unless meantime another connection between the cylinders is made. This is done in the following manner: In a slot in the cylinder C, a catch or pawl G is mounted on a pivot, and is in the position shown in fig. 4, when the cylinder is placed in the coin-receiving position. The cylinder is recessed at the front; and in the recess a raised segmental rim is formed on the front plate, the inclined end of which the nose of the catch G encounters before the cylinder has made half a turn. The catch G is thereby turned backwards, and the other end of it is protruded from the face of the cylinder, so that it catches behind the abrupt end of an inclined projection formed in the face of the back cylinder D. This cylinder continues to be turned by the front cylinder after the coin has been ejected, until the end of the lever G drops off the raised segmental rim; while at the same time the lever F, which has been raised by the projecting part of the rim next to the slot, drops into the notch X, and holds the back cylinder in the starting position, so that it makes exactly one revolution. When the revolution is completed, the nose of the catch G drops off the rim by its weight, and assumes the position indicated in fig. 4.

By these means, the two cylinders are constrained to make an entire revolution, after the insertion of each coin, before another coin can be inserted. The number of revolutions and coins paid in are registered on an index, by attaching a pawl H to the lever F, so as to act on a ratchet-wheel, and advance it by a tooth for each rotation of the coin-cylinders.

The mechanism for opening the inlet-valve for the gas, by the rotation of the coin-cylinders, and closing it by the meter when the quantity of gas paid for has been consumed, may be arranged to act in a positive manner as follows: Upon the end of the back cylinder D is a pinion meshing with a carrier-wheel I, which meshes with a spur-wheel, mounted loosely upon a stud, and formed with, or attached to, a crown-wheel, or an equivalent bevel-wheel. Opposite to the wheel, another equal crown-wheel K, or equivalent bevel-wheel, is likewise loosely mounted upon a sleeve N on the stud, and formed with a boss upon which another crown-wheel is detachably fixed in the position shown in fig. 2. This wheel can be changed for others having a greater or less number of teeth, for the purpose of varying the quantity of gas supplied for each coin. The crown-wheel meshes with a pinion L, formed on a spindle supported in brackets. In some cases it carries a spur-wheel, gearing with a pinion M upon a shaft, passing through a stuffing-box soldered to the case of the prepayment mechanism. The shaft is rotated, through a worm and worm-wheel, from the shaft which drives the usual consumption-index of the meter. The long loose sleeve N is formed with a boss between the crown-wheels, into which is screwed a stud, upon which a spur-wheel is mounted, meshing with both crown-wheels. The stud extends beyond the wheel; and the valve is so placed that its stem O is encountered by the stud when the sleeve is turned in the opposite direction to that indicated by the arrow in fig. 2.

The action of this arrangement of mechanism is as follows: When the handle is turned after the insertion of a coin, the back cylinder D is turned in the manner already described, and through the wheels turns the crown-wheel in the direction shown by the arrow in figs. 1 and 2. The crown-wheel K is held by the pinion L, as this pinion is not rotated through the gearing described while no gas is consumed, or rotated very slowly while gas is consumed. In consequence, it is rolled along the wheel K, and the stud moves through half the arc described by a tooth of the wheel, and in the same direction, away from the valve-stem O. The valve is so arranged that it opens by the gas pressure in the main, or its weight or a spring placed round the spindle, and consequently gas enters the meter. For each additional turn of the handle and coin inserted, the stud moves through a further equal arc away from the valve-spindle. As the gas is consumed, the crown-wheel K is rotated, through the gearing described, in the opposite direction to that in which the other wheel is rotated on the insertion of a coin, while this latter wheel is kept stationary by the back cylinder D. In consequence, the sleeve N and stud are turned in the opposite direction until, when the gas paid for has been entirely consumed, the stud encounters the valve-spindle O, and, lifting it, closes the inlet-valve.

Obtaining Cyanogen or Its Compounds from the Gases resulting from the Dry Distillation of Substances of Organic Origin.—Drehschmidt, H., of Berlin. No. 16,149; Aug. 24, 1894.

This invention refers to a process for obtaining, on an industrial scale, cyanogen or its compounds from the gases given off in the dry distillation of nitrogenous bodies of organic origin—including all kinds of fossil coal (whether pit-coal, lignite or bituminous shales), turf, or wood.

It is well known, the patentee remarks, that gas obtained from coal—whether in the manufacture of illuminating gas or coke—contains, after the elimination of the tar vapours, other impurities, carbonic acid, sulphuretted hydrogen, and ammonia, together with a small amount of cyanogen compounds (hydrocyanic acid). Gas yielded by turf or wood contains but little sulphuretted hydrogen and ammonia, but a large quantity of carbonic acid. To isolate and recover the cyanogen from such mixtures of gases, the well-known property of cyanogen, of forming double compounds with the alkalies or alkaline earths in the presence of a second base, has been utilized; and these double salts are decomposed with difficulty or not at all by sulphuretted hydrogen or carbonic acid, while all simple cyanogen compounds undergo a more or less easy decomposition under the action of these two gases. The tendency of cyanogen to form such stable double

compounds is so great that it or its compounds (hydrocyanic acid), acting on a suitable heavy metal—such as iron, manganese, zinc, &c.—in the form of oxide, carbonate, or sulphide, in the presence of oxide, carbonate, or sulphide of potassium, sodium, ammonium, magnesium, calcium, or other alkaline earths, are able actually to set free carbonic acid or sulphuretted hydrogen, and to form double cyanogen compounds of a heavy metal and an alkaline metal or alkaline earth metal. Attempts have been made to bring about the formation of such double cyanogen salts, with a view to the separation and recovery of the cyanogen in the gases of combustion, by passing the gases through solutions of the oxides, carbonates, or sulphides of the alkalies (such solutions containing also the oxides, carbonates, or sulphides of the metals referred to), by using a fluid in which, with the metallic compounds alluded to, there were present in suspension the oxides or carbonates of magnesia, chalk, or other alkaline earths. It was thought impossible to obtain by any other mode of procedure the intimate simultaneous contact of the cyanogen with the alkali or alkaline earth base and the metallic base, which is essential to the rapid and certain conversion of the whole of the cyanogen into the desired stable double cyanogen compound.

In this process, however, the disadvantage is experienced that it is difficult to pass gases through fluids in which solid materials are, and must be, kept in a state of suspension, and complicated apparatus is necessary to effect it; while, on the other hand, gases can be passed with facility through solid materials which are porous and absorbent, as is done on a large scale in the purification of illuminating gas by masses of oxide of iron. It has not hitherto been considered possible—nor has it, indeed, been possible—to effect by this (dry) method the combination of cyanogen in large quantity and in a concentrated form. It has been thought that, with dry materials, it only happens to a slight extent that the cyanogen comes into contact with the metal and the alkali simultaneously and everywhere; and it has been further thought that, when solid materials are employed, the cyanogen compounds as they are formed enclose the remaining portions of the mass, and protect it against further action.

The object of the present invention, therefore, is to eliminate all the above disadvantages, and so to effect the isolation and recovery of cyanogen from gases by employing solid porous masses in contrast to the previously used methods consisting in the use of fluids. To effect this object, the solid materials to be employed must be so prepared that the gas may obtain access to all parts of the mass at as nearly as possible the same time, and that the gas shall encounter at all points simultaneously the compounds of the light and the heavy metals in the proper proportions. If it were sought to fulfil the required conditions by preparing the mass which is to form the cyanogen compound, by steeping the oxide or carbonate of the metal with an alkaline solution, it would never be possible, the patentee points out, for more than a proportionately small quantity of alkali to be taken up, if the mass be intended to remain solid. The mass would, moreover, become hygroscopic, and but slightly penetrable by the gas. The alkalies alluded to above would, therefore, according to the present invention, be of necessity excluded when it was desired to form a solid absorption mass. But even for the other substances, the process of steeping would not be available; for, in the form of their oxides or carbonates, they are considerably less soluble than the alkalies, if soluble at all, indeed, so that the proportion of light metal taken up by the materials containing the heavy one would be still smaller than when the alkaline solution was used, nor would a mechanical mixture of the materials alluded to afford the desired result. Not even as the result of the most intimate mechanical mixture would the separate particles of the various substances lie closely together, and be evenly distributed to an extent which would secure that at the same time the cyanogen should come into contact with the various substances necessary to the formation of a double cyanogen compound in the proportions required. Moreover, the porosity itself must be of such a kind as to allow the gas to come into absolute molecular contact with the solid material at all points, and to prevent a protective casing from enclosing considerable portions of the mass, to the exclusion of further chemical action. This object cannot be attained by any process of mechanical mixture.

According to the present invention, the isolation and recovery of cyanogen from gases may best be effected by bringing the gases in question into contact with solid materials, in which the oxide (anhydrous or in the form of hydrate or of carbonate) of the light metals referred to above—*i.e.*, metals of alkaline earths, such as magnesium, calcium, barium, strontium—are present in the required proportion of from one to two molecules, in a mixture with one molecule of the oxide (anhydrous, or in the form of hydrate or of carbonate) of a heavy metal, such as iron, manganese, or the like, which form, with the metallic salts referred to, and cyanogen, double compounds, which are not decomposed by sulphuretted hydrogen or carbonic acid. The materials alluded to must, however, be mixed by chemical means, since mechanical methods are useless, so that the molecular contact may be so intimate, and the porosity so perfect, as to afford the gas access as complete as possible to every particle of the mixture. The chemical mixture, which thus brings about the perfect homogeneity of the material, and the most thorough porosity possible, may be effected by precipitating the oxides (anhydrous, or in the form of their hydrates or carbonates) of the heavy metals characterized, in the presence of, or in association with, the oxides of the light metals of the alkaline earths; and this may appropriately be effected by means of the oxides or carbonates of the alkaline or alkaline earth metals. Oxides of the light metals may also be precipitated in the presence of oxides or carbonates of the heavy metals from their solutions, by means of oxides or carbonates of the alkaline metals, so that the precipitation may take place, as it were, inside the masses of carbonates or oxides of the heavy metals.

The mode of manufacturing the porous mass may be further explained by means of the following examples:—

(1) The pulverized oxides (as such, or in the form of hydrates or carbonates) of the light metals of the alkaline earths are suspended in water, and solutions of heavy metals—as iron, manganese, zinc, or the like—allowed to flow with constant stirring; the heavy metals being those which, in combination with cyanogen and the light metals mentioned, form double salts, which are not capable of being decomposed by sulphuretted hydrogen or carbonic acid. By the chemical action of the oxide of the light metal of the alkaline earth, the oxides (*i.e.*, as such, or in the form of their hydrates or carbonates) of the heavy metals are precipitated in a state of fine division, and in the most intimate molecular contact with the portion of the oxide or carbonate of the light metal which is present in excess of the quantity required to bring about the chemical reaction referred to. The proportions present in the mixture may be adjusted so that one molecule of metal in the oxide of the heavy metal is present to one or two molecules or atoms of the oxide of the light metal of an alkaline earth. The oxide or carbonate of the light metal which takes part in the reaction may also be replaced by an equivalent amount of a precipitating material which has the same action as alkali or alkaline carbonate. The salts of the metals must not be such that the acid they contain unites with the oxides of the light metals to form insoluble compounds which have no affinity for cyanogen—*e.g.*, sulphuric acid with oxide of calcium. The precipitate resulting consists of the oxides or carbonates of the light and heavy metals, and is separated from the fluid, washed, dried, and powdered.

(2) The oxides or carbonates of the light metals aforesaid may also be treated with a solution of the salts of the heavy metals, until the insoluble mass has the composition mentioned in paragraph No. 1. In this case, too, the metallic salt selected must be such a one as was referred to as regards the acid contained in it. The resultant mass is then, as already described, washed, dried, and powdered. The mass described differs from Laming's mass, employed for the elimination of sulphuretted hydrogen from gas, inasmuch as it has a different composition, containing neither chlorides nor sulphates.

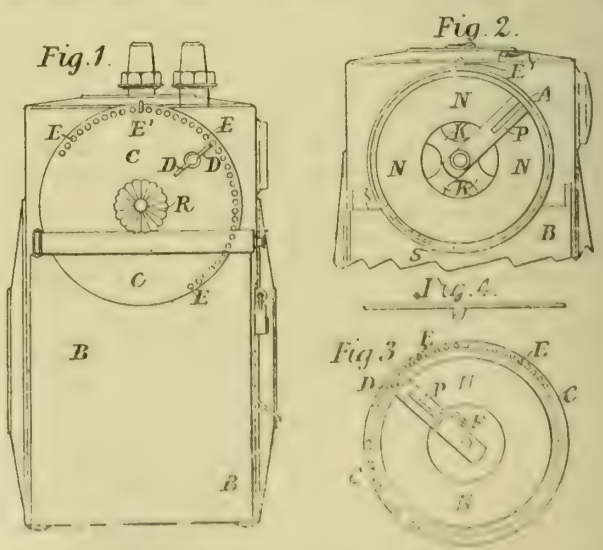
(3) A solution containing the salts of the light metals, and those of the heavy metals as well, is allowed to flow into one containing the oxides or carbonates of the alkalies, or, if magnesium salts be employed, into milk of lime. The kind of salt of the heavy metal, the composition of the precipitate, and the further treatment of the latter, are the same as those described in paragraph No. 1.

(4) The oxides of the heavy metals may be first of all mixed with a solution of those of the light metals, and then, in order to separate out the oxides (in the specified form, such as oxides, hydroxides, carbonates) of the light metals, be further treated with a solution of oxide or carbonate of an alkaline metal; the remaining conditions, and the treatment of the resultant product, being as above. The mass thus obtained, in a state of the greatest attainable freedom from constituents which have no action upon cyanogen, is so homogeneous and so perfectly porous, that the gas is able to act upon every portion of the mass, and finds at the same time, at every point, the proper proportions in the mixture. The mass is utilized for the absorption and isolation of the cyanogen in a way exactly similar to that in which the ordinary gas-purifying materials are made use of, by spreading it out upon wooden hurdles or gratings in cleansing chambers, and passing the gas over and through it. The absorption of the cyanogen, says the inventor, is both rapid and certain, in spite of the fact that both sulphuretted hydrogen and carbonic acid are present in the gas. If the mass be saturated with cyanogen, or when the absorption of it has ceased, the mass is removed and treated in any way to obtain the cyanogen compounds.

Coin-Freed Apparatus for the Sale of Gas in Fixed Quantities.—Glover, R. T. & J. G., of St. John's Street, Clerkenwell, E.C. No. 25,272; Dec. 29, 1894.

This invention has for its object "arranging upon the exterior of a prepayment gas-meter a plate in such a manner that it can be set to allow the coin-operated mechanism to be moved a greater or less distance to supply a greater or less quantity of gas to the consumer; the actual amount to be obtained for a given coin being visible to the consumer by the exterior position of the changing plate."

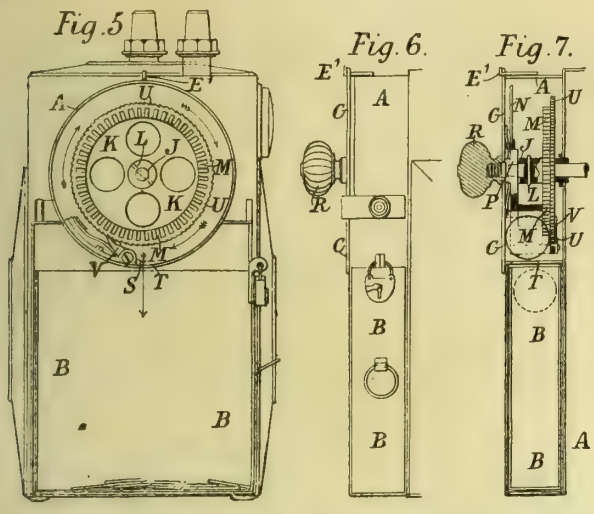
Fig. 1 is an elevation of the arrangement applied to the side of a dry meter. Fig. 2 is part of the meter side, with the external cover removed to show the coin-receiver shield. Fig. 3 is a back view of the cover and shield, showing more particularly the position of the limiting stop against which the coin-receiver abuts. Fig. 4 is a plan of the cover. Fig. 5 represents a sectional elevation of the till, and a view of the notched and ratcheted plate, as seen when the cover and coin-receiver shield are removed. Fig. 6 is a front elevation of the



apparatus and till at the side of the meter. Fig. 7 is a part front sectional elevation of the apparatus, with the coin in position just at the moment of discharge into the till.

The apparatus A is arranged immediately above a money-holder

or till B; and both are attached to the side of the meter. The cover or price-changer C is a round, flat plate, having a slot D, through which a coin can be inserted. The circumference of the price-changer is marked off by holes E, so that, by placing a given hole over the hook E^1, the coin-slot D and stop F behind the price-changer are fixed in the position required to control the degree of movement of the mechanism by the consumer, and allow a quantity of gas, corresponding to the number of the hole in which the hook appears, to be supplied. The price-changer can be moved to allow any quantity—preferably from 1 to 50 cubic feet—of gas to be supplied; and it is secured in the desired position by means of a hinged clasp or binder and a seal.



The central spindle J is connected to any known device operated by the ordinary meter mechanism for stopping the supply of gas—for instance, such a device as that described in patent No. 8327 of 1894. It may be operated by a plate K, mounted upon the spindle J, projecting from the meter-case into the box A; and it is secured thereto by a pin L or other means—the plate having side notches M facing the price-changer. Between the plate K, and immediately behind the price-changer, is a shield N, to which is secured a coin-receiver or pocket P, into which a coin is passed through the slot D of the price-changer to rest in one of the notches of the plate, and so cause it and the coin-pocket to move together when the handle R is turned. The handle is screwed upon the centrally and outwardly projecting stem of the coin-receiver. The shield N serves to prevent the insertion of a coin through the slot D so long as the pocket P is out of coincidence with the slot. The shield N is loosely mounted upon the extremity of the spindle J, so that, when no coin is inserted, the shield and coin-receiver can be turned without affecting the notched plate.

The rotative movement of the pocket P and shield N in the direction of the arrows (fig. 5), is limited by a part of the coin-receiver striking the stop-plate S, which is placed contiguous to the orifice T at the bottom of the box A, through which a coin, if one be in the coin-receiver, falls to the money-till below. The rotative movement in the reverse direction is, of course, variable, according to the position of the price-changer, as before explained; but whatever the latter's position may be, the return movement is arrested by contact with the projecting stop F, against which a part of the coin-receiver P abuts.

The distance between the stop F and stop-plate S, by determining the amount of rotative movement imparted to the spindle J when a coin is inserted, regulates the degree of movement of the valve-opening mechanism, and so allows a proportionate quantity of gas to be supplied before the valve is closed by the action of the meter mechanism.

Ratchet-teeth U, into which a spring pawl V engages, are circumferentially cut in the plate K, to prevent any back movement.

To alter the quantity of gas to be supplied for a given coin, it is only necessary to break the seal, and swing the binder back upon its hinge, unscrew the handle R, unhook the price-changer, turn it, place the hole corresponding to the number of cubic feet it is desired to supply in engagement with the hook E^1, and then fasten the price-changer by replacing the handle and binder. A spring is inserted between the price-changer and the coin-pocket P, to retain the latter in any position; and an arm on P prevents the coin from falling when the coin-pocket is turned vertically upwards.

Incandescent Gas-Mantles.—Knöfler, O., of Charlottenburg, Germany. No. 11,038; June 4, 1895.

The patentee proposes to prepare the mantles for incandescent gas-burners of threads which have, previous to being woven into the usual cone-shaped hoods, been impregnated with the oxides or salts required to give them their essential characteristics—instead of (as has hitherto been usual) dipping the mantles, after being shaped, into the solutions of "rare earths."

Water-Meters.—Lake, H. H.; communicated from F. Lux, of Ludwigshafen-on-the-Rhine. No. 11,224; June 7, 1895.

This invention relates to means for adjusting wheel water-meters in such a way as not to impair their efficiency and sensitiveness.

In the wheel water-meter described in the specification, the water freely enters the measuring chamber in a tangential direction, thereby imparting a rotary movement to the shaft of the measuring-wheel. By means of curved channels provided in the inner top portion, and by similar channels in the bottom of the casing, the measured water is led towards the shaft, and caused to pass through an aperture and openings to the place whence it is taken for use—the channels are all of uniform cross section throughout. In being driven from the peripheral portion of the measuring casing towards the aperture named above, the water, by its swell, acts to disturb the free movement of the measuring-wheel; and it is obvious that, by allowing a portion of the measured water to escape into the regular discharge conduit near the circumferential portion of the measuring casing, the measuring-wheel may be caused to rotate more freely, and that the result of the measurement may thus be altered. To this end, holes are bored in the raised portions formed by, and between, each two channels; and above the holes is provided a ring, resting in a correspondingly shaped annular recess, and provided with openings corresponding with the holes referred to above. By means of an arm or index provided on the ring, the latter may be rotated more or less, so as to alter the positions of the openings with regard to the holes; and the latter may thus either be closed entirely or opened to any desired extent. It will thus be seen that by a suitable adjustment of the position of the "gauging ring," a portion of the measured water, after having taken part in the movement of the winged measuring-wheel, may be discharged into the conduit without being forced through the aperture, and without (on its way to the aperture) hindering the movement of the winged measuring-wheel. If the wheel-train of the counting mechanism is so arranged that the result of the measurement would differ by about 10 per cent., this may be easily corrected by moving the arm or index, and thereby turning the gauging-ring, and retaining it in its position by the eight feet forming the connection between the chamber of the counting mechanism and the measuring casing.

Self-Starters for Gas-Engines.—Green, W. H., of Northampton. No. 11,493; June 12, 1895.

This invention refers to (1) means for allowing a portion of gas to enter the engine cylinder (when the engine is at rest), from the gas-supply pipe; (2) an improved igniting valve or hollow spindle, for firing the charge of gas or vapour; and (3) a trigger arrangement for keeping the valve shut and out of action when the engine has once started. The hollow spindle has a collar formed thereon, the upper side of which has a face, and acts as a stop to prevent it rising too high. There is also a device by which the valve is instantaneously closed when desired to be put out of action, and also for dispensing with a cock, which (the patentee remarks) quickly deteriorates by the gas and explosive force acting upon it.

Automatic Lighting Devices for Gas-Stoves.—Gurd, W. J., of London, Canada. No. 11,550; June 13, 1895.

According to this invention, lighter-tubes are connected with the gas supply-pipe, and extend through the stove to positions close to the several burners. These tubes either have a continuous row of perforations or are provided with a continuous longitudinal slit of such size as to admit a slight escape of gas along the tube, which, when ignited at any point, causes a flash of flame along the entire tube, and thus automatically light the several burners in contact with it. In order that the escaping gas from the lighter tubes may be ignited automatically, and also immediately upon the escape of gas after the tubes have been supplied, so as to prevent waste, there is a burner supplied from the gas-pipe adapted to carry a pilot-light, with which the entire system of lighter-tubes has communication, in such manner that the gas from all, or only a portion of the system, as may be desired, may be ignited, and thus light one or all of the several series of burners.

APPLICATIONS FOR LETTERS PATENT.

14,363.—Redman, T., "Construction and method of supporting street-lamps and the like, and the lighting of the same." July 29.

14,385.—Dürr, F., "Gas and oil engines." July 29.

14,403.—Jahnsson, J., "Electrical gas-igniting devices." July 29.

14,404.—Farkas, A., "Incandescent gas-burners." July 29.

14,460.—Howell, H., "Apparatus for the production of combustible gas." July 30.

14,605.—Shepherd, R. C., "Water motor." Aug. 1.

14,617.—M'Euen, C. H., "Treatment of kerosene shale for the production of hydrocarbons and other products therefrom." A communication from J. C. Alexander and R. C. Beveridge. Aug. 1.

14,666.—Ross, F. E., "Utilizing the exhaust gases from internal combustion engines, such as gas and oil engines." Aug. 2.

14,685.—Kühne, H., "Ascertaining the heating power of solid combustibles." Aug. 2.

14,755.—Cordingley, I. and T. W., "Regulating the speed of gas and oil engines." Aug. 3.

14,797.—Skwirsky, J., Erintchek, A., and Erintchek, I., "Gas, oil, and similar engines." Aug. 3.

The Gas Coal Contracts of the Halifax Corporation.—The Gas Committee of the Halifax Corporation have accepted tenders for 57,000 tons of coal, at prices ranging from 6s. 9d. to 8s. 3d. per ton.

Stokers' Hours at the Stockton Gas-Works.—At the last meeting of the Stockton Town Council, an attempt was made to get from the stokers employed at the gas-works an expression of opinion as to their hours of labour. The matter came up on a motion by Mr. Vickerson that a ballot be taken as to whether or not the men were in favour of an eight-hour shift. Mr. Lee characterized the proposal as "undue interference" between the Gas Manager (Mr. W. Ford) and his workmen. He said he objected to agitation being forced upon the men to say they were in favour of an eight-hour shift. Mr. Darbyshire thought the motion had been brought forward simply to gain cheap popularity at the expense of struggling ratepayers. Mr. T. B. Watson also deprecated interference by the Council. He said the men had been extremely well treated by Mr. Ford, who had over a certain number of years raised their wages from 24s. to 37s. 6d. per week. The men did not really work more than five hours out of the eleven they were in the works. Mr. Vickerson said the men were twelve hours at the works; but, whatever hours they actually worked before the retorts, the men were far too long on the premises. The motion was rejected by 16 votes to 11.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Mr. M'Gilchrist on Himself.

SIR,—Turning over the pages of the JOURNAL this week, I was attracted by the name of Mr. M'Gilchrist. I suppose I am not singular in desiring to see what he has to say on any subject; he speaks equally well upon all. I was, however, amazed to note the kind of language he had given vent to. To me it looked like another invasion of Scotland, to find a distinguished representative of that country adopting the vulgar slangy expressions of the South and West. I have known men who have been out in South Africa for nineteen years without a break, whose pride and boast it was that they had never dropped a single word or even an accent of the language they had learned in Bonnie Scotland, neither had they adopted one of any other country—they were no more capable of speaking English than they were on the day they left home. How these men would have been horrified to have heard that speech of Mr. M'Gilchrist's. However, it had the effect of inducing me to read through the whole of the paper and the discussion; and after doing so I come to the conclusion that he must have absorbed some of the potential heat that is so freely distributed throughout the paper, and (labouring under the consequent excitement) felt a desire to get someone squashed or otherwise pulverized.

Mr. Young is evidently regarded as a giant in the North, and is looked up to accordingly by the rank and file who bask in the resplendent glory of the rays which emanate from his great luminosity. I am sure it must be a source of regret to them all that he bears the common cosmopolitan name of Young. If only he was a M'Something or other, that he might proclaim his nationality every time he signed his name, how much better it would be. It was this tower of strength that Mr. M'Gilchrist desired to direct or turn on to some person or persons for the gratification of his own feelings. I have no idea who the parties are who have talked the "rot." I do not know the class of people Mr. M'Gilchrist talks to or listens to; but as one cannot have greatness in the best sense without more or less wisdom, his purpose was frustrated. Mr. Young absolutely declined to be appointed pulverizer-in-chief, and so ignored the question. Even after a reminder from Mr. M'Gilchrist, Mr. Young would not "face the music," but showed his diplomacy by a beautiful bit of hedging. I admire Mr. Young.

There is a paragraph in Mr. Irwin's letter in the same issue of the JOURNAL, in which he says that he has never been able to get more than 14-candle duty from the Manchester 20-candle gas, when burnt with a No. 4 Bray union-jet (the burner commonly used). It is the second paragraph; and it is significant. I commend it to Mr. M'Gilchrist's careful consideration, as it bears upon the subject. If he would only devote a little of his valuable time to a serious consideration of the question, I have a notion that it would lead to a little *less* "rot" being talked upon the subject.

I quite agree with Mr. MacPherson, who modestly claims that he and Mr. Young were twenty years ahead of Professor Lewes and Mr. Lewis T. Wright in the class of investigation they have been recently engaged upon, and occupying so much of our time with. That the two latter gentlemen have acted improperly, goes without saying. The least they could have done before wasting so much of their own and other people's time was to have read up the ancient proceedings of the North British Association. However, they have been properly snubbed; and I trust it will be a lesson to them. If ever they have the audacity to again appear before the public, I hope that their own good taste will suggest to them that their first duty to Mr. MacPherson, Mr. Young, and the public is to apologize for their misdoing.

Altrincham, Aug. 3, 1895. WM. CARR.

"An Evil to be Checked"—Politics and Gas Management.

SIR,—Your article in the last issue of the JOURNAL on the above subject has but one fault, and it is that you err on the side of mercy. Allow me to state my experience in connection with three vacancies that have been advertised by Gas Committees within the past twelve months.

In the first case—where, of course, canvassing was strictly prohibited—your correspondent was in due course informed that his name was retained on the first "short leet" drawn out (ten candidates). Having friends on the Committee, he was—up to a certain point—kept well informed as to the progress of events; and he had eventually a private, but undoubtedly correct, intimation that he was on the reduced short list of five candidates, and was to be sent for to a personal interview. This was at the time quite understood. Later on the Secretary to the Committee wrote, also stating that the name was retained on the final list. Yet we find the vacancy filled, and a man appointed, without any such interview being held or requested. The successful candidate proved to be a brother of a neighbouring engineer of considerable influence in the district. In the second case, canvassing was not forbidden. We will give the Committee credit so far. The undersigned, in this case also, was on the short list; being reserved for a cross-examination at the hands of a large number of gentlemen, many of whom knew as much of gas making (I mean coal gas, of course) as did their great-grandmothers. On the night previous to the interview, I was informed by an eminent gas engineer that it was very well known who was to have this appointment—mentioning the gentleman's name. Next day, I had the pleasure of meeting with the said young man, in company with other candidates, who, like myself, had been thus victimized. For my part, I had declined a meeting with another Board in order to be present at this interview. How many of the other candidates were so situated, I cannot say. Immediately on the party named entering the committee-room, we—the remaining candidates—knew at once the issue (by the general hilarity and "hail fellow well met" style of proceedings that instantaneously ensued), and that the information of the previous night was correct. Later on, the Secretary appeared, and gravely announced the decision of the Committee, arrived at "by untold trouble and discussion, due to the very general and earnest anxiety to rightly distinguish," &c., &c., and expressing sympathy with the disappointed candidates, and so on.

Still further, in connection with this same appointment. Before the date arranged for the interview, an acquaintance of mine received a letter from another party in the town making the appointment. The letter embodied four questions—given, I believe, in the order here below:—

(1) Do you know a person of the name of ———? (giving that of your correspondent).
(2) What are his politics?
(3) Is he a Churchman or a Nonconformist?
(4) Do you think he is a capable man?

Observe the position given to the matter of capability.

Lastly, the only other case I will now refer to is that of a smaller undertaking which also honoured me with an invitation to an interview. The terms even of the invitation were so dictatorial—abrupt almost to brutality, and parsimonious to a degree—that I declined the invitation with thanks. I afterwards learned that the Committee had appointed a gentleman whose exceptional abilities were to be handsomely recognized by the bestowal of a magnificent salary of considerably less than half they commanded at his previous engagement.

I trust that the importance to the profession of this unwarrantable intrusion into municipal gas appointments of any and every consideration other than professional ability and technical skill, may be accepted as an apology for troubling you at so much length.

AN INDIGNANT GAS MANAGER.

Aug. 3, 1895.

P.S.—On satisfactory guarantees being given through you, I should be prepared, if desired, to give "chapter and verse" for the foregoing statements.

Income-Tax and Depreciation.

"Inquirer" writes: "Would any reader of the JOURNAL kindly inform me as to the procedure generally adopted by gas companies for the adjustment of income-tax, and what allowances are made for depreciation of plant and machinery, after deducting general repairs, such as retorts, meters, pipes, &c.?"

LEGAL INTELLIGENCE.

HOUSE OF LORDS.—Monday, July 29.

(*Before the* LORD CHANCELLOR, LORD WATSON, LORD ASHBOURNE, *and* LORD MACNAGHTEN.)

The Mayor, &c., of the Borough of Bradford v. Pickles.

This was an appeal from an order of the Court of Appeal, reversing an order of Mr. Justice North's, and declaring that the appellants were not entitled to any of the relief claimed by them, and ordering them to pay the costs. The action was brought by the appellants to restrain the respondent from making or continuing a drift or tunnel in his lands situate near East Many Wells, in the parish of Bradford, Yorkshire, whereby the waters of certain springs and underground streams, known as Many Wells, to which the appellants alleged they were entitled under certain Acts of Parliament, might be diverted, drawn off, or diminished in quantity. The appellants were authorized by the Bradford Corporation Water-Works Act, 1854, to purchase the whole undertaking of the Bradford Water-Works Company, who had acquired the exclusive right to the springs and streams of water called Many Wells, arising or flowing in and through certain farm lands and grounds called Trooper or Many Wells Farm. By the 234th section of the Bradford Water-Works Act of 1842, it was provided that, after the Many Wells springs had been purchased by the Company, it should not be lawful for any persons to divert or appropriate in any other manner than by law they might be legally entitled, any of the waters then supplying or flowing from the same. The respondent was the owner of a farm of about 140 acres immediately adjoining Trooper's Farm, and on higher ground, which had been in the possession of his family for about 100 years. The surface soil was now let to certain agricultural tenants; but the mines and minerals, which are of considerable value, are reserved to the respondent. The respondent had been advised that large quantities of stone and other minerals could be profitably worked, if the works could be kept effectually drained and cleared of water without the expense of pumping-engines; but the effect would be that the underground stream of water which supplied Many Wells would be cut off. The appellants, by the present proceedings, sought to restrain the respondent from executing the proposed works for the purpose of draining his mines. The action was tried before Mr. Justice North in 1893, when the learned Judge granted an injunction restraining the respondent from executing his drainage works. The Court of Appeal, consisting of Lord Herschell (Lord Chancellor), Lord Justice Lindley, and Lord Justice A. L. Smith, reversed the decision of Mr. Justice North, and ordered the appellants to pay the costs.* The appellants now sought to have the decision of the Court of Appeal reversed.

Mr. COZENS-HARDY, Q.C., and Mr. B. EYRE appeared for the appellants; and Mr. EVERITT, Q.C., Mr. TINDAL ATKINSON, Q.C., and Mr. BUTCHER for the respondent.

The case was argued some time ago, when judgment was reserved.

Their LORDSHIPS delivered their considered judgment this morning, when they affirmed the decision of the Court of Appeal, and dismissed the action with costs.

The LORD CHANCELLOR: In this action, the plaintiffs seek to restrain the defendant from doing certain acts which they allege will interfere with the supply of water which they want, and which they are incorporated to collect for the purpose of better supplying the town of Bradford.

* Reports of the proceedings in the Lower Courts will be found in the JOURNAL, Vol. LXIII., p. 1018; Vol. LIV., pp. 931, 1215.

Mr. Justice North ordered the injunction to issue; but subsequently the Court of Appeal, consisting of Lord Herschell, Lord Justice Lindley, and Lord Justice Smith, reversed his judgment. The facts that are material to the decision of this question, seem to me to lie in a very narrow compass. The acts done, or sought to be done, by the defendant were all done upon his own land; and the interference, whatever it is, with the flow of water, is an interference with water which is under ground, and not shown to be water flowing in any defined stream, but is percolating water, which, but for such interference, would undoubtedly reach the plaintiffs' works, and in that sense does deprive them of the water which they would otherwise get. But although it does deprive them of water which they would otherwise get, it is necessary for the plaintiffs to establish that they have a right to the flow of water, and that the defendant has no right to do what he is doing. My Lords, I am of opinion that neither of those propositions can be established. Apart from the consideration of the particular Act of Parliament incorporating the plaintiffs, which requires separate treatment, the question whether the plaintiffs have a right to the flow of such water appears to me to be covered by authority. In the case of *Chasemore v. Richards* (7 H. L. Cases, 349), it became necessary for this House to decide whether an owner of land had a right to sink a well upon his own premises, and thereby abstract the subterranean water percolating through his own soil, which would otherwise, by the natural force of gravity, have found its way into springs which fed the River Wandle, the flow of which the plaintiff in that action had enjoyed for upwards of 60 years. The very question was then determined by this House; and it was held that the landowner had a right to do what he had done, whatever his object or purpose might be, and although the purpose might be wholly unconnected with the enjoyment of his own estate. It therefore appears to me that, treating this question apart from the particular Act of Parliament—and, indeed, apart from the 49th section of the Act of Parliament upon which the whole question turns—it would be absolutely hopeless to contend that this case is not governed by the authority of *Chasemore v. Richards*. This brings me to the 49th section of the Statute 17 and 18 Vict., c. 124, upon which reliance has been placed. That section is as follows: "It shall not be lawful for any person other than the Company to divert, alter, or appropriate in any other manner than by law they may be legally entitled, any of the waters supplying or flowing from certain streams and springs called Many Wells, arising or flowing in and through a certain farm called Trooper or Many Wells Farm, in the township of Wilsden, in the parish of Bradford, or to sink any well or pit, or do any act, matter, or thing whereby the waters of the said springs might be drawn off or diminished in quantity; and if any person shall illegally divert, alter, or appropriate the said water, or any part thereof, or sink any such well or pit, or shall do any other act, matter, or thing whereby the said waters may be drawn off or diminished in quantity, and shall not, immediately on being required so to do by the Company, repair the injury done by him, so as to restore the said springs and the waters thereof to the state in which they were before such illegal act as aforesaid, he shall forfeit to the Company any sum not exceeding £5 for every day during which the said supply of water shall be diverted or diminished by reason of any work done or act performed by, or by the authority of, such person, in addition to the damage the Company may sustain by reason of their supply of water being diminished." Whatever may be said of the drafting of this section, two things are clear—first, that the section in its terms contemplates that persons other than the Company may be legally entitled to divert, alter, or appropriate the waters supplying or flowing from the streams and springs: and, secondly, that the acts against which the section is directed must be illegal diversion, alteration, or appropriation of the said waters. The natural interpretation of such language seems to me to be this—that whereas the generality of the language of the section might apply to any alteration or appropriation of waters supplying or flowing from the streams and springs called Many Wells, the section only intended to protect such streams and springs and supplies as the Company should have acquired a right to by purchase, compensation, or otherwise; but in such wise as should vest in them the proprietorship of the waters, streams, springs, &c. And, lest the generality of the language should give them more than that to which they had acquired the proprietary right, the legal rights of all other persons were expressly saved; and upon this assumption, the latter part of the section makes penal the illegal diversion, alteration, or appropriation of any streams, &c., of which, by the hypothesis, the Company had become the proprietors. I do not think that Mr. Justice North does justice to the language of the section when he says that "the section enacts that a man is not to do certain specified things, except so far as he may lawfully do them." The fallacy of that particular observation (with all respect to Mr. Justice North) resides in the phrase "certain specified things." If my reading of the section be correct, the thing that is prohibited is taking or diverting water which has been appropriated and paid for by the Company; but the thing which is not prohibited is taking water which has not reached the Company's premises, to the property in which no title is given by the section, and which, by the very act complained of, never can reach the Company's premises at all. To use popular language, therefore, what is prohibited is taking what belongs to the Company; and what is not prohibited, is taking what does not belong to the Company. My Lords, I have used popular language, because I have no doubt that the draftsman who drew the section was encountered with the proposition in his own mind that you could not absolutely assert property in percolating water at all. You may have a right to the flow of water—you may have a property in the water when it is collected and appropriated, and reduced into possession; but in view of the particular subject-matter with which the draftsman was dealing, it seems to me intelligible enough why he adopted the phraseology now under construction. It appears to me that this is the true construction of the section from the language itself. But I confess I can entertain no doubt that the mere fact that the section, as construed by the plaintiffs, affords no right to compensation to those whose rights might be affected, is conclusive against the construction contended for by the plaintiffs. The only remaining point is the question of fact alleged by the plaintiffs—that the acts done by the defendant are done not with any view which deals with the use of his own land or the percolating water through it, but is done, in the language of the pleader, "maliciously." I am not certain that I can understand, or give any intelligible construction to the word so used. Upon the supposition on which I am now arguing, it comes to an allegation that the defendant did maliciously something that he had a right to do. If this question were to have been tried in old times as an injury to the right in an action on the case, the plaintiff would have had to allege, and to prove, if traversed, that he was entitled to the flow of the water, which, as I have already said, was an allegation he would have failed to establish. This is not a case in which the state of mind of the person doing the act can affect the right to do it. If it was a lawful act, however ill the motive might be, he had a right to do it; if it was an unlawful act, however good his motive might be, he would have no right to do it. Motives and intentions in such a question as is now before your Lordships seem to me to be absolutely irrelevant. But I am not prepared to adopt Lord Justice Lindley's view of the moral obliquity of the person insisting on his right when that right is challenged. It is not an uncommon thing to stop up a path which may be a convenience to everybody else, and the use of which may be no inconvenience to the owner of the land over which the path goes. But when the use of it is insisted upon as a right, it is a familiar mode of testing that right to stop the permissive use, which the owner of the land would contend it to be, though the use may form no inconvenience to the owner. So, here, if the owner of the adjoining land is in a situation in which an act of his, lawfully done on his own land, may divert the water which otherwise would go into the possession of this trading Company, I see no reason why he should not insist on their purchasing his interest, from which this trading Company desires to make profit. For these reasons, my Lords, I am of opinion that this appeal ought to be dismissed with costs, and that the plaintiffs should pay to the defendant the costs both here and below.

Lord WATSON, Lord ASHBOURNE, and Lord MACNAGHTEN concurred.

After some consultation between their Lordships, their Lordships resolved that the judgment of the Court of Appeal be affirmed, and that the action be dismissed with costs.

Electric Lighting Transformer Stations.

In the Chancery Division of the High Court of Justice on the 3rd inst., before Mr. Justice Stirling, the case of *The Wandsworth District Board of Works v. The County of London and Brush Provincial Electric Lighting Company, Limited*, was heard. The question was whether the defendants, who had been authorized by the Board of Trade, under a Provisional Order, to supply electricity in the plaintiffs' district, were at liberty to excavate and construct certain large chambers under the streets for the purpose of containing apparatus for transforming the electric current from high to low pressure. The question turned upon the construction of the Electric Lighting Acts and the Provisional Order for the district which had been confirmed by Parliament. The chambers proposed to be used by the defendants were 10 feet deep, 7ft. 6in. long, and 5ft. 6in. wide; and it was contended by the plaintiffs that they could not be considered "boxes" within the meaning of the Order, which allowed the use of street-boxes for certain purposes. His Lordship came to the conclusion that the question of the size of the boxes was one for the determination of the Board of Trade; and as that body had sanctioned the Company's plans, the plaintiffs were not entitled to prevent them from carrying them out. It was also contended that the boxes could not be used for the purpose of holding transformers; but the Provisional Order laid it down that they might be used (*inter alia*) for the purpose of regulating and controlling the supply of electrical energy. His Lordship thought that the process of transforming clearly came within these words. He accordingly refused to grant the injunction for which the plaintiffs asked.

Imitation of the "Torbay" Trade Mark.

At the Southwark Police Court last Wednesday, before Mr. Marsham, the Pomphlet Paint Company, of Southwark Street, S.E., appeared to an adjourned summons, taken out under the Merchandise Marks Act, 1887, by the Torbay Paint Company, of Billiter Street, E.C., and Torbay, South Devonshire, charging the defendant Company with having applied a false trade description to certain paints sold by them. Mr. H. Kisch, barrister (with whom was Mr. H. J. Turrell), prosecuted; Mr. G. M. Cohen, barrister, defended. The prosecution alleged that the defendants used a false trade description to the paints manufactured by them in such a way as to lead the public to believe that they were selling the goods manufactured by the complainants; also that they used words so nearly resembling the plaintiffs' trade mark as to lead the public to believe that it was the same. It was argued, on behalf of the complainants, that they were the original manufacturers of what was known as "Torbay" paint; and it was stated that the word "Torbay" became significant, because the paint was manufactured principally from a valuable deposit of iron oxide which came from certain beds on the coast of Torbay, and from nowhere else. The complainants owned all these beds; and the defendants had no interest whatever in them. Evidence on both sides having been given, the Magistrate said his view was that the word "Torbay" was really a place within the meaning of the Act, and must be so treated; and that the use of the word by the defendants was calculated to mislead the public. He therefore fined them £10, and 20 guineas costs.

Reading Corporation Water Department.—In a report submitted at the last meeting of the Reading Town Council, it was stated, respecting the expenses of special works caused by the frost, that the sum of £2590 of Corporation 3½ per cent. stock, which formed part of the water-works depreciation fund, had been sold; and the amount realized, less charges, was £3230. The revenue accounts showed the balances of surplus profits to be £1201 for the half year ended Michaelmas, 1894, and £1151 for six months to Lady-day.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Half-Yearly Accounts.

In the JOURNAL last week we gave the report of the Directors of the above-named Company for the half year ending June 30 last, which will be presented to the shareholders at the general meeting to-morrow. The following is an epitome of the portions of the accounts in which but slight alterations have taken place; and the remainder will be found on the next page.

Statements Nos. 1 and 2 show the amount of share and loan capital raised at the close of the past half year. The former stood at £2,158,685; the latter, at £800,000—an increase of £18,685 of "C" stock, and of £25,000 of debenture stock, as compared with the preceding period.

Statements Nos. 3, 4, and 5—the capital, revenue, and profit and loss accounts—are given in full on the next page.

Statements Nos. 6, 7, and 8 show the positions of the reserve, renewal, and insurance funds. The reserve fund stood at £67,715, as compared with £61,071 on Dec. 31, 1894—the difference consisting of interest on the amount invested, £794; and undivided dividend transferred from the net revenue account, £5850. The renewal fund stood at £14,022; and the insurance fund, at £42,184. At the close of 1894, the last-named fund stood at £36,507. The difference consists of £280 received for interest, and £5397 brought from the net revenue account.

Statements Nos. 9 to 11—furnishing particulars as to the manufacturing operations of the Company—and No. 12, the general balance-sheet, are given in full.

BROMLEY GAS CONSUMERS' COMPANY.

Half-Yearly Report and Accounts.

The trading of this Company during the past half year, as shown by the Directors' report and accounts, has been of a gratifying nature. The quantity of gas made advanced to the total of 102 million cubic feet; being nearly 12 millions in excess of the corresponding half of last year, or an increase of 13·3 per cent., as compared with the then corresponding increase of about 4·6 per cent. The profit and loss account shows a balance of £6263; and the Directors recommend the declaration of the usual dividend at the rates of 11½ per cent. per annum on the ordinary 10 per cent. shares, and 8½ per cent. on the 7 per cent. shares, which will absorb £5723, and leave a balance of £540 to be carried forward. The Directors mention in their report that oil-gas plant has been successfully completed and brought into use, with satisfactory results; the experience gained suggesting certain additions and substitutions which are now being effected in readiness for the coming season. The maximum day's demand for gas last winter having exceeded the maximum manufacturing power of the works on their old scale, the policy of the Board in making the recent enlargement and improvement of the plant has been fully justified. For greater facility, regularity, and economy in stoking, it has been decided to adopt hydraulic machinery in the new retort-house; the works preparatory to its reception being nearly finished. A mechanical coke-breaker is also in course of erection. As nearly the whole of the capital last created by the Company, and authorized to be issued, has now been raised, a resolution for the creation of further share capital, to the extent of 1000 £10 shares of the ordinary 7 per cent. capital under the Company's Act of 1879, and of the further sum of debenture stock capable of being raised in relation thereto, and empowering the Directors to issue the same from time to time, will be submitted for adoption at the coming meeting of the shareholders. The Directors also record with regret the very sudden death of the late esteemed Chairman of the Company, Mr. Robinson Latter, whose valuable services from the formation of the concern largely contributed to its prosperity. The Directors have elected Mr. A. Dickson as Chairman of the Board, and Mr. A. E. Willett as a Director.

Concerning the accounts, the total revenue of the half year was £20,028, which was derived from the following sources: Gas, £14,872; meter-rental, £379; residuals, £4551; rents, £32; fitting, £93; rental of fittings and stoves, £97; and transfer fees, £2. The sum expended on revenue account was £13,722, which was made up as follows: Manufacture of gas, £11,056; distribution, £243; public lamps, £252; rates and taxes, £726; management, £1388; bad debts and allowances, £23; and other small items amount to about £34. The balance carried to profit and loss account is £6306. The quantity of coal carbonized during the half year (including 148 tons of cannel) was 10,786 tons, from which 102,179,000 cubic feet of gas were made, and the following quantities of residuals produced: Coke, 10,786 chaldrons; breeze, 1417 chaldrons; tar, 99,799 gallons; and sulphate of ammonia, 69 tons. With reference to the capital account, the sum spent in the six months was £3214; making the total £169,201. As the total capital receipts to June 30 amounted to £168,049, the balance overdrawn is £1152.

SOUTHPORT CORPORATION GAS DEPARTMENT.

Annual Report of the Gas Engineer.

The Engineer and Manager of the Southport Corporation Gas Department (Mr. J. Booth), in submitting to his Committee his report upon the working of the gas undertaking during the year ending March 25 last, remarks that it is satisfactory to say there has been a large increase in the sale of gas; and, in the matter of net profit realized, the year is a record one. There are, he observes, several causes for the year being so successful, among which may be stated (1) The substitution of oil for cannel as an enricher, (2) the increase in the price of gas; (3) cheaper coal, and (4) less expenditure for renewals. The installation of the small oil-gas plant in the early part of 1894 has been a great financial success. To show the monetary saving by using oil in place of cannel, Mr. Booth gives the total cost of the enrichers used in the years ending in 1893 and 1895; leaving out 1894, when, owing to the coal strike, enhanced prices were paid for cannel. In 1892-3, £11,472 was paid for cannel; and in 1894-5, £951 was spent on cannel, and £1498 on oil—the enriching material thus costing for the past year £9023 less than in 1892-3. The increase in the price of gas of 3d. and 6d. per 1000 cubic feet in Southport and Birkdale respectively, has been maintained throughout the year; but in September, 1894, it was agreed that for gas consumed by separate meter, for all purposes other than lighting, the charge should be 6d. per 1000 cubic feet less than the current price. It is interesting to note that, at the end of the year, there were in use 189 meters for cooking and heating purposes, and 71 meters connected to gas-engines. The cost of coal during the twelvemonth averaged about 4d. per ton less than in the previous year; being equal to £608. In the carbonizing department, the total quantity of gas made amounted to 350,850,000 cubic feet; being an increase of 36,110,000 cubic feet, or 11·47 per cent. The materials used varied as follows: Oil increased by 428 tons; cannel decreased by 12,842 tons; and coal increased by 16,210 tons. These figures in another way prove the benefit obtained from the introduction of the manufacture of oil gas. The minimum and maximum makes of gas during 24 hours were 417,000 cubic feet and 1,604,000 cubic feet respectively; and on 165 days the make of gas exceeded a million cubic feet. The total number of retorts now available is: Throughs, 198; singles, 36; and oil, 18. The quantity of gas sold amounted to 334,626,800 cubic feet; being an increase over the previous year of 34,351,800 cubic feet, or 11·44 per cent. The minimum and maximum deliveries of gas were 361,000 cubic feet and 1,776,000 cubic feet respectively; and on 169 days, the delivery of gas from the works exceeded a million cubic feet. During the year, 375 new service-pipes were laid, and 507 new meters fixed; the total number of the latter at the close being 9406. The sales of residuals realized £13,804; the net increase being £1126. There was an increase on coke of £1584, and on tar of £125; but sulphate of ammonia produced £583 less—the average price being about £1 per ton lower than in the previous year. The total amount received for residuals equalled 7s. 2·84d. per ton of coal carbonized. The gross profit for the year is £23,118; and after paying interest on loans £5270, and sinking fund £1591, there remains a net profit of £16,256. Of this amount, £200 is placed to the reserve fund; leaving available for the relief of the rates or other purposes £16,056, which is equal to a rate of about 14·25d. in the pound. The gas-works reserve fund now amounts to £1458. The expenditure during the year on capital account was only £1095; the total of this account at the end of the year being £188,052. The total sum paid off capital account through the sinking fund is £37,495; and the present mortgage debt amounts to £150,735. Regarding the works, new purifiers were put to work in July, 1894; the sulphate of ammonia house has been taken down and re-built during the year; and in connection with the sulphate plant a new saturator is being fixed. With a view of increasing the sale of gas in the daytime, it was agreed in September last to let out gas-cookers, &c., on hire; but the Corporation not having powers to do this, application was made to the Local Government Board for a Provisional Order giving them the necessary authority, and the usual inquiry was held. The Board have intimated their consent to the application; and the Order is now waiting parliamentary sanction. The new work in hand for the current year includes the following: Buildings and plant for carburetted water gas equal to a make of 750,000 cubic feet of gas per day; erection of condensers for 1¼ million cubic feet of gas per day; a tank for storing tar; and the fixing of two additional exhausters.

THE PROFITS OF THE LEEDS CORPORATION GAS-WORKS.

On the Chairman of the Gas Committee (Mr. Tweedale) presenting their report at last Wednesday's meeting of the Leeds City Council, Mr. Willey called attention to the great profit that had been made in the year ending March last. There was a surplus on the trading of £33,718. At the commencement of the year, there was an accumulated deficiency amounting to £31,188; so that at the end there was a net surplus on the revenue account of £2530. Mr. Batley remarked that the Council ought not to forget that much of this satisfactory result was due to the lower price of coal. Mr. Lowden hoped that, at the next meeting of the Council, the Chairman of the Gas Committee would be prepared to propose a reduction in the price of gas. As to the quality, he did not think that any change was necessary. The illuminating power had, he thought, been quite satisfactory. Mr. Wilson asked the Chairman of the Committee, when considering the question of the disposal of the surplus, to remember the Lamp Committee. The Mayor (Alderman Gilston) said that, with regard to the surplus up to Jan. 25, it was made upon contracts entered into in June of 1894. At that time he predicted that, by the end of June of this year, they would clear off the entire deficit. The present Committee had done well; but he was satisfied that they did not wish to take any credit to the disadvantage of their predecessors. Mr. Tweedale thought the discussion which had taken place was rather inopportune. The questions of the reduction of the price of gas, the abolition of gas-meter rents, and the abolition of the lamp-rate, were not before the Council; and he thought it would have been advisable if the matters had been first discussed by the Committee. In reply to Mr. Henry, Mr. Tweedale added that the opinions he held prior to his appointment as Chairman of the Committee as to the quality of the Leeds gas had not changed. He held the same views as to the management of the gas-works and as to the quality of the gas. The report was adopted.

Sulphate Plant for the Stalybridge Gas Works.—The Gas Committee of the Stalybridge Corporation have resolved to recommend the Council to give an order for the erection of a sulphate of ammonia plant, at a cost of about £725.

ACCOUNTS OF THE SOUTH METROPOLITAN GAS COMPANY FOR THE HALF YEAR ENDED JUNE 30, 1895.

No. 3.—CAPITAL ACCOUNT.

Dr.

	£ s. d.	£ s. d.
To Expenditure to Dec. 31, 1894.	..	3,269,364 10 8
Expenditure during half year to June 30, 1895, viz.—		
New buildings and machinery in extension of works	4,396 14 2	
New and additional mains and services	8,064 19 5	
Do. meters	11,867 1 4	
Do. stoves	14,385 4 10	
	38,713 19 9	
Cr. By sale of land.	4,350 0 0	34,363 19 9
Total expenditure	..	3,303,728 10 5
Balance	..	185,032 17 7
		3,489,761 8 0

Cr.

Description of Capital.	Certified to Dec. 31, 1894.	Received since that Date.	Total to June 30, 1895.
	£ s. d.		£ s. d.
By A stock	500,000 0 0	..	500,000 0 0
B stock	1,850,000 0 0	..	1,850,000 0 0
C stock	290,000 0 0	18,685 0 0	308,685 0 0
Debenture stock, 5 per cent.	775,000 0 0	25,000 0 0	800,000 0 0
	2,915,000 0 0	43,685 0 0	2,958,685 0 0
Premium capital	474,899 0 0	56,177 8 0	531,076 8 0
	3,389,899 0 0	99,862 8 0	
			3,489,761 8 0

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—		
Coals into store, including cost of petroleum spirit for enriching (See Account No. 9)	£223,528 5 5	
Purification, including £5714 12s. for labour	10,440 5 10	
Salaries of Engineer and Officers at works	6,230 10 10	
Wages (carbonizing)	49,437 0 3	
Repairs and maintenance of works and plant, including £36,216 4s. 2d. for labour, less £1421 3s. 0d. received for old materials	73,843 14 0	
		£363,479 16 4
Profit sharing for 12 months to June 30, 1895	£13,538 11 7	
Less on account, Dec. 31, 1894	6,000 0 0	
		7,538 11 7
Distribution of gas—		
Repair, maintenance, and renewal of mains and service pipes, including £12,589 16s. 6d. for labour	£16,614 13 4	
Salaries, &c., Officers and Rental Clerks	10,506 8 2	
Repair, &c., of meters (£920 16s. 11d. for labour)	9,341 5 5	
Repair, &c., of stoves (£2127 3s. 9d. for labour)	5,881 3 0	
Gas fittings (labour)	3,499 4 9	
		45,875 14 8
Public lamps—lighting and repairing		6,234 10 3
Rents, rates, and taxes		23,478 13 8
Management—		
Directors' allowance	£1,750 0 0	
Salaries of Secretary, Accountant, and Clerks	2,166 16 1	
Collectors	6,749 10 10	
Stationery and printing	1,368 12 7	
General charges	3,860 6 3	
Company's Auditors	112 10 0	
		16,007 15 9
Parliamentary charges		542 1 6
Bad debts		1,392 13 1
Pensions and officers and men's superannuation and sick fund		3,915 16 7
Gas Referees and Official Auditor		291 2 1
Total expenditure		£468,756 15 6
Balance carried to net revenue account (No. 5)		177,002 5 4
		£645,759 0 10

By Sale of gas—		
Lady Day, at 2s. 4d. per 1000 feet	£276,637 12 6	
Midsummer, at 2s. 4d. per 1000 feet	150,411 8 4	
	£427,049 0 10	
Public lighting and under contracts (see Statement No. 11)	30,787 13 10	
		£457,836 14
Meters in use, 119,242—		
Company's meters at rent: Ordinary, 77,885; automatic, 32,333	£11,397 9 1	
Stoves at rent: Ordinary, 27,120; auto., 20,817	7,718 3 2	
		19,115 12 3
Residual products—		
Coke, less £15,071 16s. 5d. for labour, &c.	£110,479 1 2	
Breeze, less £2159 1s. 4d. for labour, &c.	3,287 11 10	
Tar, less £356 14s. 10d. for labour, &c.	25,476 7 9	
Ammoniacal liquor, less £184 12s. 3d. for labour, &c.	14,983 3 4	
Sulphate, less £4026 10s. 6d. labour, acid, &c.	12,970 11 4	
		167,196 15 5
Rents receivable		1,537 16 0
Transfer fees		72 2 6
Total receipts		£645,759 0 10

No. 5.—PROFIT AND LOSS (Net Revenue) ACCOUNT.

Interest on temporary loan and deposits			£1,177 14 3
Interest on debenture stock			19,333 6 8
Amount carried to insurance fund			5,396 1½ 3
Balance applicable to dividend on the ordinary stock			179,577 17 11
			£205,485 13 1
Balance from last account			£172,736 14 7
Less—Dividend for half year ended Dec. 31, 1894	£138,600 0 0		
Dividend undivided carried to reserve fund	5,850 0 0		
			144,450 0 0
			£28,286 14 7
Amount from revenue account (No. 4)			177,002 5 4
Interest on Bankers' balances			196 13 2
			£205,485 13 1

No. 9.—STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1894.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, June 30, 1895.
	Tons.	Tons.	Tons.	Tons.	Tons.
Newcastle coal	72,488	352,896	407,129	405	17,790
Cannel coal	1,592	1,130	1,352*	..	1,370
	74,080	353,966	408,481	405	19,160

* 245,334 gallons of petroleum spirit used as a substitute for cannel.

No. 10.—STATEMENT OF RESIDUAL PRODUCTS.

—	In Store, Dec. 31, 1894.	Made during Half Year.	Used in the Half Year.	Sold in the Half Year.	In Store, June 30, 1895.
Coke—cwt.†	478,553	5,024,748	1,002,815	3,789,011	711,475
Breeze—yards	6,292	76,050	16,064	60,488	5,790
Tar—gallons	357,655	4,064,249	11,165	4,141,017	269,722
Ammoniacal liquor—butts.	17,372	126,456	59,173	74,906	9,749

† 1 cwt. of coke about equals 1 sack of 4 bushels, under Weights and Measures Act, 1878.

No. 11.—STATEMENT OF GAS MADE, SOLD, Etc.

Description of Gas.	Quantity made.	Quantity Sold.			Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lamps.
		Public Lights (estimated).	Private Lights (per Meter).	Total Quantity Sold.				
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	4,179,426	220,072	3,695,340	3,915,412	56,553	3,971,965	207,461	19,630

No. 12.—BALANCE-SHEET.

To Capital—		
Balance—per account No. 3		£186,082 17 7
Reserve fund—per account No. 6		67,715 0 1
Renewal fund—per account No. 7		14,022 4 5
Insurance fund—per account No. 8		42,184 2 8
Net revenue account—for balance, per account No. 5		179,577 17 11
Debenture interest, for amount due to June 30, 1895		19,333 6 8
Sundry tradesmen, for amount due for coals, stores, and sundries		52,983 0 4
Deposits by consumers		25,969 18 5
Dividend account (outstanding)		1,487 13 11
Debenture account "		368 18 1
Workmen's bonus and savings deposited with the Company		41,212 3 0
Officers' superannuation and guarantee funds		21,669 6 3
		£652,556 9 4
By Cash at Bankers		£204,641 10 7
Amount invested (reserve fund, £54,636 11s. 8d.; renewal fund, £14,012 10s. 3d.; insurance fund, £20,038 6s. 11d.)		88,747 8 10
Cash in hand for sundry payments		500 0 0
Stores in hand—		
Coals and enriching materials	£11,472 4 3	
Coke and breeze	15,111 17 11	
Tar, sulphate, and ammoniacal liquor	4,613 9 5	
Sundry stores	105,640 14 10	
		136,838 6 5
Investment of workmen's bonus, &c.		11,167 22 9
Accounts due to the Company—		
Gas meter and stove rental, quarter ending June 30, 1895	£159,098 1 11	
Arrears outstanding	3,875 19 1	162,974 1 0
Coke and other residual products		18,401 4 6
Balance due for automatic gas-fittings		25,680 9 0
Sundries		3,605 16 3
		£652,556 9 4

THE BOLTON CORPORATION AND THEIR GAS STOKERS.

A threatened strike of stokers at the Lum Street Gas-Works of the Bolton Corporation has been averted for the present; but a good deal of friction has been created between the parties to the dispute. Alderman Miles, the Chairman of the Gas Committee, explained to the Council, at their meeting last Wednesday, how matters stood in regard to the dispute. He said that early in the present year the stokers, under the auspices of the Gas-Workers' Union, made an application for an alteration of the conditions under which they laboured, and also for increased remuneration. After long negotiations, it was agreed that the stokers should be paid time-and-a-half for a third shift of eight hours on Sundays. Formerly only two shifts were paid time-and-a-half; and the Committee agreed to the extra remuneration for the other shift, provided the men could see their way to carbonize a little extra coal. At the Lum Street works, the coal then carbonized was 3 tons 8 cwt.; and it was felt, in view of the concession, that 3 tons 12 cwt. would be a reasonable quantity. Since the generative system of firing had been adopted at Lum Street, it had been found that, with 3 tons 8 cwt., the 560 odd retorts had never done a full day's work; and the Engineer had from the outset advocated a much larger quantity being carbonized. The men provisionally agreed to the extra work, providing screens were put up; and the new arrangement was to take effect as from the 1st inst. Before a shift and a half had been completed on that day, however, the men declared they could not do the work, and were disinclined to continue the attempt. The Committee offered, as a means of settlement, that from the 1st of October to the 31st of March, 3 tons 12 cwt. of coal should be carbonized each shift, and for the remainder of the year 3 tons 8 cwt.; but this proposition was rejected by the men. At a special meeting of the Committee held the night previous to the Council meeting, it was resolved that the increased carbonization of coal be not insisted upon, provided the money paid to the workmen since the 5th of April, in pursuance of the original arrangement, be refunded, and that in future time-and-a-half only be paid for the two shifts on Sundays. Alderman Miles added that he presumed this would settle the matter; but he could not refrain from expressing the opinion that the action of the men was misguided. He would leave the future to develop itself. The proceedings of the Committee were confirmed without comment. The men at the Gas Street works of the Corporation are not affected by the dispute.

MANCHESTER CORPORATION GAS AND ELECTRIC LIGHT SUPPLY.

Annual Reports of the Gas and Electric Light Committee—Abstract of the Accounts of the Gas Department.

In the last number of the JOURNAL, we referred to the result of the working of the Manchester Corporation Gas Department in the past financial year. The department, it will be remembered, has also the management of the electric light undertaking. We have, as usual, received from the Superintendent (Mr. Charles Nickson) copies of the annual reports of the Gas and Electric Lighting Committee, from which we make the following extracts:—

The Gas Committee begin by calling attention to the fact that the long-continued frost of last winter and the exceptionally dark and severe weather during the months of February and March last caused a great increase in the consumption of gas, especially during the day-time, which taxed to the utmost the resources of the works. The Committee, however, were enabled to give a full supply of gas during the whole year. The increase for the twelve months was 4·28 per cent., as compared with a decrease of 2·82 per cent. in the year 1893-4. The following statement shows the quantity of coal and cannel carbonized during the past year as compared with the previous year:—

	Coal and Cannel Carbonized. Tons.	Gas Made per Ton. Cubic Feet.	Gas Sent Out from the Works. Cubic Feet.	Gas Unaccounted for. Cubic Feet.	Percentage of Loss.
1895	364,895	10,084	3,683,067,000	103,634,000	2·81
1894	360,654	9,802	3,532,035,000	112,910,000	3·20

The average illuminating power of the gas sent out was equivalent to 19·16 sperm candles, as against 19·04 candles for the previous year. The following statement shows the quantity of coke, tar, and ammoniacal liquor made during the year, as compared with the year 1893-4:—

	Tar.		Ammoniacal Liquor.		Coke.	
	Total Quantity. Tons.	Yield per Ton. Gallons.	Total Quantity 10-oz. Strength. Gallons.	Yield per Ton. Gallons.	Total Quantity. Tons.	Yield per Ton. Cwt.
1895	25,110	13·42	10,177,248	27·90	231,125	12·67
1894	21,990	11·90	9,142,616	25·35	235,474	13·06

The number of consumers in the city in the past financial year was 66,345; and beyond the city, 15,944—making a total of 82,289, or 654 more than in the previous year. The average consumption of gas per consumer in the city was 42,208 cubic feet; and beyond the city, 27,743 cubic feet. The number of gas fires and cookers in use was 7040, and the number of gas-engines 983, as compared with 6160 and 858 respectively for the year ended March 31, 1894. The quantity of gas used in these appliances is estimated at 185,500,000 cubic feet; being an increase of 14·51 per cent. The number of prepayment meters in use at the end of the financial year was 1481; being an increase of 9·6. The quantity of gas consumed through these meters was 6,430,000 cubic feet—an increase of 4,083,100 cubic feet, or 170·87 per cent., on the preceding year.

The total amount of revenue last year was £579,277 14s. 9d., as compared with £569,031 14s. 5d. in the year 1893-4; being an increase of £10,246 0s. 4d. The amounts received were as follows:—

	Year 1894-5.	Year 1893-4.
Gas-rents within the city	£361,467	£348,695
" beyond the city	74,693	70,927
City fund for street lighting	46,058	44,878
Coke	46,077	53,211
Tar	18,905	18,270
Ammonia water	31,705	32,774
Sundry receipts	373	277
Total	£579,278	£569,032

With regard to expenditure, the amount paid for coal and cannel, including the cost of unloading, was £244,011 13s. 6d., against £293,280 10s. for 1893-4; being a decrease of £49,268 16s. 6d. The gross profit on the year's working is £134,692 1s. 6d. The sum of £30,299 13s. 8d. was paid for interest, and £13,954 has been placed to the sinking fund (as required by the Acts of Parliament under which the money is borrowed). The net profit therefore amounted to £90,438 7s. 10d., which has been applied as follows: Amount paid over to the city fund during the year, as per estimate, £54,044; balance placed to the contingent fund account (of which sum £15,000 will be paid to the city fund in aid of the rates for the year ending March 31, 1896), £36,394 7s. 10d.

By the decision of the City Council on Feb. 6 last, meter-rents were abolished within the city, and the price of gas was reduced 3d. per 1000 cubic feet to all consumers both within and beyond the city. These concessions it is estimated will reduce the revenue of the department from meter-rents, by £10,500; from gas-rents within the city, by £39,500; and from gas-rents beyond the city, by £6100—together £56,100. The advantageous terms upon which coal and cannel have been recently purchased will, however, to some extent compensate the Committee for these reductions.

As to extensions and renewal of works, the Committee state that the new gasholder at the Gaythorn station was in partial use during the past winter, and will be fully available for next winter, to ensure a good supply of gas to rapidly-increasing districts to the south and south-west of the city. The four large purifiers, and the new condenser, Livesey washer, and washer-scrubbers, reported last year to be in progress at the Rochdale Road station, have been completed, and have worked satisfactorily. The construction of the tank for the large gasholder at the Bradford Road station has made fair progress, and is now rapidly approaching completion. A new stage-floor has been erected in No. 2 retort-house. The new offices, stables, stores, and mechanics' workshops have been completed, and are now in occupation and use, and are adding greatly to convenience and efficiency in working the station. The settings of inclined retorts at the Droylsden station continue to give satisfaction. An experiment in the purification of gas which is being tried there is being watched with considerable interest, with the view of ascertaining if the result will justify its application to other of the works. The usual annual renewals and repairs of plant have been efficiently carried out; and the whole of the works have been kept in thorough order out of revenue.

With respect to the supply and distribution of gas, the operations of the past year were chiefly devoted to a thorough examination and repair of the mains and services, the whole of which, so far as is known, are in good condition. This is clearly proved by the loss from leakage and condensation being only 2·81 per cent.—the lowest on record. The work of laying larger mains along some of the principal roads leading to certain outlying districts is to be completed during the present summer.

The new building erected in Deansgate for the exhibition of gas-stoves is now complete; and various cookers, fires, and other gas-consuming appliances are being fixed therein. The basement is used as a workshop; and the top storey for light repairs. The whole of the building is lighted by gas and electricity; and a small electric motor has been put up to supply power to certain machines. The premises are well adapted to the purpose for which they are intended; and the Committee are about to take steps to promote gas consumption for cooking, heating, power, and other non-illuminating purposes.

In the report on the electric light undertaking, the Committee state that the number of consumers at the close of the year ending March 31 last was 741; being an increase of 329 as compared with the previous year. The number of lamps in use was: Incandescent, 30,316 (of 16-candle power); and arc, 385. For the preceding year, the numbers were 18,478 and 250 respectively. There were also 17 motors in use, representing 16-horse power, as compared with 11 similar motors last year. The total length of mains laid was 63 miles 258 yards. The total quantity of current accounted for was 1,199,988 units. The amount received for sales of current, which works out to 5·63d. per unit accounted for, was £28,145 3s. 6d.; the rental of meters was £494 19s. 11d.—making a total revenue of £28,640 3s. 5d. The cost of generation, distribution, and management was £10,991 17s. 4d.; to which must be added £7938 18s. 7d. for interest, bankers' commission, and sinking fund, and £4000 for transfer to renewals account—total, £22,930 15s. 11d. This left a balance of £5709 7s. 6d., which has been dealt with as follows: To previous year's debit balance, £209 18s. 10d.; carried forward to next year's account, £5499 8s. 8d. (of which sum it has been decided to pay £5140 12s. 11d. to the city fund in aid of rates for the year ending March, 1896, as per estimates). The reduction in the price of current from 8d. to 6d. per unit is estimated to affect the revenue during the current year to the amount of £4650; but it is expected that increased business will to some extent recoup the Committee for this reduction. The works reported last year to be in progress, with the new offices, workshops, and store-rooms, have been completed, and are now in full use and occupancy. The entire plant has worked satisfactorily; and there has been no interruption in the supply of current of more than a minute or so, and then only on a portion of the system, throughout the year. The applications for the supply of electricity have been so numerous that, as already reported to the Council, the Committee have decided to increase the plant at the central station; to erect a storage battery equal to 4000 16 candle power incandescent lamps at the Hunt's Bank sub-station, and to extend the supply of electricity in various streets. The Local Government Board have given authority to the Corporation to borrow the sum of £100,000 for

carrying out these extensions and additions to the plant, which are expected to be partly available for the ensuing winter. The plans are in a forward state; and main laying has already been commenced. The method of distribution will be as before—on the five-wire system; and it is intended to carry out the extensions of mains by the Corporation's own staff.

The following are some of the principal figures in the accounts of the Gas Department for the year ending March 31 last;—

PROFIT AND LOSS ACCOUNT

EXPENDITURE.

Cannel and coal (including cost of unloading, &c.)		£244,011 13 6
Retort men's wages		43,585 8 11
Retorts, fire-bricks, &c. (including cost of setting)		11,199 15 5
Repairs and maintenance of works, mains, &c.		52,729 10 4
Purifying material and wages		4,020 17 0
Salaries and wages of clerks in Superintendent's office, rental and inquiry offices, and meter inspectors		16,964 6 8
Collectors' salaries		7,212 11 1
Rents, rates, and taxes		22,404 11 1
Renewals of plant, &c.		24,689 16 4
Bad debts		592 19 4
Miscellaneous expenses		4,872 5 8
Lighting, repairing, and maintaining city lamps		12,296 16 8
		£444,580 12 0
Balance carried forward		134,697 2 9
		£579,277 14 9
Interest		£30,304 14 11
Sinking fund		13,954 0 0
Balance carried down		90,438 7 10
		£134,697 2 9

INCOME.

Gas-rental		£416,409 19 10
Meter-rents		13,110 6 9
Stove-hire		1,578 17 1
Total cost of street lighting receivable from city fund—		
Value of gas	£33,760 18 1	
Lighting, repairs, and maintenance	12,296 16 8	
		46,057 14 9
Public lamps beyond the city		5,060 6 9
Residual products—		
Coke	£46,077 4 10	
Tar	18,905 3 10	
Ammonia water	31,704 16 5	
		96,687 5 1
Rents of cottages, &c.		373 4 6
		£579,277 14 9
Balance of profit		£90,438 7 10
Amount paid over to the city fund account		£54,044 0 0
Balance placed to contingent fund account		36,394 7 10
		£90,438 7 10

STATEMENT OF ASSETS AND LIABILITIES.

ASSETS.

Gaythorn station—land, buildings, and apparatus		£238,357 3 2
Rochdale Road station		284,645 10 10
Bradford Road station		509,496 6 5
Droylsden station		25,404 16 10
Street-mains stores (Poland Street)—land, buildings, and apparatus		2,961 8 10
Street-mains		397,968 9 0
Service-pipes		63,942 12 8
Hired meters		88,432 17 1
Hired stoves		11,923 11 10
Stoves show-rooms (Deansgate)		6,132 2 11
Cottage property purchase-money		1,652 13 6
Total property		£1,630,917 13 1
Cannel, coal, retorts, and other material in stock		117,106 7 2
Gas-rents and other accounts due to the Committee		160,633 14 2
Cash in hand		5,673 13 1
Total property and assets		£1,914,331 7 6

LIABILITIES.

Mortgage debt		£828,627 0 0
Sums advanced (not secured by mortgage)		1,430 0 0
City fund—		
Amount received for street lighting	£47,316 4 0	
Less expenditure (including balance brought forward)	46,886 16 6	
		429 7 6
Accounts owing for coal, &c.		41,665 9 4
Deposits held in security of gas-rents		38,788 3 4
Interest due thereon		5,384 4 4
Cash deposits for due performance of contracts		4,550 0 0
Amount payable on account of cottage property		1,600 0 0
Amount owing to bankers		63,379 9 11
Total liabilities		£985,853 14 5
Surplus and sinking fund, as per last statement	£872,248 10 0	
Transferred from profit and loss account for the year ended March 31, 1895	13,954 0 0	
		886,202 10 0
Contingent fund account—		
Amount as on March 31, 1894	£5,880 15 3	
Add transferred from the profit and loss account this year	36,394 7 10	
		42,275 3 1
		£1,914,331 7 6

GENERAL SUMMARY OF THE CAPITAL AND REVENUE ACCOUNTS.

RECEIPTS.

Balance brought forward (see summary March 31, 1894)		£150,897 6 5
Amount received on sale of clay, &c., at Bradford Road		50 0 0
Loans received during the year		194,551 0 0
Sinking fund, transferred from profit and loss account		13,954 0 0
Balance of profit and loss account (as per statement)		90,438 7 10
		£449,890 14 3

EXPENDITURE.

Loans repaid		£19,900 0 0
Temporary loan from Manchester Ship Canal Company		175,000 0 0
Amount paid over to the city fund account, being the estimated year's profits		54,044 0 0
Expenditure charged to capital account		73,329 14 3
Stocks on hand	£117,106 7 2	
Gas-rents, &c., due	160,633 14 2	
Cash in hand	5,673 13 1	
	£283,413 14 5	
Less accounts owing to sundry creditors	155,796 14 5	
		127,617 0 0
		£449,890 14 3

The accounts proper are followed by the usual appendices, giving some interesting statistics as to the progress of the gas undertaking during the past municipal year.

The figures in Appendix A—a statement of the lamp and private rental, including meter and stove rents, derived from within and beyond the city—have already been given when dealing with the profit and loss account.

Appendix B is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1894	865,994,000	3,532,035,000
Do. do. 1895	988,362,000	3,683,067,000
Increase	122,368,000	151,032,000

	Cubic Feet.
Quantity of gas transmitted from works	3,683,067,000
,, measured and accounted for	3,579,433,000
Loss (by condensation and leakage)	103,634,000, or 2·81 per cent.

In Appendix C, particulars are given as to the results of the working from June 24, 1880, to March 31, 1895. The table contains statistics as to the number of tons of coal carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., for each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 364,895 tons; gas made, 3,679,669,000 cubic feet; yield per ton of coal carbonized, 10,084 cubic feet; illuminating power, 19·16 candles; make, reduced to 20-candle power, 3,525,122,000 cubic feet; make per ton, 20-candle power, 9661 cubic feet; make of coke, 231,125 tons; do. per ton of coal, 12·67 cwt.; make of tar, 25,110 tons; do. per ton of coal, 13·42 gallons; make of ammoniacal liquor (10-oz. strength), 10,177,248 gallons; do. per ton of coal, 27·9 gallons.

Appendix D shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 5300 stoves in use within, and 1740 beyond the city—together, 7040. Of these, 2544 were on hire within, and 835 beyond the city (together, 3379), as compared with 2343 and 776 (together, 3119) at the corresponding date in 1894; so that there was an increase of 260. The numbers of the meters in use were 82,289 in 1895 and 81,637 in 1894. There was last year a net increase of 652 on the number for the preceding year. Of the total number at work on March 31 last, 72,881 were on hire, as compared with 71,796 at the close of the financial year 1893-4. The number of prepayment meters on hire on March 31 last was 1481—an increase of 956 on the number at the close of the preceding year.

From Appendix E we learn that the gas-mains laid last year within the city amounted to 19,128 yards, and beyond the city to 7809 yards—a total of 26,937 yards, or 15¼ miles 97 yards. The mains taken up were 9209 and 992 yards respectively—a total of 10,201 yards, or 5¾ miles 81 yards. The total net increase during the year therefore was 16,736 yards, or 9½ miles 16 yards. The total length of mains laid at March 31 last was 1,274,254 yards, or 724 miles 14 yards.

Appendix F consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from 1862 to March last. The figures for the past financial year are as follows: Profit, £134,697; paid over for improvement purposes, £54,044; carried to contingent fund, £36,394; borrowed money owing, £830,057; and excess of assets, £928,477. The profit of £134,697 is appropriated thus: Interest, £30,304; liquidation of mortgage debt, £13,954—leaving a surplus of £90,438.

The Recent Scarcity of Water at the East-End.—Owing to the recent rains, the water available for distribution by the East London Company has considerably augmented. Last Tuesday, the officials of the Company reported that since the previous Saturday there had been an increase in the volume of water stored in the various reservoirs of upwards of 50 million gallons; and during the day there was a further accretion to the extent of some 15 million gallons—making a total of 65 millions. By last Thursday, this had risen to 100 millions. In most of the districts at the East-end, the five hours' intermittent supply is being so managed as to allow of an hour's service in the evening. The crisis may now be regarded as past; and the constant service will be restored at the earliest possible moment.

GLASGOW CORPORATION GAS AND ELECTRICITY SUPPLY.

The Annual Accounts.

The accounts of the Gas and Electricity Department of the Glasgow Corporation for the year ending May 31 last were submitted to the Town Council on the 1st inst. by Mr. MITCHELL, who has succeeded the late ex-Bailie Ure as Convener of the Works Committee.

The report on the Gas Department stated that the gross revenue amounted to £629,362; and the gross expenditure, to £489,910. To the latter was added £67,518, depreciation written off capital; making together £557,428, and leaving a balance of £71,933 to go to the profit and loss account. The Committee had to meet the following requirements during the year: Annuities on stock, £33,603; interest on borrowed money, £27,997 (together £61,600); and sinking fund, £5350; making altogether £66,950, and leaving a surplus on the year's operations amounting to £4983. There was a balance of £164 brought from the previous year; and this, added to the surplus from last year, made £5147. Out of this there was made good the loss on the electric lighting account, amounting to £1527; and £3500 was transferred to the fire insurance fund—leaving £120 to be carried forward.

The income from residuals last year showed an increase of £27,000; the average price for coke having been nearly 1s., and of ammoniacal liquor and tar, about 6d. per ton of coal carbonized, more than in the previous year. While the Committee anticipated a considerable decrease in the income from ammoniacal liquor and tar during the current twelve months, they, having regard to the favourable results of the year's operations, and to the decreased price at which the coal required had been purchased, felt they were justified in recommending that the price of gas should be 2s. 4d. per 1000 cubic feet—being a reduction of 2d., and the lowest price at which gas had been supplied in Glasgow; the reduction to take effect retrospectively as from the date of the last survey. The quantity of gas sold or accounted for during the year was 4,029,107,000 cubic feet—an increase, as compared with the previous year, of 7·11 per cent. The sinking fund, with its accumulations, now stands at £297,804.

The works and mains were maintained in a state of efficiency during the year. The alterations and additions which were carried out at Tradeston and Dawsholm works proved of great advantage in the manufacture. The Committee stated that the construction of the new gasholder at Tradeston, contracted for in March last, was being proceeded with, and there was every reason to hope that it would be ready for use before the winter of next year. About five miles of new mains—principally 24 and 18 inches in diameter—are at present being laid, which will improve the supply of gas in several districts. Notwithstanding the severe frost of last winter, which did considerable damage to the gas-pipes throughout the city, the gas unaccounted for during the year was 10·90 per cent., as compared with 11·97 per cent. in the preceding year. The greatest quantity of gas sent out during the year in 24 hours was 26,077,000 cubic feet. The maximum daily make was 23,313,000 cubic feet. The number of meters in use on the 31st of May last was 166,574; being an increase of 4500 over the number at the corresponding date in the preceding year. During the twelve months reported upon, 17,386 meters were repaired; 13,101 were examined while in use, of which 10,920 were found in a satisfactory condition, while 2181 were defective and were removed. The number of gas-stoves let out on hire was 12,135; being 1136 more than the number on hire at the corresponding date last year. The number of gas heating and cooking appliances sold during the year was 1694.

The sum payable in annuities upon £415,000 stock of the old Gas Companies is £34,762. Of the amount of loan capital authorized—£1,000,000—there has been borrowed £903,535; leaving £96,465 to be raised. The capital value of the Dalmarnock station and works is entered in the accounts at £103,534; the Dawsholm station and works, at £244,131 (including an addition of £14,095 during the year); the Tradeston station and works, at £133,828 (including an addition of £3719 during the year); the Temple station and works, at £140,413 (including an addition of £1000 during the year); the Old Kilpatrick station and works, at £6032; and the Pollokshaws station and works, at £3206. The chemical works at Dawsholm are entered at the capital value of £6660; and the chemical works at Tradeston, at £9227. The capital value of pipes, including the cost of laying, is put down at £287,960, which includes an addition of £16,866 during the year. Gas-meters are entered at £154,480, inclusive of an addition of £14,774. In the gas-stoves account, the value is entered at £25,080. The total capital account is £1,140,426.

In the revenue account, the cost of coal (487,382 tons) is stated at £264,060; of purifying materials, at £15,202; the salaries of engineers and officers of works, at £4732; workmen's wages, at £76,251; repairs and maintenance of works and plant, machines, apparatus, tools, materials, and labour, at £44,224; and carting and stabling, at £5253—making a total in the manufacturing department of £409,725, as compared with £382,089 in the preceding year. Distribution of gas cost £50,669, as compared with £44,372; rents, rates, and taxes, £20,687, as compared with £20,110; and management, £8718, as compared with £8986. There were no law and parliamentary charges; and retiring allowances to old servants of the Companies amounted to only £110. The amount derived fom the sale of gas was £496,285, as compared with £463,457; from coke, £46,693, as compared with £38,514; from ammoniacal liquor and tar, £83,849, as compared with £65,084; and from waste lime, £1084, as compared with £675. Mortgages to the amount of £233,435 have been redeemed

In the electric lighting department, it was stated that the gross revenue amounted to £21,196, and the gross expenditure to £11,987. To this there was added £5151 for depreciation; leaving a balance on the profit and loss account of £4057. Out of this the Committee had to meet: Interest on loans, £4254; and sinking fund, £1330 (together, £5584)—producing a deficit of £1527, which was made up out of the gas account, in terms of the Electric Lighting Provisional Order. The reduction in the price of electricity sanctioned by the Town Council last year was expected to be more than met by an increase in the quantity consumed. The Committee expressed regret that this anticipation had not been realized; the increase due to new consumers being counteracted by the discontinuance of supply to one or two important customers, which, however, it was believed, would be, to some extent, temporary. Notwithstanding the adverse result of the year's operations, the Committee recommended that the price of electric current should be continued at 6d. per Board of Trade unit. While interest and sinking fund had been charged on the capital of the works, including additions during the year, the full benefit of the increased capability of supply thereby secured could, they remarked, only be felt gradually, when no doubt a better result would be obtained. The additional plant referred to in last year's report had now all been laid down, and was ready for the coming lighting sesaon. The number of consumers on May 31 last was 586; being an increase of 208 over the number on the same date last year. The quantity of electricity sold to private consumers, irrespective of public lighting, was 714,362 Board of Trade units—an increase of 31·51 per cent. over the preceding year. In the capital account, it was stated that, of the total amount authorized—£200,000—there had been borrowed £133,000; and £2000 had been repaid. The John Street station (land and buildings) is entered as of the value of £2137; and machinery and plant at £6162. The Waterloo Street station (land and buildings) is entered as of the value of £19,919; and machinery and plant, at £31,432, which includes an addition of £7688 during the year. Mains and cables are put down as being of the capital value of £60,613, which includes an addition of £10,763 during the year; transformers are charged at £400; meters and certifying fees, at £5116, inclusive of an addition of £1258 during the year; and the royalties account is stated at £425. In the revenue account, coal cost £2117, as compared with £1617 in the preceding year; and the total generating charges are stated at £6702, against £5897. Distribution charges amounted to £1752, as compared with £1104; and management cost £1143, against £1250. The amount derived from the sale of current to private consumers was £17,850; from public lighting, £2671; from the hire of meters, £535; and from the hire of electric lighting machinery, £139. The quantity of electricity generated was 1,022,730 Board of Trade units, of which there were sold, to private consumers, 714,362 units; and supplied to public lamps, 186,925 units—leaving 922,115 units, or 9·83 per cent., unaccounted for.

At a meeting of the Sub-Committee on Works, held on the 24th ult., there was read a report from Mr. Foulis in regard to the opening up of streets for laying down gas and water pipes. Mr. Foulis informed the Committee that it had always been the practice of the Gas Department, when laying pipes in crowded thoroughfares, to have as much as possible of the work done when the traffic on the streets was least; but about nine-tenths of the work must be carried out during daylight, for the reason that it would be unsafe to use lights in the trenches while making gas connections.

Mr. MITCHELL, in submitting the report of the Committee, said the history of the past year's working amply justified the hope expressed in last year's report that a favourable result would be obtained. At one time, indeed, in the midst of a long, disastrous coal strike, it seemed as if the result would be very different; but, thanks to the continued efforts of the Committee and officials, the loss sustained by purchasing coal during a suspension of contracts was minimized as far as possible, and an increased consumption of gas, a favourable price for residual products, and extended use of mechanical appliances, had all combined to enable the Committee to lay before the Council a favourable retrospect of this great commercial department of the Corporation, the revenue of which now amounted to upwards of £650,000. Regarding the Gas Department, and how the profit had been dealt with, he had only to repeat what had already been announced—that, following a policy which had always been the aim of the Gas Committee, they had pleasure in recommending that the consumers should immediately participate in their prosperity, and that the price of gas should be 2s. 4d. per 1000 cubic feet, from the date of the last survey; being the cheapest price at which gas had been supplied in Glasgow. The only important expenditure being incurred at present was for the last new gasholder at the Tradeston station, which would be second only to that at Dawsholm, and when completed would afford a great additional security for a continuous supply of gas during dark and wintry weather. In the Electric Lighting Department, the Committee regretted that a profit had not yet resulted. No doubt this would be altered in the near future. In the circumstances, the Committee did not propose to alter the price of 6d. per Board of Trade unit, at which electricity was at present supplied. Mr. Mitchell, on behalf of the Committee, referred feelingly to the loss of Mr. Ure, their honoured and respected Chairman.

Mr. W. F. ANDERSON called attention to Mr. Foulis's report as to the opening of streets, and expressed regret that it was not more favourable. He admitted that emergencies arose to cause the streets to be opened. To this no one would object. But unless a promise could be given that the desire of the Statute Labour Committee would be carried out, he would have to enter his dissent.

Mr. W. STEVENSON said the report really carried out all that was needed; for, as far as possible, Mr. Foulis promised that he would consult with the Master of Works.

Mr. R. ANDERSON said he was one of the deputation from the Statute Labour Committee to the Gas Committee on the subject; and he recognized that the report of Mr. Foulis met all the Statute Labour Committee desired, and this was also the opinion of the Convener of the Committee.

The minutes and the motion of Mr. Mitchell were approved.

Welsh Watersheds and Water Schemes.—At the quarterly meeting of the County Council for Monmouthshire last Wednesday, Alderman Grove brought forward the subject of the decreasing limits of water-gathering areas in Wales; and, on his motion, the following resolution was passed: "That in view of the rapidly decreasing area in Wales and Monmouthshire available as gathering-ground for the supply of water, and of the possibility of still further inroads being made by English corporate bodies, it be referred to the Parliamentary Committee to specially report to the Council at its next meeting as to what steps, if any, can and ought to be taken for the conservation to this county of such areas as may be necessary for the adequate supply of water."

STOCKPORT CORPORATION GAS SUPPLY.

The Quality of the Gas.

At the Meeting of the Stockport Town Council last Wednesday, the subject of the quality of the gas supplied by the Corporation came before the members on a motion submitted by Mr. Burrows. It was as follows: "That an independent and competent person be appointed by the Council to act under the direction of the General Purposes Committee, whose duty shall be to examine and report upon the pressure, quality, and illuminating power of gas supplied by the Corporation, and that all such reports shall be entered in a book kept for that purpose." In support of his motion, he inferred that the quality of the gas was affected by the cremation of dogs' carcases at the gas-works. The effect of the motion was not startling, for nobody seemed inclined to second it. After a protracted pause, however, Mr. Fairbrother did so; expressing the opinion that general satisfaction would be given if it were passed. Dr. Hyde Marriott supported the motion in a speech in which he gave the Council a few scientific details in regard to the manufacture of gas. He stated that experiments had been tried by Mr. Bell at the gas-works; and he thought the Corporation ought to have a small destructor to get rid of the refuse. Mr. Redfern characterized the motion as an insult to the Gas Committee, inasmuch as it proposed to appoint an officer to supervise the work of the Gas Engineer (Mr. S. Meunier), and to set him above the Committee. He thought Mr. Burrows had shown bad taste in bringing forward his motion when the Chairman and Vice-Chairman of the Committee were absent. It would have shown better taste if he had adjourned it for a month. Mr. Burrows really wished to override the Council. Mr. Roscoe said the Committee were doing all they could. They were erecting a testing-house. Mr. Bell said he ought to make a few remarks with reference to burning dogs. Alderman White some time ago spoke about burying them; but the late Alderman Marshall advised that the carcases should be destroyed in the furnaces at the gas-works. It had been done in Birmingham without any detrimental results. The dogs could be destroyed in the simplest manner possible. The Mayor (Mr. F. R. Robinson, J.P.) remarked that, in the absence of the Chairman of the Gas Committee, he might state that he had been a member of the Committee for fourteen years. If Mr. Burrows' statements were true, the public would not long continue to consume the gas supplied. The dogs referred to were put into the furnace; and the products could not come in contact with the gas. With regard to the illuminating quality, if the light were of 8-candle power only, as had been stated, it was invariably the fault of the meter or the fittings. If the consumer sent to the Gas Office, he could have all his fittings inspected and put right. Up to 1888, an Analytical Chemist was employed. But the Council came to the conclusion that his services were of no use. The present Gas Engineer was quite chemist enough to determine the composition of the gas so far as sulphur and ammonia were concerned; and these were the two ingredients detrimental to health. Mr. Burrows having disclaimed any intention of offering an insult to the Committee, the motion was put, and lost.

OIL GAS ENRICHMENT COMPANY, LIMITED.

The Second Annual General Meeting of the shareholders of this Company was held in Edinburgh on the 29th ult.—Mr. Walter Thorburn, M.P., in the chair.

The Secretary (Mr. J. G. Mason, S.S.C.) having read the minutes of the first annual meeting, the report and accounts, already noticed in the Journal, were presented.

The Chairman, in moving the adoption of the report, expressed regret that it was not so favourable as regards dividend as it was last year. The reasons were, he said, not far to seek. First of all, the price of cannel coal had been very much reduced; and, on the other hand, the price of oil had been very much increased. The effect had been, in the meantime, to deter gas companies from going in for the Company's process. The Directors might have prepared the balance-sheet to show considerably better than it did; for £547 15s. had been entirely written off. This sum was incurred in connection with foreign patents and experimental work which had been going on during the past year; and it might have been added to the preliminary expenses, and only a proportion taken off. But, having written off this large sum entirely against the profits of the year, they had not deducted anything from the balance of preliminary expenses, which stood at £487 10s. 5d. Another reason why this large sum had been written off was that they came into possession of a sum of £250 in connection with a foreign patent, which, at one time, they scarcely expected to have. This money had been put into the year's profits. The introduction of the Peebles process had not gone on at the rapid rate the Directors had reason to expect it would, for the reasons already given; but the reports from the different works where it had been adopted were of the most highly favourable description. It was stated—and the Directors investigated the matter at once—that, during the severe weather in the winter months, the enriched gas had been condensing and choking up the service-pipes. This they found to be absolutely untrue. He thought the proprietors would agree that there were most satisfactory indications that the process would develop to a very large extent in this country. He would not go any further into the matter, because Mr. Beilby would be able to give much more information about details than he could.

Mr. G. T. Beilby, in seconding the motion, said the Chairman had referred to the very great effect on the business of the Company of the extraordinary fall there had been during the year in the price of cannel coal. He thought they might safely put that down at from 60 to 70 per cent. It must be evident to them all that a gas manager would be the first to appreciate this great fall, and that, when he found his old enriching material supplied to him at this extremely low rate, it was very natural he should think that for some time yet he would adhere to his old friend, the cannel, and not take up the process the Company offered him. In the next place, there was the change in the price of oil. This change was only now coming into effect as regarded gas oil. He thought in the past there had been simply a fear that the shale oil producers were going to take advantage of the rise in the value of lamp oils to make gas managers pay much more for their enriching material. So far as he had any experience of the rise in the price of gas oil, it did not amount to more than about 7s. 6d. per ton. It was quite possible that the rise might become much more serious; but this rise, fortunately for them, might have a great value. It might be in the minds of some that Mr. Young originally invented the Peebles process expressly to deal with a low class of oil, which had never before been available for enriching gas. Mr. Young, so far as he (Mr. Beilby) remembered, began experimenting with blast-furnace oils and tar, and oils of a low class, which nobody had been able to employ before; and the remarkable success of his process, which took everybody by surprise, was that he had been able to use those oils. Now, the producers of shale oils were last year offering a once-run oil of from ·830 to ·840 specific gravity at 2¼d. per gallon. That was practically giving away a large portion of the lamp oil along with this low-priced oil. They were doing so in order to induce gas companies to take the oil and use it in combination with water-gas processes. It was quite to be expected that, when the oil companies were getting 100 per cent. more for their burning oils, they would not continue to supply water-gas companies with highly-refined oil at this extremely low price. He thought Mr. Young shared the view with him that the Peebles process would be helped rather than hindered by this rise, because the gas companies would be forced back upon the oils with which the process dealt so successfully; and these oils were not likely to rise much above the prices of the last few years.

The report was adopted.

HINCKLEY DISTRICT COUNCIL GAS SUPPLY.

Report by the Engineer on the Works.

An important report upon the position of the Hinckley District Council Gas-Works in relation to the growing demands upon them has been addressed to the Gas Committee by the Engineer (Mr. G. Helps); and it is manifest from the facts contained in the document that an extension of the plant must be speedily taken in hand. The Committee, Mr. Helps says, have already been considerate enough to record the fact that the responsibility with regard to failure or insufficient supply of gas caused by inadequate plant is not his; but the language in which the first paragraph of the report is framed indicates the gravity of the position of affairs. It reads: "That no persistence on my part shall be wanting, and in order that you may be as fully aware of the facts as myself, with regard to the serious consequences likely to follow another attempt to pull through a winter season with existing plant, I feel it my duty to once more endeavour to point out how probable it is a failure of supply will occur—in fact, in my opinion, under ordinary working conditions (*i.e.*, making allowances for breakdowns, &c.) is bound to occur." Mr. Helps proceeds to give the figures as to the consumption of gas during the past five years, to show how the demands on the works have been increasing. In the year ending March, 1891, the consumption amounted to 25,615,800 cubic feet; March, 1892, 27,595,400 cubic feet; March, 1893, 28,952,600 cubic feet; March, 1894, 30,400,200 cubic feet; March, 1895, 37,934,300 cubic feet. Since March, 1894, Mr. Helps has made (including the present one) ten reports to his Committee upon the various requirements at the works, and in all of which he has urged upon them the insufficiency of the plant. From the date of the first of these reports, the consumption has increased 25 per cent. The position now in relation to the coming winter's work is thus described by Mr. Helps: The heaviest day's consumption last winter was 247,000 cubic feet; and the probable heaviest day's consumption next winter may be taken as 10 per cent. more—271,700 cubic feet. To meet this, 55 retorts of existing section are required under fire in good condition, and 20 per cent. more for emergencies, making the number of retorts required 66. There are at present 55 retorts, 34 of which are only in second-class order, having been lighted up when green, and having already done two seasons' work. Two exhausters, with engines, are required, each capable of passing 11,000 cubic feet per hour at 80 revolutions. The existing exhauster will only pass (at 80 revolutions) 5000 cubic feet per hour; and the works possess but one gas-engine and an old steam-engine. A scrubber is needed, capable of purifying 11,000 cubic feet per hour. The existing scrubber can only properly take 1700 cubic feet per hour. The purifiers should be capable of purifying 11,000 cubic feet per hour; but the present boxes will only deal with 5000 cubic feet. The holders should be capable of storing 270,000 cubic feet; the existing storage being only 200,000 cubic feet. A compensating governor capable of passing 40,000 cubic feet per hour is required. The present governor is not compensating, and is only properly capable of passing 30,000 cubic feet per hour. Mr. Helps also points out that, in speaking of existing requirements, the sizes of apparatus given must not be taken as representing what he should recommend to put down, as in extensions a margin must be left for future increase.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The 54th ordinary general meeting of the Chester United Gas Company was held at the offices last Wednesday—Mr. J. Gamon presiding. The notice convening the meeting having been read by the Secretary (Mr. J. Pye), and the audited accounts, with the Directors' report, laid before the meeting, the Chairman moved the declaration of an interim dividend in respect of the past half year. In doing so, he called attention to the fact that the revenue account showed a substantial increase in the sale of gas, amounting to nearly 8 million cubic feet, attributable largely to its use for heating purposes during the exceptionally severe weather experienced in the early part of the year, as

well as to its more general adoption for cooking purposes. The result of the half-year's working showed an increased revenue of £1221, of which sum the additional working expenses absorbed £685; leaving a net increased balance of profit of £536. Remarking upon the satisfactory condition of the Company's works and plant, he congratulated the proprietors on the healthy outlook for the future; pointing out that during the past half year 59 additional cookers had been sold and fitted up on hire, while 40 gas-fires had been supplied and fixed during the same time—being largely in excess of the business of any previous similar period. Alluding to the subject of public lighting by means of incandescent gas-burners, he remarked that the Directors had, by way of experiment, introduced clusters of these burners into the lamps in the Town Hall Square; though in their opinion, as well as in that of their Manager (Mr. R. Hunter), this was not the most advantageous place, owing to the extra height of the lamp-columns there. However, they had not felt justified in incurring further expense in this direction, in view of the intimation conveyed through the Press that it was the intention of the Town Council to undertake the lighting of some of the streets by means of electricity. In concluding his remarks, the Chairman intimated that the policy of the Directors would now be to build up the reserve fund, which last year was reduced by £2112 to meet the deficiency owing to the coal strike, and also to form a contingency fund; and when this had been done, he hoped they might be in a position to make a further reduction in the price of gas. The motion having been seconded by Mr. J. Hignett, J.P., it was carried unanimously; and the meeting closed with a vote of thanks to the Chairman and Directors, and to the officers of the Company.

The half-year's receipts of the Grantham Gas Company amounted to £9115, and the outlay to £6641; leaving a balance of £2474. Dividends of 5 and 3½ per cent. for the half year have been declared.

The Kildwick Gas Company have made a total profit for the past twelve months—including £321 brought forward, and deducting £200 for depreciation—of £2167. An interim dividend of 2½ per cent. was paid; and a further dividend of 3 per cent., less income-tax, has been declared—making 5½ per cent. for the year. A sum of £250 has been placed to the reserve fund; and the remaining balance of £322 is to be carried forward.

The annual meeting of the Paignton Gas Company was held last Wednesday week—Mr. F. Palk presiding. The Directors reported an increase in the consumption of gas; but they stated that the expenditure on revenue account was larger than in the previous year—owing partly to the salary of a duly qualified Manager and the interest on loan account. Negotiations were pending for a loan on mortgage of the undertaking at the rate of 3½ per cent., which would considerably reduce the interest account in future years. The available balance in the bank was £564, to which must be added £1652 due to the Company to June 24. After paying 4 per cent. on the preference shares, the Directors recommended a dividend of 8 per cent. on the ordinary shares, which would absorb £1104. The report and statement of accounts were adopted. At an extraordinary meeting held subsequently, it was resolved to increase the capital of the Company by the issue of 100 preference shares (£10), to bear dividend at the rate of 4 per cent. per annum.

The Directors of the Poole Gas Company, Limited, had a very cheering report to present to the shareholders at their half-yearly meeting yesterday. A profit of £1235 was made in the six months ending June, compared with £1100 in the first half of 1894; and the consumption of gas showed the material increase of 7·85 per cent. With this bright state of affairs, and a favourable contract having been made for the supply of coal for the current year, the Directors recommended that a reduction of 3d. per 1000 cubic feet be made in the price of gas from the end of June last. The payment of the maximum dividends on the stock and shares was proposed.

The Scarborough Gas Company derived from their working last half year an income of £17,418. The sum received for gas was £13,822. The quantity of gas delivered to private consumers was 87,402,200 cubic feet; and 8,696,359 cubic feet were supplied for public lighting and under contract. The rent of meters, fittings, &c., came to £544; and of stoves, to £209. Coke, tar, and ammoniacal liquor yielded £2793; and three other small items produced £50. The total expenditure was £12,988, made up of the following figures: Manufacture of gas, £10,715; distribution, £1013; public lamps, £518; rates and taxes, 6s. 9d.; management, £659; bad debts, &c., £82. The balance of revenue is £4430. The net revenue, including £2394 brought from last account, and after deducting all interest charges for the half year, is £6300. Out of this, after providing for dividends on the preference stock, the Directors recommend the payment of the maximum dividends upon all other stocks, less income-tax. The payment of these will absorb £5351; leaving a balance of £948 to be carried forward. The increased consumption of gas during the half year has, the Directors say, been most satisfactory; and the continued and growing demand for all classes of appliances for cooking and heating encourages the belief that this increase may be fully maintained in the future. The introduction of prepayment meters has also proved very successful. Regarding the works, the erection of retort-settings upon one of the most modern systems of regenerative heating is being rapidly proceeded with; and the station governors and the trunk mains connected therewith have been rearranged. Referring to the Company's new Act, the report mentions that arrangements have been made for raising the first portion of the capital authorized.

The Weymouth Consumers' Gas Company had an income last half year of £6677. Of this £5231 was produced by the sale of 27,421,700 cubic feet of gas; and £1080 was obtained from coke, tar, and sulphate of ammonia. Meter-rents yielded £125; gas-fittings, £237; and transfer fees, £4 5s. The outlay totalled to £4693; so that a profit of £1984 was made. The balance on the net revenue account is £3281. Commenting upon the half-year's finances, the Directors remark that both the receipts and expenditure have been heavier than they were in the corresponding half of 1894. The exceptional severity of the weather during the early months of this year caused an unusually heavy consumption of gas; and the demand for coke was also brisk. All the other items of receipts show an increase, except sulphate of ammonia, the market for which has been slack, and the prices depressed. Coal has cost more, consequent upon an increased quantity being used; and the expenditure on repair and maintenance has been unprecedentedly high, owing to one of the gasholders being demolished to make way for a double-lift holder of about twice the capacity of the old one. This alteration has been rendered necessary in consequence of the gas consumption having outgrown the storage room; and a portion of the cost of the work has been debited in these accounts. The profit of £1984 is barely sufficient to cover the maximum dividends; but the undivided balance permits of the usual payments being made—viz., 10 and 7 per cent. on the ordinary "A" stock and ordinary shares.

Water Companies.

The receipts of the Dorking Water Company for the half year ending June amounted to £1309; and the expenditure, to £526—leaving a profit of £783. The effect of the long frost in the first quarter was not overcome till the beginning of May; and this was immediately followed by severe drought, which continued to the end of the half year. Owing to the very large loss of water through waste in the early months, the Company started, when the summer commenced, without any stock of water; and, although every effort had been made to maintain the ordinary supply, it has latterly had to be seriously curtailed, owing to the enormous use, or waste, for garden purposes. Matters are, however, righting themselves now with the change of weather; and the Directors are considering the question of augmenting the supply. After many years of useful work, the Managing-Director of the Company (Mr. W. J. Rossiter) is relinquishing this position; and Mr. J. Dawes, of the Henley Water-Works, has been appointed to succeed him. An interim dividend at the rate of 5 per cent. per annum has been declared.

The balance upon the half-year's revenue account of the Grantham Water Company is £5328. Of this it has been decided to appropriate £1750 in the payment of a dividend of 5 per cent. for the six months—carrying forward the substantial balance of £3578.

The report and accounts of the South Hants Water Company (which were noticed in last week's issue) were adopted at the recent meeting of the shareholders; and at a subsequent extraordinary meeting, a resolution was passed, authorizing the raising of additional capital to the extent of £20,000. In moving the adoption of the resolution, the Chairman (Mr. W. E. Darwin, J.P.) said the proposal was to issue more shares to enable them to extend the works. They had reached the end of the capital; and to carry on the necessary work, they had had to borrow £4000 from the bank. Since October last, they had expended between £9000 and £10,000 chiefly on new plant at the pumping-station. They were at the present time in negotiation with the authorities at Lyndhurst for supplying the village; and if they came to terms, it would involve a considerable outlay, which would, however, bring a tolerable return.

The Directors of the South Staffordshire Water Company report that the number of houses laid on during the half year ending June was 1073; making the total supplied 86,367. The gross amount of water-rates for the six months was £42,551, as against £41,378 in the corresponding period of 1894. After providing for interest on debenture and preference stock, the amount remaining for division (including £4779 brought forward) is £15,956; and the Directors recommend the declaration of a dividend on the ordinary stock at the rate of 5½ per cent. per annum, less income-tax. The amount of this dividend being £15,817, there will remain £139 for the credit of next half year. The small balance carried forward is entirely attributable to the extraordinary cost of maintenance and other losses (amounting to about £5000) arising out of the frost in the first quarter of the year. The report also announces the appointment as Engineer of Mr. H. Ashton Hill in succession to the late Mr. William Vawdrey. The proprietors are to be asked to empower the Directors to issue £30,000, the unissued portion of the £50,000 of new stock created by resolution at an extraordinary meeting held on Aug. 24, 1893; and also to create a further £50,000 of the new stock authorized by the Company's Act of 1893.

The half-yearly meeting of the Truro Water Company was held last Wednesday, under the presidency of Mr. A. C. Willyams. The Engineer (Mr. N. Trestrail) reported that 23,574,000 gallons of water were pumped during the half year, at a total cost for coal and coke of £83—a saving of 45 per cent. in cost of fuel as compared with the previous half year. The accounts showed a profit on the six months of £482, and a total balance in favour of the Company of £495. The cost of the new machinery erected last year was £1268, which had been advanced by the bank. The report was adopted, and a dividend of 3 per cent. was declared, while £250 was transferred to capital account. A statement presented by the Secretary (Mr. A. E. Adams) showed the progress made by the Company in the past ten years. In the corresponding period of 1885, the income from domestic supplies was £334; while now it was £609; and the meter supply yielded £412 now, as against £163 ten years ago. The annual average increase of revenue had been over £100. In 1885, the profit and loss account showed an adverse balance of £529; while now there was a credit balance of £495. In the interval, they had paid £1600 in dividends, and transferred £2500 to the capital account. As against an overdraft at the bank of £1663 ten years ago, they had now a credit balance of £600.

ELECTRIC LIGHTING NOTES.

Mr. W. H. Preece, who resides at Wimbledon, has long desired to see the district illuminated by electricity in place of the present system of oil lighting. As far back as 1884, he presented the then Local Board with a report on the subject. But the members were cautious men, and, although they frequently considered the question, nothing came of their deliberations. The new District Council are moving more seriously in the matter; and the work of advising them has passed from father to son. An elaborate report has been prepared for them by Mr. Arthur Preece, in which he draws attention to what is being done at Manchester, Liverpool, and Brighton. Instead of instancing large places of this kind to show the profit made, it would have been more to the point if Mr. Preece had been able to

name purely residential localities such as Wimbledon where successful installations are to be found. The present cost of lighting by oil averages £2 9s. 6d. per lamp; and there are about 725 lamps in the streets. The total cost of lighting is thus approximately £1800. If gas were installed in place of oil, the cost would be, according to a report previously submitted to the Lighting Committee by the Surveyor (Mr. Cooper), about £4 11s. 7d. per lamp; and therefore the total annual cost would be near £3320. Mr. Preece sketches two schemes—one for the lighting of the whole district, and the other the lighting of only the main streets, by incandescent electric lamps. In the scheme for the whole parish, he has estimated for 1000 lamps of 32-candle power for the public lighting, and 5000 lamps of 8-candle power for the private lighting. By this scheme, Mr. Preece estimates that, with a capital expenditure of £31,000, and for a total annual cost of £2350, the Council would be able to light the streets at an extra cost of 15s. 2d. per lamp, providing a demand arises for 3500 private lamps. The extra cost of lighting the streets by electricity will be £550. In the second scheme, which provides for the lighting of the main streets only, a plant to light 600 32-candle power public lamps and 3000 private lamps is estimated for. This scheme shows that, with a capital expenditure of £20,000, and a total annual cost of £2310, the Council would be able to light about 400 of the lamps at an extra cost of £1 6s. 6d., including 325 oil-lamps, provided a demand for 2500 private lamps arises. Even assuming that the private lighting is not taken up to the extent anticipated by him, Mr. Preece cannot see that it is possible for the annual cost of lighting by electricity to exceed the estimated cost of lighting by gas. With only 1000 private lamps connected, he does not think the annual cost of lighting the streets would exceed £3000. The District Council have, on the recommendation of a Special Committee on Electric Lighting, adopted the first scheme, and have agreed to apply to the Local Government Board for sanction to borrow £32,000 to carry out the work.

The last electric lighting loan of £10,000 which the Kingston-on-Thames Town Council applied for to the Local Government Board has been curtailed by £2228; the Board intimating that, so far as the items related to prospective expenditure, they can form the subject of another inquiry.

A full report by the Lighting Committee of the Liverpool Corporation on their proposals regarding the purchase of the undertaking and business of the local Electric Supply Company came before the City Council last Wednesday. The agreed purchase price, as already mentioned, is £400,000; and the transfer is to be completed on Sept. 2 next, or not later than Jan. 1, 1896. As to the total sum required to be borrowed by the Corporation, calculating interest at 2¾ per cent., and assuming a period of 42 years is allowed for repayment, and reckoning that the total capital required by the date when the purchase will be completed at £425,000, the annual charge to the Corporation for interest and sinking fund will be £17,187. If a period of 35 years is taken, the annual charge would be £19,064. As against this, the Corporation will have an undertaking which, for the year 1894, produced a net revenue of £20,908 after the payment of working expenses, maintenance, Directors' fees, and legal charges. The Directors' fees and law charges amounted in 1894 to between £900 and £1000; and as these charges will not be payable if the Corporation purchase the undertaking, the net revenue for the year, from a Corporation point of view, may be taken at £21,800. During the first six months of the present year, there has been, according to the Committee, a considerable increase in the business of the Company; the gross receipts from the sale of electricity showing an increase of £2500 on the receipts for the corresponding period of last year. During the first six months of 1895, the number of lamps has increased from 31,792 to 33,800. The Committee consider it is, therefore, reasonable to calculate that the net income from the undertaking for 1895 will be between £23,000 and £24,000, as against an annual expenditure by the Corporation of £17,187, if 42 years for repayment of the borrowed money is allowed, and as against £19,064 if 35 years is allowed. When the Corporation acquire the undertaking, they will be able, it is said, to increase the gross receipts in a short time by between £3000 and £4000 per annum by lighting the public buildings in the centre of the city with electricity instead of gas. This can be done almost entirely from the existing mains of the Company; and only a small capital expenditure will be necessary to carry it out. The amount paid to the Gas Company in 1894 for gas supplied to all the public buildings was £7065 2s. 10d.; and the sum paid in respect of those buildings in the centre of the city which could easily be lighted by electricity, was £3486 16s. 7d. In addition to this, it is pointed out that the Corporation will be in a position to consider the question of lighting the chief streets with electric light instead of gas, and of supplying electricity for motive power. The share capital of the Company consists of 50,000 £5 shares; and the Company have spent additional capital on the works to the extent of about £16,000 up to May 31 last. Since July 1, 1894, the Company have paid a 6 per cent. dividend. By their Provisional Order of 1891 they can pay a dividend up to 7 per cent., but after that point has been reached, one-half of the surplus profit must be applied in the reduction of charges, and the other half can be paid as additional dividend. By the purchase of the undertaking, the Committee point out that the Corporation will get the right of supplying the city with electricity into their own hands at a price which is undoubtedly a good one for the Company, but at the same time one which should give the Corporation, after paying interest and sinking fund, maintenance and working expenses, a considerable margin on revenue account. There is also, they say, every probability that the Corporation will be able to make substantial reductions on the present charges made by the Company for electric light. The adoption of the report was moved at the Council meeting by Alderman F. Smith, who remarked that the price of £425,000 might appear to be extremely high; but taking all the circumstances into account, he thought the purchase was desirable. Mr. Williamson also considered that five or ten years hence the Council would look upon the transaction as a very advantageous bargain. Sir Arthur Forwood regarded the arrangement as an improvident one from the standpoint of the Corporation. He admitted that in all probability there would be a large extension of the use of electricity; but it might have been far better to entrust the work to a private company, as in the case of the Gas Company, and enforce such conditions as would have proved advantageous to the Corporation. The whole business would be better and more economically worked in that way than under the management of the Corporation. Sir Arthur also criticized the financial details of the report, and said the Council were asked to pay £425,000 for property that had cost £265,000; giving the present shareholders a bonus sum of £160,000. He argued that a sufficient allowance had not been made for depreciation and renewals, and in that respect the interests of the ratepayers were not properly protected. Alderman Bowring, commenting upon the last speaker's observations, said he considered the bargain made with the Gas Company was the most unfortunate one the city had ever entered into. If they had had the foresight to acquire that undertaking in its early days, and when it was controllable, they would have done a very excellent thing for the community; and he was sure the Committee had done a very excellent thing in securing the Electric Supply Company's undertaking. The city paid dearer for gas than almost any other city in the kingdom; whereas Manchester made an enormous profit out of the supply, which was obtainable at a much cheaper rate. Mr. A. Taylor having expressed his entire sympathy with the action of the Committee, Alderman Smith replied on the discussion. He said Sir Arthur Forwood had failed to recognize that the action of the Gas Company was paralyzing the industry of Liverpool to a very large extent; and instead of the sale of shares working any benefit upon the citizens of Liverpool, it seemed to have acted in an entirely opposite direction. The report was then adopted.

The Salford Corporation electric lighting works, which are under the charge of the Gas Committee, were formally opened last Wednesday by the Chairman (Mr. R. Holland). There was a goodly company present, including the Mayor (Alderman Mottram), the Mayoress and other ladies, and the members and officials of the Corporation, among whom was the Gas Engineer (Mr. S. Y. Shoubridge). Before handing over the works to the Mayor, Mr. Holland addressed the company, and traced the proceedings in connection with the provision of electric light for the borough from 1892, in which year the Council decided to embark upon this new undertaking. At that time, he said, they did not intend to spend more than £15,000 upon the installation. But from the replies to a circular which the Committee sent to probable consumers, it was evident that this sum would be inadequate; and, on this being reported to the Council, they agreed to extend the scheme to the extent of £30,000, and to apply to the Local Government Board for power to borrow £50,000, to cover the first cost of the installation, and to meet future extensions. The amount actually paid to the present time was £29,206; and the balances due to the various contractors on the expiration of the period of maintenance would increase the expenditure to £34,338. Regarding the works, the Committee engaged Messrs. Kincaid, Waller, and Manville, of Westminster, to devise a scheme. The system adopted is the high-pressure alternating one, by which the current is supplied at a pressure of 3000 volts, and reduced by transformers at consumers' premises to about 100 volts. There are three sets of engines and dynamos at the generating station, each capable of supplying 2500 8-candle power lamps alight at one time, or 2800 lamps connected to the mains. As it is necessary to keep one of the sets of plant in reserve, the producing power of the station is equal to supplying 8300 8-candle power lamps connected to the mains. The fuel to be used in the boilers is coke from the Corporation gas-works. From trials that have been made, it has been found that not only has gas coke the great advantage of being a clean smokeless fuel, but it is a very economical one for steam-boilers. The cables have been constructed to supply 17,000 8-candle power lamps, and will therefore meet the requirements for a considerable time. At present, the Corporation have nineteen customers, who have altogether about 1000 lamps; and there are applications from others for a supply for about 500 additional lamps. The charge for current is 7d. per unit; but the Committee intend to reduce this as soon as they are able to do so. At the conclusion of the Chairman's speech on Wednesday, the Mayor said, as an Engineer, he was satisfied they had an excellent installation, creditable alike to the Contractor and the Corporation. Mrs. Holland then started the engines and switched on the current; and the engine-room and other parts of the station were instantly brilliantly illuminated.

In the annual report of the Berlin Town Council on the administration of the municipal gas-works, some interesting figures are given in regard to electric lighting in the city. There are in all 185 street arc lamps, 71 of which are alight all night; the remainder only burning up to midnight. For private purposes, there are 9932 arc lamps, 200,474 glow lamps, and 667 motors and apparatus. Of these, 4259 arc and 79,212 glow lamps are supplied by isolated plants, of which 251 are driven by steam, and 97 by gas engines.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Recent Scarcity of Water at the East-End.

It may be remembered that, at the meeting of the London County Council on the 23rd ult., the Water Committee brought up a report on the subject of the recent scarcity of water at the East-end, and recommended that a letter be written to the East London Water Company thereon, and asking for certain information as to the quantity of water pumped by the Company. The recommendation was agreed to; and on the following Thursday, the Clerk to the Council (Mr. H. De la Hooke) addressed to the Secretary of the Company (Mr. I. A. Crookenden) the following letter:—

Sir,—Numerous complaints having reached the Council of the interruption of the constant supply system in the area of the county of London supplied by the East London Water-Works Company, the Council, as the Metropolitan Authority under the Metropolis Water Act, 1871, feels it to be its duty to inquire into the circumstances; and I have accordingly been instructed to communicate with you on the

subject. In doing so, I am to point out the discrepancy between the position taken up by the Company before the recent Royal Commission and that now assumed by it with regard to constant supply.

When before the Royal Commission, the Company put in a statement, upon which it obtained the Commissioners' favourable report, to the effect that from its then existing works it was able to supply as follows:—

	Gallons per Day.
From the Lea and storage reservoirs	30,000,000
From the Thames	10,000,000
From the existing gravel springs at Hanworth	2,000,000
From the Company's existing wells in the Lea Valley	11,000,000
Total	53,000,000

From the report of the Water Examiner for the month of May last—the latest return available—the Council finds that the supply was as follows:—

	Gallons per Day.
From the Lea	38,608,294
From the Thames	5,598,180
From the wells and springs	6,956,125
Total	51,162,599

On comparing these figures with the statement placed before the Royal Commission, it appears that, though the quantity taken from the Lea exceeded the estimate by 8,608,294 gallons, the Company did not avail itself of its full power to draw water from the Thames to the extent of 4,401,820 gallons, and that its well supply fell short by 6,043,875 gallons.

These figures seem to the Council to justify a request for information; and I have been instructed to ask that the Company will be good enough to furnish answers to the following inquiries: (*a*) How much water the Company has drawn from the Lea in each week during the past four weeks. (*b*) How much it has drawn from wells in each week during the past four weeks. (*c*) How much it has drawn from the Thames in each week during the past four weeks. (*d*) How much it has drawn from gravel springs at Hanworth in each week during the past four weeks. (*e*) If the Company is not drawing the 10 million gallons a day which it is authorized to take from the Thames, what are the reasons why this has not been done.

I am to add that the Council's Engineer has been instructed to confer with the Engineer of the Company as to the best means of immediately improving the now insufficient and irregular supply; such conference to be without prejudice to the rights of the Council or the consumer to compel the Company to carry out its obligations.

Mr. Crookenden replied to the above letter on the 1st inst. as follows:—

Sir,—I am instructed by the Directors of the East London Water-Works Company to reply to your letter of the 25th ult.

My Directors regret that the contingency has happened of which they warned both Parliament and the London County Council, when their Bill was rejected on second reading, at the instance of the London County Council, in 1893, and that they have been unable to maintain a constant supply during the late unusual drought.

The Company, in promoting their Bill in 1893, stated that it was essential that they should have extended powers, both for storage and for pumping, in order to carry out their responsibilities towards the public. That Bill, which would have given them ample powers for both purposes, was opposed and defeated by the County Council, in the face of the following statement circulated at the time by the Company: "That the rejection of the Bill must jeopardize the water supply to a very large population in the East-end of London." If that Bill had been allowed to proceed, the capacity of the storage reservoirs of the Company would have at this moment been increased by nearly 200 million gallons, and their pumping capacity from wells by a daily amount of 3 million gallons.

My Directors are not aware of any legal obligation on their part to supply to the London County Council, as the Metropolitan Authority, the information asked for in your letter; but, as a matter of courtesy, and also because they are very anxious that the public should be completely informed of all the circumstances of the case, they beg to furnish you with the following particulars. But, before doing so, they wish to say that it is an entire misapprehension to suppose that the Company put any statement before the Royal Commission to the effect that they could supply from their then existing works 53 million gallons per day. The figures you quote are, indeed, but a part of a comprehensive estimate of the average daily quantity which the Company could supply in the year 1931 from their present sources when utilized to a further extent; and it is clear that no comparison can be made between that estimate and the daily quantity actually supplied in the month of May in the present year, when it is obvious that the existing sources of supply are not so utilized.

Now, dealing with the subject-matter of your questions:—

(*a*) The Company have drawn from the Lea and from the stock of water accumulated in their storage reservoirs, during the past four weeks, an average daily quantity of 29¼ million gallons. If the County Council had not opposed and caused the rejection of the Company's Bill in 1893, additional storage reservoirs, as before stated, capable of holding 200 million gallons, would by this time have been constructed; and the additional daily quantity available from such reservoirs during the same four weeks would have been 7 million gallons.

(*b*) The Company have drawn from wells during the past four weeks an average daily quantity of 6·7 million gallons. If the County Council had not opposed and caused the rejection of the Company's Bill in 1893, additional pumping machinery would have been at work, and the additional supply from wells would have been 3 million gallons. The additional supply from these two sources, amounting to not less than 10 million gallons per day, would have met the public demand; and the present suspension of constant supply should not have occurred.

(*c*) and (*d*) The Company have drawn from their Thames works 9·82 million gallons per day during the past four weeks.

All the above figures are computed from the pump displacements.

Throughout the past month, during the late unusual drought, the lowest quantity supplied by the Company amounted to upwards of 29 gallons per head per day of the population, after due allowance has been made for slip of pump. This minimum quantity per head (to which, be it observed, the supply has only fallen for seven days) is in itself a larger supply than the consumption per head in the majority of large towns. But had the works above alluded to, as asked for by the Bill of 1893, been in operation, the supply would have averaged at least 43 gallons net per head per day of the population all through the drought; and there should therefore have been no reason for the suspension of a constant supply.

We therefore emphatically declare, and wish the public to understand, that the responsibility for the present state of things rests with the London County Council. That body, in pursuance of their avowed policy of hostility to the Water Companies, thought fit to do their best to wreck the measure of 1893 on its second reading in Parliament. They succeeded, and the public are suffering accordingly. In 1894, the London County Council tried to repeat their tactics of 1893. This time they were happily unsuccessful; and the Bill of this Company passed its second reading by a majority of one. In due course, it became law; and the Parliamentary Committee to which it was referred recognized its urgency by inserting a clause to the effect that the new storage works should be proceeded with with all possible despatch. These were actually started within a week or two after the Act had received the Royal Assent. Contracts for the new pumping machinery were entered into with equal promptitude. In the early spring of 1896, the Company hope to be in the position as regards supply that they would have been in in 1895 but for the obstructive action of the London County Council before alluded to.

With regard to the conference suggested with the Engineer of the County Council, the Company most respectfully decline it. They feel that the conduct of this matter is, and ought to remain, their own. They are content to proceed according to the best independent professional advice obtainable in the event, by no means likely, of their thinking it necessary to fortify the action of their own experienced and highly-trusted Engineer.

The Company give you notice that they intend to take steps to make this correspondence public.

The following letter from the Solicitors to the Company (Messrs. Bircham and Co.), dated the 6th inst., appeared in *The Times* last Thursday:—

In your account of what passed at the meeting of the London County Council on Tuesday last [July 30], the report of the Parliamentary Agent to that body is referred to as containing the following statement: "There was no opposition on the part of the Council to the Company making additional works. He personally offered to the Company, under instructions and on behalf of the Council, that their Bill should be allowed to pass unopposed if they would withdraw the clause imposing arbitrary restrictions on the consumers, and limit the amount of capital to what would be necessary for the next two years, which would have carried them well over the time during which the Council would have to consider what steps they would take after the issue of the report of the Royal Commission." This statement is not correct, and we ask to be allowed to show: (1) That the Council did oppose the additional works. (2) That the clause imposing the arbitrary restrictions was withdrawn by the Company, and was not treated as a ground of opposition by the Council. (3) That the offer to withdraw the opposition was made conditional on the Company abandoning the capital for the storage reservoirs and pumping machinery.

The Council circulated a statement, in opposition to the second reading of the Company's Bill, which contained (*inter alia*) the following clause: "It is submitted, on behalf of the London County Council, that, as the evidence before the Royal Commission on Metropolitan Water Supply is practically complete, and their report will shortly be issued, it is inexpedient to confer further statutory powers on one of the Metropolitan Water Companies to increase its capital at the present time."

The following extracts from speeches made in the House of Commons by Mr. Stuart and Mr. Benn, the spokesmen of the Council, are taken from *The Times* "Reports of Parliamentary Debates," Friday, March 17, 1893:—

Mr. STUART proposed that the Bill be read a second time that day six months. He explained that he adopted this course at the wish of his colleagues representing East London, and on behalf of the London County Council; objection being taken to the substance and essence of the Bill. . . . . It was proposed to expend the money in obtaining an additional water supply from the Thames, from the Lea, or from wells. Every one of those questions was in dispute before the Royal Commission. There was no urgent necessity for this measure.

Mr. MELLOR said the House would, in his opinion, incur a very grave responsibility if they refused to send the Bill to a Committee upstairs, though it might be true that the promoters were asking more than they ought. But, after all, it was necessary to have a sufficient supply of water; and, if the House rejected the Bill, one of the objects of which was to maintain a sufficient supply of water, they would incur a very grave responsibility.

Mr. BANBURY said he was authorized by the Company to say that they were perfectly ready to withdraw the clause which enabled the Company to stamp all fittings, upon which the opposition of the Council appeared to some extent to be based. . . . . It was absolutely necessary that, in an increasing district, such as that for which these powers were sought, the Company should make every provision.

Mr. BENN said the County Council did not base their opposition on the clause referred to by the hon. member for Peckham (Mr. Banbury); but they thought that, on the eve of the issue of the report of the Royal Commission, to add this financial burden to the purchase which must come sooner or later, would be very unfair.

Not one word in the Council's circulated statement about the clause containing restrictions on the consumers; while in the House Mr. Benn positively denied that this was a cause of opposition. Not one word in either statement or speech offering any portion of the capital to the Company for the necessary works. The opposition of the Council was directed against the Bill, substance and essence, additional works and all. The so-called offer of a portion of the capital was this: At a meeting on the 10th of March, when the Engineer of the Company, we, the Agent to the Council, Mr. C. Harrison, and Mr. Stuart were present, it was stated that the Council would consent to the Bill if limited to a sum of £40,000 for the cost of laying down

mains for two years, but any portion for the needed works—*i.e.*, of the £150,000 for the reservoirs or the £100,000 for the extension of machinery and pumping power—would be strenuously opposed. The Company's advisers having stated that the reservoirs and extension of machinery, &c., were urgently needed if the supply was to be maintained, the meeting broke up.

If the report now put forward by the Council's Agent be correct, why did the Council again in 1894 strenuously oppose (fortunately without success) the Company's Bill, re-introduced that year, for reservoirs, &c., in which the clause as to fittings found no place? The report is an unfair attempt to evade the responsibility of the Council for having been instrumental in procuring the rejection of the Company's Bill in 1893.

Reference was also made on Tuesday to the report of the Council's Engineer, suggesting that the shortness of water may be attributed to the bursts in the Company's mains which have not been repaired since the frost. We are desired to state that the actual facts which are being collected, and will be produced at the proper time, will show that there is no foundation for this suggestion.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Reverting to the annual accounts of the Gas and Electricity Department of the Glasgow Corporation, it has to be observed that the quantity of gas sold, amounting to 4029 million cubic feet, was 268 million cubic feet greater than in the preceding year, when the price of gas was the same as last year—2s. 6d. per 1000 cubic feet—and 210 million cubic feet greater than in the year before that, when the price was 2s. 9d. The greatest quantity of gas sent out in 24 hours was 26 million feet, as compared with some 22¾ millions in the preceding year, and 25 millions in the year before that; and the maximum daily make—23¾ million cubic feet—compared with 22 millions in the preceding year, and 24¾ millions in the year before. The number of meters in use show an increase, as compared with two years ago, of 7675. No mention is made in the Committee's report of the working of the water and oil gas plant; there being apparently nothing connected with it calling for special notice. The capital account was increased last year by £5000; and in the course of two years it has been raised by £136,903, which is largely accounted for by the outlay upon the new gasholder at Dawsholm, and the extensions and renewals there. The revenue from gas (£493,560) was £32,415 greater than in the preceding year, but £54,596 less than in the year before that, when the price of gas was 2s. 9d. The revenue from coke (£46,693) was £8179 more than in the preceding year, and £16,466 more than two years ago. From ammoniacal liquor and tar the receipts (£83,849) were greater by £18,765 and £40,057 respectively. The Electricity Department has not made the progress which was expected—in fact, although 199,039 more units were sold than in the preceding year, the deficit upon the year's accounts rose from £607 to £1527. Two years ago it was £1773. The capital account is, of course, larger, having risen £15,179 during the year, which necessitates greater outlay upon interest. But the revenue only increased by £3181, of which £2032 was due to sales of current to private consumers, and £979 to the increased charge for public lighting; while the expenditure also increased by £3153, of which £805 was due to charges connected with the generation of electricity, £548 to increased charges in the distribution department, and £842 to increased rents, rates, and taxes. It is evident that, in an undertaking where the expenditure increases at the same rate as the revenue, the prospects of profitable working are not very bright. The Committee are still hopeful of a better financial result, which is the feeling always of such bodies. Taken as a whole, the accounts are decidedly encouraging so far as the gas supply is concerned, but not by any means so in the case of electricity.

The second annual general meeting of the shareholders of the Oil-Gas Enrichment Company, who are the owners of the Peebles process, was held in Edinburgh at the end of last month, with Mr. Walter Thorburn, M.P., in the chair.* The proceedings were quite harmonious, though the dividend was only 5 per cent., as compared with 10 per cent. for the preceding year. The causes of the small dividend were explained by the Chairman to be the heavy expenditure the Company had had in connection with their foreign patents, all of which have now been secured, and the costs of experimenting by Mr. Young, at Peebles. Mr. Beilby's remarks, in seconding the motion for the adoption of the report, were exceedingly practical, and well worth perusing. Mr. Beilby is a great authority on oil matters; having been the joint inventor, with Mr. Young, of the retort now almost universally adopted for the manufacture of oil from shale, which is known as the Young and Beilby retort. Very satisfactory accounts were given regarding the prospects of the Company.

The Alloa Corporation Gas-Works, which are managed by Mr. A. Yuill, the President for the current year of the North British Association of Gas Managers, were profitably worked during the past year. Mr. Yuill, as is well known, is one of the staunchest supporters of the Peebles oil-gas process; and he has reason to be satisfied with it. A year ago the Corporation were, on account of the saving the system effected in working, able to reduce the price of gas from 3s. 4d. to 3s. per 1000 cubic feet; and at their meeting this year, they again reduced it to 2s. 10d. A further reduction might have been made; but the Corporation are erecting new sulphate and tar distilling plant, the cost of which will be taken out of revenue. Consumers will thus benefit by the saving on the oil to a greater extent than is represented by the direct decrease in price. The total output of gas was 44,242,300 cubic feet; and the quantity sold was 39,326,500 cubic feet. Gas unaccounted for amounted to 10·13 per cent. The net cost of gas sold was 2s. 11·95d. per 1000 cubic feet. The total revenue was £7207, as compared with £7094 in the preceding year. From gas, there was derived £6069, as compared with £6174; but the reduction in the price accounted for £600, with which added the revenue would have shown a large increase. Tar and liquor realized £501, as compared with £369; and coke and waste lime, £555, as against £468. In 1892-93, the sum derived from coke and waste lime was £390; so that, compared with two years ago, there is an increase of revenue from that source alone of £165, which is mostly due to the better price that is obtained for oil coke. There were carbonized during the year 4341 tons of coal, at a cost of £1830; and 68,777 gallons of oil, at a cost for oil and royalty, of £605. The total manufacturing charges amounted to £2675, as compared with £2331 in the preceding year. The balance carried to profit and loss account was £844, as against £842; and there is a balance at profit and loss account of £1341. There was an increase of consumers to the number of 108 during the year. The outlook in connection with the Alloa Gas Corporation is decidedly hopeful.

Among other places where the Peebles process of oil-gas manufacture has been adopted with success, is the town of Auchterarder, in Perthshire. Mr. A. C. Young is the Manager of the Gas Company there. Working without an exhauster, he obtains 21,566 cubic feet of gas per ton of oil, and 8638 cubic feet per ton of splint coal. The total annual make of gas is under three million cubic feet. Mr. Young states that, by reason of the better quality of coke derived from the splint coal which they used along with the oil, they were able not only to sell the usual quantity, but to keep sufficient coke for use during the summer, thus dispensing with the purchase of furnace coal. They have been offered 17s. 6d. per ton for their oil coke, delivered at Auchterarder railway station. With oil gas he found, during the past winter, that he had much less difficulty than in previous periods of frost in keeping up the illuminating power of the gas. There was no condensation whatever in the case of the oil gas. The most interesting part of the business is that Mr. Young, on receiving the estimates of offerers for the work of erecting the oil-gas plant, found that they amounted to £175; and thinking he could do the work cheaper himself, he set about it, and succeeded in putting up plant, to his own plans, at a cost of £95. I have seen the plans; and they show excellent workmanship. The plant has been worked during the winter season, and has given satisfaction. It is estimated that by its use a saving of £60 has been effected. The Company formerly gave gas of 28-candle power; and they now give 30 candles. As the price is 6s. 8d. per 1000 cubic feet, it would, I think, occur to most people to reduce the candle power to at least 25, and strike off a large slice from the price. I understand that a proposal to reduce the price of gas was entertained; but it was left over in view of the possibility of changes now in contemplation.

The Peebles process has also been worked during the past winter at Huntly, where the Gas Company is managed by Provost Bowman. It will be remembered that, at the meeting of the North British Association of Gas Managers in Glasgow last year, Mr. Bowman asked Mr. Young, the inventor of the process, how it would answer in very small works; and Mr. Young replied that they had no information on the subject. Mr. Bowman, however, tried the process; and the result has been that the Company have reduced the price of gas 5d. per 1000 cubic feet, while a further reduction is contemplated.

The Huyton and Roby Gas Company, and the Chorley Corporation, both in Lancashire, have adopted the Peebles process. The former has an output of 20, and the latter of over 60 million cubic feet of gas per annum.

Mr. W. Foulis, Engineer to the Glasgow Gas Corporation, has reported to the Perth Gas Commissioners, regarding the proposal to transfer the Perth Gas-Works to a new site, that he has no hesitation in stating that the site of the present works is more than fully occupied; that the crowded condition of the apparatus and buildings must interfere prejudicially with the economy of manufacture; and that although, by a certain amount of rearrangement and reconstruction of the apparatus, a small increase in the manufacturing capacity of the works might be obtained, yet that would only be sufficient to meet the increased demand for (say) two or three years, when the construction of new works would become absolutely necessary. For these reasons, he is strongly of opinion that it would be very unwise to incur further capital expenditure on the present works, and also that arrangements should at once be made for the construction of new works in a more suitable position. The proposed site at Sand Island appears to him to fulfil the necessary conditions; being in close proximity to railway sidings, and also to the harbour. The area, being about three times that of the existing works, would be sufficient to meet the requirements of the city for many years. From the plan and sections of the ground prepared by the City Surveyor, it appeared that the surface of the ground over the whole area was below the level of the water when the river was in flood, but that a good foundation could be secured about twelve feet below that level. The yard level should be made at least three feet above the flood-water level. The foundations would therefore require to be some 15 feet below the yard level. This would necessitate a considerable amount of underground building, and add to the cost of construction, which would, however, probably be compensated for by the price at which the ground could be obtained as compared with that of other sites, equally suitable in position. If that site were adopted, it would probably be necessary to acquire a strip of ground to the north of the site, so as to give a connection with the harbour railway on a workable gradient.

The annual accounts of the Forfar Gas Corporation were submitted this week. They show a total revenue of £6121, and an expenditure of £5606; leaving a balance, being free revenue to meet annuities, of £514. The annuities payable amount to £476; a surplus thus being left at the end of the year of £38. The revenue was made up as follows: Balance from revenue account of year ending June 15, 1894, £300; rates for gas consumed for current year, at 4s. 3d. per 1000 cubic feet (less discount to consumers), £5113; residual products sold, £707. During the year £2822 was expended for coal; on retorts, bricks, and fire-clay goods, £118; lime and oxide for purification, £99; wages to firemen, clerks, and labourers at works, £930; interest, £288; sinking fund (sum set apart and added to this fund out of the current year's revenue), £150; contingent fund, £136; and management, £202. The sinking fund amounts to £1187, and the contingent fund to £2926. The quantity of gas manufactured during the year was 28,446,700 cubic feet, accounted for as follows: Sold to consumers, 23,902,500 cubic feet; sold to Police Commission, 1,052,498 cubic feet; consumed at gas-works, 300,000 cubic feet; unaccounted for, 3,191,702 cubic feet, making the leakage 10½ per cent. The price of gas was last year

* A report appears in another column.—Ed. J. G. L.

lowered from 4s. 6d. to 4s. 3d.; and it is proposed to further reduce it to 3s. 9d. per 1000 cubic feet. Mr. Forbes Waddell has not yet been a year in charge of the works, and therefore comparisons cannot be made with former workings; but it may be pointed out that already the community of Forfar are benefiting by his vigorous and effective management.

In my "Notes" last week, I briefly mentioned that the Coatbridge Gas Company had declared dividends at the rates of 10 and 7 per cent. per annum. The amount available for the purpose was £3624. The revenue in the six months ending June 30 last was £6437; and the expenditure, £4719—leaving a balance of £1718. There was a sum of £2023 brought forward; making in all £3741, out of which had to come £117 for interest. The consumption of gas increased by about 2 million cubic feet in the half year, as compared with the corresponding period of 1894. At the end of March, meter-rental was abolished to the general satisfaction of the consumers. The works and plant, under the supervision of Mr. T. Wilson, have been maintained in an efficient condition; but, owing to the damage caused to the pipes by the severe weather early in the year, the percentage of unaccounted-for gas is exceptionally high.

The Kilsyth Gas Commissioners have reduced the price of gas from 4s. 2d. to 3s. 9d. per 1000 cubic feet; being able to do so on account of their having contracted for coal at an average price, for the year, of 9s. 7½d. per ton, which is about 2s. per ton less than last year's price. There was a profit on the past year's working of about £250; and the estimate this year is for a profit of between £500 and £600. The Commissioners are desirous of accumulating money to meet the cost of renewals of plant.

I am informed that on Sunday night last the newly-installed electric lighting in Nicolson Street, Edinburgh, did not give satisfaction—how, I am not aware—and that, in consequence, the incandescent gas-lamps which have been on trial there, and which had been superseded, had to be again lighted.

Sulphate of ammonia is quiet at £9 5s. per ton.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 10.

Sulphate of Ammonia.—The market has throughout the week been quiet; the tendency being again in the downward direction, and quotations at the ports have become so irregular that it is difficult to fix exact values. Consumers' orders are very scarce; the buying being mainly by dealers—showing conclusively that there has been extensive "bear" selling ahead. Makers in the North have all along put their stuff on the market as it has been produced, at current prices; thus securing a larger proportion of business than would otherwise have been the case. The sagacity of this policy is confirmed by the present weakness in the London market, and the lower prices now being accepted in that quarter.

Nitrate of Soda is quiet at 8s. 3d. per cwt. for fine quality on spot; and at 8s. 1½d. to 8s. 4½d., according to position and test, Autumn shipment.

LONDON, *Aug.* 10.

Tar Products.—Very little new business is reported; and there is no important change in the value of, or demand for, any of the products. Pitch is firm; but all the other tar products are distinctly flat. Anthracene maintains its nominal value, and is likely to do so. But there is a wild competition in alizarine; and sales are reported at very low prices—prices, indeed, which must mean a loss with the present value of anthracene. Several tar contracts have been let during the week at prices ranging between 17s. and 20s. 9d.; the difference in value being represented by the geographical position and quality of the tar. Other prices are as follows: Pitch, West coast, 34s. to 35s.; East coast, 37s. to 38s. Benzols, 90's, 11½d.; 50's, 11d. Solvent naphtha, 1s. 0¾d. Toluol, 1s. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1¼d.; ordinary, ¾d. Naphthalene salts, 21s. Cresylic acid, refined, 1s. 1d.; brown, 11d. Carbolic acid, 60's, 1s. 7d. Anthracene, "A" quality, 1s. 1d.; "B," 10d.

Sulphate of Ammonia does not improve; and although some parcels have changed hands during the week, no large business is being transacted at the fearfully low prices now being quoted. The following prices represent the market quotations of the week: London (Beckton), £9 6s. 3d.; London outside makes, £9 7s. 6d.; Hull, £9 7s. 6d.; Leith, £9 5s.; Liverpool, £9 7s. 6d.—in all cases, excepting Beckton, less 3½ per cent. f.o.b., including bags. Gas liquor is offered at 6s. 6d. to 7s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—There is no material change to report in the coal trade here. With regard to gas coal contracts, nothing new can be noted, except that one or two, including that for Salford, are still unsettled. Prices remain at last week's quotations. Partially screened Arley gas coal averages about 7s., and good Wigan four-feet 6s. 6d. per ton at the pit. In the general round coal trade, business continues very depressed; and supplies are largely in excess of requirements, even with pits working not much more than half time. In the better qualities, the demand for house-fire purposes continues to be restricted to the most limited dimensions; no increased weight of buying having as yet come forward to meet winter consumption. Prices, however, still average from 10s. to 10s. 6d. per ton at the pit for best Wigan Arley; 8s. 6d. to 9s., for seconds Arley and Pemberton four-feet; and 7s. to 7s. 6d., for common house-fire coals. In common round coals, there is perhaps less competition from Yorkshire collieries, as they are getting rather more busy on shipping orders, and showing less disposition to take the excessively low figures at which recently they have been pushing surplus supplies on this market. But prices generally are still cut very low, to effect sales in anything like quantity for prompt delivery. Good ordinary steam and forge coal does not average more than 6s. per ton at the pit mouth; whilst 5s. 6d. at the pit, representing about 7s. 3d. delivered at the ports, is a very common figure for shipment—even less being taken in odd cases. Some of the colliery proprietors, however, are holding to 7s. 9d. per ton as their minimum for good qualities of steam coal, delivered at the ports; and 8s. 6d. to 9s. per ton are about the average quoted figures, for delivery at the Partington Tips on the Manchester Ship Canal. As regards engine classes of fuel, the limited production of slack of course tends to cause rather a shortness of supplies at some of the collieries, which have consequently a difficulty in satisfying their customers' needs from their restricted output; but supplies are readily obtainable out of slack held in stock at many of the collieries. This tends to keep prices down; common slack being still obtainable at 3s. to 3s. 6d., and better qualities at 4s. 6d. to 5s. per ton at the pit mouth.

Northern Coal Trade.—There has been a large demand for coal in the last few days; and in the case of one or two collieries, a higher price is asked for their produce. The best Northumbrian steam coal has shown the upward tendency most markedly, because the period for shipment to the Baltic is now beginning to draw to a close; and some shippers have considerable quantities to send yet. Hence 9s. 1½d. per ton f.o.b. has had to be paid in several cases to secure cargoes for export during this and next month; and this has stiffened the general quotation of 9s. per ton. There is not so much pressure for second-class coal, and the price is unaltered at 8s. to 8s. 6d. per ton f.o.b.; whilst steam smalls are from 3s. to 3s. 6d. Gas coals are in better demand; and as the consumption increases appreciably every week, it is certain that there will be with each week a better demand for, and a fuller working at, the pits producing gas coals. The price for uncontracted lots varies considerably; some of the best collieries asking 6s. 9d. per ton f.o.b., whilst others quote 6s. 6d. and less. On the other hand, 7s. and even 7s. 6d. per ton is asked by two collieries that are exceptionally situated for certain markets. Some local contracts are in the market, including one of 32,000 tons for a seaside town, and others are impending; but in view of the uncertainty as to the labour question in Durham collieries, it is expected that there will be rather higher prices quoted than in recently-decided tenders. The coke trade is steady; and with fuller shipments, and an average local consumption, the prices remain at about 13s. to 14s. per ton f.o.b. There is no alteration in the gas coal trade, for the slightly-increasing production is well taken up, and seems tolerably certain to be so for some time.

Scotch Coal Trade.—There are indications of an improvement in the coal trade in Scotland, due to orders returning which were lost during the strike of the miners last year, and to the feeling which is abroad that trade generally is about to improve. Gas bodies, who last year mostly contracted for a six months' supply of coal, are now contracting for the whole year. Prices are hardening a little. The quotations are: Main, 5s. 10d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. (full); splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 189,882 tons—an increase upon the quantity in the preceding week of 23,626 tons, and upon the quantity in the corresponding week of last year of 166,566 tons. For the year to date, the total quantity has been 4,144,168 tons—an increase upon the corresponding period of last year of 385,681 tons.

Incandescent Gas Lighting for Bradford Streets.—The Gas and Electricity Committee of the Bradford Town Council have appointed a Sub-Committee to consider an offer by the Incandescent Gas-Light Company, Limited, as to applying their system of lighting to all the Bray lamps within the borough.

The "Penny-in-the-Slot" System at Bolton.—At last Wednesday's meeting of the Bolton Town Council, Alderman Miles, the Chairman of the Gas Committee, referred to the increased demand for gas for heating and cooking purposes, and to the rapid extension of the "penny-in-the-slot" system to secure a supply of gas. From the books, he found that the Committee had now 1350 prepayment meters out. He thought this was a gratifying feature, because it represented so many persons who would not have been gas consumers but for this system. He added that the Gas Department had on hire 1694 cookers of various sizes, 1738 grillers, and 716 gas-fires. All this showed that the working classes of Bolton were taking advantage of the facilities offered by the department for the extended use of gas.

Suffocation by Gas at Liverpool.—A young girl, named Eleanor Woods, the daughter of W. T. Woods, of Northwold, Norfolk, was suffocated by gas last Tuesday night, at some cocoa rooms, in Manchester Street, Liverpool, where she was staying with her father before sailing for New York. In his evidence at the inquest, Mr. Woods stated that, on Wednesday morning, the gas-tap in the room was found turned full on. His daughter had had no experience of gas, as they did not use it at home. It was also stated that there was no fireplace in the bedroom, and the windows were closed; but there was an open ventilator. The Coroner (Mr. T. E. Sampson) observed that it ought to be the duty of the owners of all such places to have them properly ventilated, if only for health's sake. A verdict of "Accidental death" was returned.

The Price of Gas at Barnsley.—At the monthly meeting of the Barnsley Town Council last Tuesday, the Park and Lighting Committee reported that they had noted that at York the price of gas had been lowered from 2s. to 1s. 10d. per 1000 cubic feet, on account of the low cost of coal; and they regretted that they had been unable to secure a reduction in Barnsley. The Committee further recommended that the Town Clerk be instructed to apply to the Gas Company for a reduction in the price charged for gas supplied to the public lamps. Alderman Wray, in moving the adoption of the minutes, said the public might be satisfied with the price of gas; but he was not. He should continue to try to expose the charges. The Corporation were one of the largest consumers; and he thought they had a right to ask for a reduction. Mr. Charlesworth asked if it was advisable that the Committee should consider the question of purchasing the gas-works. He thought it was now time, as the shares would be getting more valuable. The Deputy-Mayor (Alderman Halton) thought these remarks were rather outside the minutes, which, after some further conversation, were adopted.

Reduction in Price.—The Dorking Gas Company have reduced the price of gas from 4s. to 3s. 9d. per 1000 cubic feet net.

Water-Works Extensions at Derby.—In addition to works, estimated to cost £22,500, which have already been ordered by the Water Committee of the Derby Town Council, permission was given them last Wednesday to spend £5500 in the construction of a filter tunnel to connect the existing tunnels with a proposed new receiving-tank.

West Bromwich Gas Supply.—At the meeting of the West Bromwich Town Council last Wednesday, the Gas Committee reported that the sales of gas for the Midsummer quarter amounted to 32,246,600 cubic feet, as compared with 31,688,000 cubic feet in the corresponding quarter of last year; and that the amount of gas-rental (exclusive of public lighting) was £3737, against £3652.

Additional Land for the Manchester Gas-Works.—The Manchester City Council last Wednesday agreed to a proposal of the Gas Committee that a piece of land offered by the Ship Canal Company, comprising between 3 and 4 acres, should be purchased for storage and other purposes. The immediate use to which the land is to be put is for the accommodation of oil-tanks, required in connection with the manufacture of water gas.

Gloucester New Water-Works.—In connection with the Newent water-works scheme of the Gloucester Corporation, the Water Committee recently invited tenders for the supply and construction of a steel girder bridge and line of water-pipes over the River Severn. The offers ranged from £1767 to £2488. The lowest tender was submitted by Messrs. J. Lysaght, Limited, of Bristol; and the Committee have recommended the Council to accept it.

Contemplated Water-Works Extensions at Worcester.—Some extensive improvements at the water-works are under the consideration of the Water Committee of the Worcester Corporation. New pumping engines have been talked of for some time past—the present ones costing a large sum annually for repairs—and a further extension of the filtering arrangements is now proposed. The outlay to be incurred is expected to amount to about £20,000.

A Large Loan for the Leeds Corporation Water Department.—The Leeds Corporation Water Committee last Friday decided to ask the City Council for authority to apply to the Local Government Board for sanction to borrow £100,000 under the powers of the Leeds Improvement Act, 1893, for water-works purposes. The loan is required for extensions of service-mains necessitated by the growth of the city, the construction of the 30-inch main from Eccup and Swinsty, the making of service reservoirs at Harehills and Beeston, the putting down of pumping-engines at Headingly, &c.

The Profits of the Wolverhampton Water Department.—The Water Committee of the Wolverhampton Corporation report that the profits for the year ended March 31 last, after paying interest charges on the capital and providing for the sinking fund, amounts to £4675. The income from sales of water has been £501 in excess of the previous year. The surplus of £3000 which appears in the balance-sheet on the revenue account will be forthwith transferred to the credit of the improvement fund. An agreement has been entered into with the Urban District Council of Bilston for the sale to them of the water-rights and water-mains of the Corporation in the Coseley area, and the water-main from Goldthorn Hill to the boundary of the township of Bilston, at the sum of £7750. The balance-sheet shows a total income for the year of £28,586, and an expenditure of £23,911.

New Joint-Stock Companies.—The Wingate and District Water Company, Limited, has been registered with a capital of £5000, in £1 shares, to supply water in the township of Wingate and elsewhere, in the county of Durham. Under the title of La Société Anonyme du Bec Auer pour l'Europe du Nord, a Company has been formed in Brussels, with a capital of £160,000, to acquire and exploit the Welsbach patents in Russia, Finland, Sweden, Norway, and Denmark. The Gas Power and Light Corporation, Limited, has been registered with a capital of £20,000, in £1 shares, to adopt and carry into effect an agreement, made by the Company with the London Traders' Trust Corporation, Limited, for the acquisition of certain patents, patent rights, &c., relating to improvements in the manufacture of gas, &c., and to turn to account the same. The registered office is at No. 20, Bucklersbury, E.C.

Sales of Stock and Shares.—Last Thursday, Messrs. Alexander, Daniel, Selfe, and Co., of Bristol, sold by auction £20,000 of 7 per cent. maximum consolidated ordinary stock of the *Bristol Water-Works Company*. The reserve was £145 per cent.; and the prices realized fluctuated between £145 2s. 6d. and £146 15s. The total amount produced was £29,126 15s.; being an average of about £145 12s. 6d. per cent.——£50 ordinary stock in the *Broadstairs Water Company* has been sold at £60; £85 of "A" stock in the *Broadstairs Gas Company*, at £180; and £75 "B" stock in the same concern at £110. A perpetual rent charge (minimum of £200 per annum guaranteed), payable by the *Maidstone Water Company* at the rate of 1d. per 1000 gallons of water taken from the Boarley Springs, has been sold for £5750.——Twelve £10 shares in the same Company were sold last Thursday by auction at £31 per share; and eight, at £30 10s. per share.

Colchester Water-Works Extensions.—Colonel J. O. Hasted, one of the Inspectors of the Local Government Board, held an inquiry at Colchester in reference to an application by the Council for a loan of £6250 for water-supply purposes. The Chairman of the Water Committee (Mr. J. Paxman) informed the Inspector that the new machinery they had put down cost £16,500; but the Committee asked, in the first instance, for a loan of £12,000, thinking that the other portion of the money could be taken from revenue. It was afterwards thought, however, that, as they were building sound, permanent works, it would be right to ask for an additional loan spread over as long a period as the authorities would grant. It was found that extra works were required. The water-tower was discovered to be insufficiently strong; and the Engineer (Mr. Wood) estimated that to do all that was necessary to secure absolute safety, would involve an outlay of £12,000 or £13,000. Some minor improvements were also explained by Mr. Paxman; and other witnesses were examined in support of the application.

The Acquisition of the Ystrad Gas and Water Company's Property by the Rhondda District Council.—A letter from the Ystrad Gas and Water Company was read at the last meeting of the Rhondda District Council, intimating that they were prepared to dispose of the whole of their water and gas works by arbitration. After a brief discussion, a Committee was appointed "to consider the water question generally, and to conduct an arbitration between the Ystrad Water Company and the Council, with full power to act and engage professional assistance."

Outing of the Employees of the Ilkeston Gas Department.—Last Saturday week, the stokers and fitters employed by the Gas Department of the Ilkeston Corporation enjoyed an outing arranged for them by the Gas Committee, in the shape of a trip to Skegness, and a dinner at the Pavilion. The Engineer and Manager (Mr. F. C. Humphrys) was in the chair; and Mr. J. Beardsley, who has been foreman for more than a quarter of a century, was in the vice-chair. The after-dinner proceedings were very brief; consisting of a loyal toast, and "Success to the Gas Department."

Changes in the Wages and Hours of Birmingham Water-Works Men.—The Water Committee of the Birmingham Corporation have resolved to make some alterations in the hours of labour and wages paid at their pumping-stations. Continuous pumping is necessary to maintain the supply; and hitherto the stations have worked by two shifts of men, each working twelve hours, except in the larger stations, where they are allowed two hours off for meals. The Committee have now decided to adopt the system of eight-hour shifts from the beginning of October next. The wages of the men have been: Drivers, 5s. per day, and stokers 4s. 2d. per day; each with time-and-a-half for Sundays. When the alteration of hours takes place, the wages will be lowered to 4s. 6d. per day for drivers, and 4s. per day for stokers; the time-and-a-half rate for Sundays being maintained. The men have been allowed, in consideration of their long hours, twelve days' holiday per year, for which no pay has been stopped. Six days' holiday will be withdrawn at the same time; reducing the holidays of the workmen to the level of the other Corporation departments.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 331.)

Issue.	Share	Whe ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23—24	+1	4 7 6
100,000	10	,,	7½	Do. 7 p. c.	10	15½—16½	..	4 10 11
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	104—106	..	4 14 4
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	28 Feb.	12†	Brentford Consolidated	100	257—262	..	4 11 7
180,000	,,	,,	9†	Do. New	100	205—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
888,500	Stck.	28 Feb.	5	Bristol	100	125—130	..	3 16 11
320,000	20	28 Mar.	11¼	British	20	54—56	..	4 0 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾—8¼	+¼	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	+1	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	28—30	..	5 10 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	299—304	..	4 8 9
165,000	,,	,,	10½	Do. New	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	265—275	..	4 14 6
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26*	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18*	..	4 14 3
5,646,590	Stck.	14 Feb.	12¾†	Gaslight & Coke, A, Ordinary	100	297—302	+7½	4 4 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	283—288	+3	3 9 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	190—195	..	3 11 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	280—285	+3	3 10 2
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	165—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	131—134	+1	2 19 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	200—205	..	2 18 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	250—255	−2	4 14 1
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	16½—17½	..	5 14 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	..	6 7 3
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	305—310	+3	3 17 5
308,685	,,	,,	13	Do. C do.	100	310—315	..	4 2 6
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172—176	..	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	230—235	..	3 8 1
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	114—118	..	2 19 4
708,000	Stck.	14 Feb.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—264	..	2 16 9
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Feb.	12¾	New River, New Shares	100	390—400	..	3 3 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—145*	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157—163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	292—297	+4	3 7 4

* Ex div.

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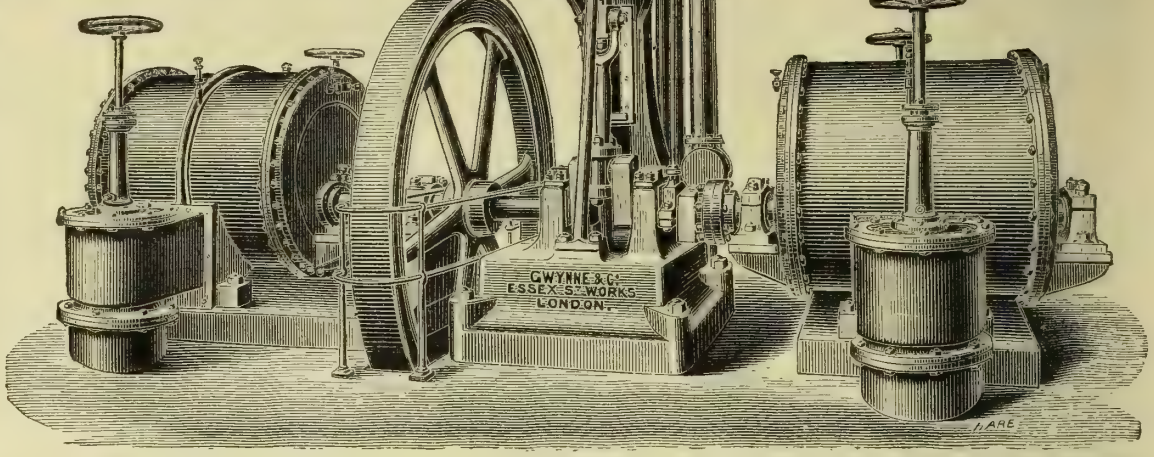

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EDITORIAL NOTES.

The South Metropolitan Meeting.

THE ordinary general meeting of the South Metropolitan Gas Company last Wednesday terminated, as was to have been anticipated, in another personal triumph for the Chairman, Mr. George Livesey. What was hardly to have been expected by anybody, however, and certainly not by Mr. Livesey himself or his declared opponents in this regard, was the apparent ease with which his legislative projects, the "workman director" and all, were accepted by an almost unanimous body of stockholders. It cannot be truly stated that Wednesday's vote was "snatched;" or that he or anybody else put any obstacles in the way of those proprietors who might disapprove of his plans, to prevent their having an effective say in the matter. Notice was given in the Directors' report that an expression of proprietarial opinion would be taken on the question of the expediency of reintroducing the Company's Bill; and we took an opportunity a fortnight ago for urging upon all and sundry of those concerned the expediency of attending the meeting in full force. As a matter of fact, the attendance was by no means large. No unofficial opponent of the Chairman's policy put in an appearance; and consequently it does not now lie in anybody's mouth to cavil with Mr. Livesey for carrying through the plans to which he was known to be committed, and which have received no opposition worthy of the name. It would be affectation to express surprise at the result. When certain gentlemen, writing in our columns last April, referred to the workman-director project as dead and buried, we ventured to hint that, if so, the only epitaph to fit the subject would be a word the truth of which was made manifest last week. We knew our man. Perhaps the weakest part of Mr. Ewart's otherwise unexceptionable little speech on Wednesday was his naive confession that, in face of the Chairman's dogged sincerity in the matter, he had no option of acting otherwise than did the immortal Colonel Davy Crockett's 'coon in similar circumstances.

It is not our desire, however, to publish anything to further irritate the susceptibilities of those well-meaning persons who must now find the ready complaisance of the South Metropolitan shareholders to follow the lead of their Chairman more than a little disappointing. It could have been wished that Mr. Livesey's opponents had made a better fight of it; but now the opportunity for effective warfare is past, it is to be hoped that there will be no further controversy or rancour. For Mr. Livesey's chief adversary, Mr. Ewart, it is possible to entertain the sincerest respect. He does not like the Chairman's project. He has said as much in his place; and the proprietors have decided between the two causes. Unfortunately for gentlemen like Mr. Ewart, the mere dislikes of conscientious and (in the financial sense) qualified directors of the ordinary City type cannot be hopefully set up against the positive counsels of forceful experts like the South Metropolitan Chairman. He, too, is qualified to hold an opinion in regard to a point of administrative policy in respect of the Company; and his qualification is higher and stronger, in the judgment of the proprietors, than that of the opposing section of the Board. This is all done with now. The South Metropolitan Board is united again; and, all being well, an interesting bit of parliamentary business is assured for next session.

It would not be just to the proprietors who composed Wednesday's meeting to merely record their vote of confidence in the Chairman and of acquiescence in his scheme for altering the constitution of the Board, without remarking upon the very high degree of public spirit which this historic vote exhibited. Shareholders in general, and gas shareholders especially, have often and deservedly been held up to opprobrium for their imputed greed, narrowness, and indifference to anything and everything but dividends. The imputation has not always been unjustified; and some of the least worthy of the reflections concerning dividends and prices which have fallen from the lips of directors of the commoner brands of the order have been applauded on occasion by proprietors who appeared content to pose as money-making automatons. But it is due to the South Metropolitan proprietary to say they have never allowed sordid considerations to stand in the way of the higher requirements of the undertaking and the community. On the occasion of the strike, these

shareholders willingly surrendered, in what they perceived to be a right cause, a large amount of the dividend to which they were lawfully entitled. They permitted the Board to do what was considered to be fair to the employees of the Company in the matter of the establishment of the profit-sharing scheme. Now they have gone to a length in the same direction, which it has been freely predicted would never be sanctioned by any gas shareholder, by approving of a new departure in administration of the greatest political importance. Of course, it is open for anybody to say: "It is all Mr. George Livesey!" And in a certain sense this is so. If he were not prepared to lead, his fellow-proprietors could not follow; but being the born leader of men he is, he could still do nothing without his following. Therefore, whatever may be the outcome of the new Bill—whether Mr. Livesey's designs, important as they are politically, turn out to be industrially and commercially barren or the opposite, let the South Metropolitan proprietors be praised for the liberal-mindedness that is undoubtedly theirs. It is no small credit to any body of men now-a-days to be able to follow a leader, as distinguished from merely standing still or "marking time" with somebody occupying this position. Mr. Livesey has asked his fellow-proprietors to follow him into a strange country which some say is peopled with "Gorgons, and Hydras, "and Chimæras dire;" and they are with him, as they probably will be, through thick and thin, for as long as he continues able and willing to remain at the head of the Company.

Meeting of the North of Ireland Gas Managers' Association.

The North of Ireland Association of Gas Managers had a very successful annual meeting at Drogheda on Tuesday last, under the presidency of Mr. P. J. Salmon, of Galway. A satisfactory accession of strength to the Association was at the same time signalized by the election of six ordinary and four extraordinary members, several of whom belong to towns situated outside the geographical boundary indicated by the title of the Association. This is gratifying as an indication that the advantages of an Association of the kind are being recognized throughout the length and breadth of Ireland; but the circumstance was made the occasion for once more raising that question of changing the name of the Association, or taking some other step towards recognizing the widening distribution of its membership, which cannot be easily or summarily disposed of. Doubtless there is room for an "Irish Gas Managers' "Association" meeting all over the country; indeed, the principal difficulty consists in there being only too much room in Ireland for such an institution to comfortably spread itself in. We do not consider that the initial lack of general interest in Mr. Whimster's originating circular finally disposes of the question; and, in point of fact, it would be found that the roll of the existing Association contains many names of gas managers who did not respond to this circular invitation. For all technical purposes, and for most social objects, a gas manager engaged in any part of Ireland will find complete satisfaction in joining the present organization; for when men employed in the same industry meet to hear and talk "shop," it does not matter in the least whether the society which affords this privilege and solace bears a name expressive of a specific localization. The great thing is that the "shop" talk should be good; and that there is enough of it. Next to this paramount consideration comes that of accessibility. To slightly change the meaning of the term, it is obviously useless to go to the trouble and expense of opening a shop in a place where many would-be customers cannot get at it; and Ireland is not provided with a number of centres to which the scattered gas managers can conveniently resort for conference. Any Irish Gas Managers' Association must partake of the nature of a Provincial, not to say a District, Association; and it is an essential condition of the success of the meetings of such societies as there are in England, that they are held in places to which the majority of the members can travel cheaply, and without necessarily spending more than a single night from home. If even this necessity is avoidable, so much the better for the prospects of the meeting. This statement of the Irish case explains the circumstances sufficiently, without reference to other considerations which do not really influence the question.

To return to the proceedings of the Drogheda meeting, we can unreservedly praise the Inaugural Address of the President, which was exactly the kind and quality of composition appropriate to such an occasion. Mr. Salmon gave his audience a clear, practical statement of personal doings and experiences in his own works and district; and the result was all that could be desired of the head of a Gas Managers' Association. He also gave some excellent advice with regard to the benefits to be derived from attendance at technical meetings. There is, indeed, nothing so good for furthering the general levelling-up of a group of gas managers to the datum of their most advanced and experienced members. What Mr. Salmon said upon this head should go home to the class of workers he was addressing, and also to their employers. It is no libel to describe Ireland as a poor country; and it is certainly true to classify the great majority of its gas undertakings as belonging to "a concatenation accordingly." Moreover, most of the Irish gas-works are of considerable age; and as few of the towns they supply have grown to any great extent, there has been little opportunity for modernizing buildings or plant. The men who have charge of such unprogressive establishments are liable to get into grooves, and to go plodding on in the same way year after year, unless they have applied to them the stimulus of association and comparison with their fellows. Hence we most cordially support Mr. Salmon's recommendation that not only should Irish gas managers make the fullest use of all opportunities for meeting together, but also that their reasonable expenses in this regard should be borne by their employers. It would be money well spent.

The rest of the business of the meeting consisted of reading and discussing useful papers by Mr. Martin, of Drogheda, and Mr. Tully, of Sligo, which do not call for comment here. We have to say, however, that we cordially support the latter's plea for the issue of Provisional Orders for Ireland by a Dublin Government department. Dr. W. Ivison Macadam also lectured very acceptably to the Association on the phenomena exhibited by illuminating gas-flames.

An Electrician's Amusement.

Our electrical contemporaries of the first class are admirable chroniclers and critics of matters coming within their proper province; but we must be permitted to observe that when, as not infrequently happens, they undertake to enlighten their readers in regard to points of interest connected with gas supply, they occasionally print great nonsense. Mr. George Livesey mentioned, in his speech at the South Metropolitan meeting, without taking the trouble to discuss, a wonderful farrago of rubbish concerning the Company's profit-sharing scheme recently published by the *Electrical Review;* and last week the same usually sane journal perpetrated a silly and superfluous calumny against gas companies in regard to their wholly imaginary dealings with calcium carbide. The statement starts with the assertion respecting this interesting compound that "few new products have been so extravagantly and so "quickly be-puffed;" the assigned reason being that "the gas companies recognized in it a means whereby "they might solve the hitherto-to-them-almost-insuperable "difficulty of raising the candle power of their illuminant. "At any rate," we are told, "they [the gas companies] "welcomed the advent of acetylene as the advent of a "saviour; and the incense of their thanksgiving arose in "the land." This is news to us, who should know at least as well as the *Electrical Review* what gas companies are doing in the matter of enrichment. Our contemporary proceeds, in the engaging style beloved of electrical scribes, to condole with the "aged and failing" gas companies upon the intelligence it professes to have obtained from a variety of foreign sources that calcium carbide is not the "good "thing" it was at first supposed to be. It also kindly warns those whom it describes as "*quondam* rivals, that all "is not gold that glitters; and that they should not pro-"ceed to adopt a new thing as an universal *panacea* before "they have carefully investigated it." Really, this is very good of our young friend; but the kindness is unfortunately misdirected. There is an old saying about the superfluity of teaching one's grandmother how to suck eggs, which the writer in our contemporary might take to heart before he next essays to instruct the "aged and failing" as to the prudence of observing that caution in adopting novelties which is, at any rate, likely to characterize old age, whatever other qualities may be lacking. It would be

waste of effort to dispute with an electrician the fact of that decrepitude of the gas industry in which he pretends to believe, or one might ask by what physiological law senility is associated with that growth to which—taking the nearest evidence to hand—Mr. George Livesey testifies in the South Metropolitan case. This particular electrical "wheeze" is no compliment to the sagacity of those for whom it is so repeatedly served up; and one would have thought that if they are as scientific as they claim to be, electricians would prefer to look the facts of the lighting trades in the face, instead of trying to amuse themselves by voting gas to be dying or dead. However, if this sort of thing amuses them, it certainly will not hurt the gas industry. With regard to the asserted delight of gas companies in calcium carbide, we can only say that this is as much a figment of the electrical brain as the decrepitude of the companies themselves. We never heard of a gas company buying a pound of the substance for use in carburetting; and if our contemporary will take the trouble to turn to our report of the May meeting of the Incorporated Institution of Gas Engineers, it will discover that gas companies have long since been in possession of better information on the whole subject of calcium carbide than it has been in such belated haste to obtain from other sources, which probably had it at second-hand.

The Independent Labour Party.

The comment upon the recent General Election which has been issued as a circular to the members of the Independent Labour Party by the heads of this remarkable organization, is a wonderful exercise in apologetics. The party ran 28 candidates, not one of whom secured a seat. Yet, by employing the magic of "proportional representation" computations, it is made out that upon the votes actually polled the party ought to be represented in Parliament by between 60 and 70 members. For the present, however, it seems to be a subject of congratulation to the wire-pullers that they achieved the triumph of the complete and contemptuous rejection by the constituencies of every one of their nominees. Of course, if this pleases them, nobody will seek to take away the source of their satisfaction. It would be remarkable, if it were not such a commonplace of studies in fanaticism, that the circular does not betray the smallest suspicion on the part of its framers—the wire-pullers aforesaid—that their candidates failed from the cause to which they were committed, "the independent "representation of Socialism as a distinct issue," being worthless in the estimation of the electors. Yet to everybody not wilfully blind, the lesson in this regard of the election was clear as print. The Socialists, and all the noisy gangs of Trades Unionists, Social Democrats, and proprietors of "fads" of every kind and hue, had before the election worked themselves into a belief that "the great heart of the people" was theirs, and theirs only. They told themselves and the slightly awed world this; and their newspapers echoed the assurance in the shrillest of "progressive" journalese. As it turned out, not even the half-hearted adoption of American spelling by these tremendous agents of moral force had the effect expected of it. Spelling "Progress" with a capital letter failed to induce the electorate to regard it as the peculiar property of a party; and the whole "program" of the same party did not "go" one whit farther for having the two last letters docked from the word as usually spelt. No, the present is certainly not with the Independent faddists; and Socialism has been laid upon the shelf. The world will not stand still, however, because a few busybodies have discovered their own insignificance. Such of the aims of the Independent Labour Party as are praiseworthy will be accomplished in due course, just as they would have been if no such organization had been heard of. It is only the "flies on the wheel" who will vanish; and they will not be missed.

Mr. Alfred West, the Manager of the Rastrick Gas-Works, has been chosen to succeed Mr. R. G. Shadbolt in the management of the North Bierley Gas-Works, when that gentleman takes up his duties at Grantham.

Mr. F. H. Newman has been appointed Assistant to Mr. C. B. Newton, the Gas and Water Engineer to the Carlisle Corporation. Mr. Newman was with Mr. Newton at Rotherham. The appointment gave rise to a long discussion at the Town Council meeting last Tuesday; the Gas Committee's action in the matter being much criticized. In the end, their minutes were confirmed by a majority of only two.

WATER AND SANITARY AFFAIRS.

The personal visit paid to the East-end of London by the President of the Local Government Board, and to which we adverted last week, was made the subject of a statement addressed to the House of Commons by Mr. Chaplin, in connection with a couple of interrogations in the interest of the County Council. The plain account thus presented gave so little support to the views entertained by the Progressive party, that Mr. Pickersgill at once endeavoured to detract from the effect of Mr. Chaplin's speech by the carping inquiry "whether the right honourable gentleman "was personally conducted by the District Engineer of the "Water Company when he paid his visit." Receiving a negative on this point, Mr. Pickersgill thereupon slightly modified his insinuation by asking whether Mr. Chaplin was not "accompanied" by the Engineer. Of course, Mr. Chaplin was "accompanied" by several persons, for whose presence he was not responsible. There were others for whose presence he might be held accountable, as, for instance, Sir Hugh Owen, the Secretary to the Local Government Board, and Major-General Scott, the Metropolitan Water Examiner. So far as being "con-"ducted" came in evidence, Mr. Chaplin was in the hands of the local authorities, as exemplified by the circumstance that, on alighting at the Shadwell Station, he was met by three representatives of the Vestry of St. George-in-the East, consisting of the Assistant Vestry Clerk, the Medical Officer of Health, and the Sanitary Inspector. It is only to be regretted that Mr. Pickersgill and Mr. Stuart were not present. But while the suggestion contained in Mr. Pickersgill's question was conceived in particularly bad taste, we find something still worse in the editorial columns of the *Daily Chronicle*. This organ of the Progressives has lately been advancing in its audacity in discussing the water question, until it has become absolutely reckless in its attacks upon the Company. Now at last, because Mr. Chaplin has made a calm and impartial statement of facts relative to the East London water supply, the *Chronicle* denounces the President of the Local Government Board as "the official apologist of that arch-sinner, "the East London Water Company." This is going beyond all bounds, and is of a piece with a subsequent sentence, which says: "Why it should have pleased "the Dictator to place the vast interests of London adminis-"tration in the hands of a man who knows and cares so "little about them as Mr. Chaplin, we do not pretend to "know." We should have thought that such a remark as this would have been impossible, in view of the fact that Mr. Chaplin has taken a step very unusual on the part of a Minister of State, in proceeding to the personal inspection of a district where the interests of the people were said to be suffering. Had Mr. Chaplin come back with a report favourable to the policy of the County Council, he would doubtless have been praised for his public spirit in thus seeking to learn for himself what was the true state of the case. Having made this virulent attack, the *Chronicle* says: "With Mr. Chaplin himself we "have no quarrel." We should think not. The question lies rather the other way, if the President of the Local Government Board thought fit to pay any regard to the *Chronicle* when charging him with utter incompetence and carelessness in the discharge of the duties of his high and responsible office.

If the *Daily Chronicle* has little regard for the official position and reputation of a Cabinet Minister, what can be expected when such a partisan journal has to deal with a comparatively humble functionary in the shape of a Water Company's Secretary? The *Chronicle* one day last week asked what was to be said of a Company, placed in such a situation as the East London, which "is actually "selling for a paltry sum to a neighbouring Water Com-"pany to whom it has no obligations at all, a delivery of "nearly 4,000,000 gallons?" The context of this statement naturally led to the conclusion that there was a "daily" delivery. Mr. Crookenden at once wrote to say that the Company, so far from "selling," were actually "purchasing" that quantity for daily distribution in their district. It might have been thought this little correction would have tamed the fiery spirit of the criticizing scribe. But no such homage to common sense and good faith was forthcoming. It was held sufficient to say that the word "delivery" did not mean every day; and, on the other hand, it was argued that Mr. Crookenden did not

say for how long a period the daily purchase had been in operation. Accusations carried on in such a spirit can, of course, never be met. The actual "selling" amounted to 184,000 gallons per day; while the East London Company were pumping from 45 to 50 million gallons per day into their district. Moreover, Tottenham is inside the parliamentary area of the East London Company, and therefore had some claim to assistance. Another onslaught on the Company has reference to fractured pipes as a source of leakage. The *Chronicle* states that in an interview with one of their representatives last Friday, Mr. Crookenden said no less than 40,000 fractures had been found in the water-pipes in this Company's district. But it appeared that all this mischief was limited to the private pipes belonging to the consumers; the pipes and mains of the Company being in "an excellent condition of repair." However private the pipes may be, the *Chronicle* considers that the Company should have seen in some way that they were repaired "months ago." Respecting the quality of the water, which the veracious *Chronicle* has lately been describing as discoloured, and even "viscous," we find nothing to justify such a description in the monthly report by Mr. Crookes and Professor Dewar. On one occasion, the East London supply was "clear but dull;" and on another, "slightly turbid." On all the other days of the month, Sundays only being excepted from observation, the supply is reported "clear." In regard to quantity, the supply is now on for eleven hours per day—a much longer period than that which is given in districts whence no complaints proceed. But East London is deficient in house cisterns, and hence demands a constant stream.

It is ludicrous to learn that the London County Council have a Committee which has been "inquiring into the "scarcity of the water at the East-end," and has now embodied the results in a report. The Committee need have taken very little trouble in this matter. A reference to "Hansard" will make the true cause perfectly clear. It is a question between 1893 and 1894. The works to be finished next May might have been finished last May, had not the County Council persuaded the Government that there was no need to enlarge the East London Company's reservoirs. The Council will now have to suffer a year's delay with regard to one of their own projects; and the year may be followed by many others. The Transfer Bills cannot be proceeded with any further this year, but must stand over until 1896, when they will be taken up at the stage they have already reached. Perhaps, in view of the present composition of Parliament, the Council will be disposed to let the Bills drop, and proceed solely with their own scheme for bringing in a fresh supply. But the enormous expense involved in drawing water from Wales renders the project hopeless, until actual necessity for its adoption can be shown. It is also generally understood that, before a new scheme can be introduced, the existing undertakings must be purchased. For this reason, the transfer scheme seems to be inevitable, except that the Council have no chance of carrying it unless considerable modifications are admitted. A well-devised Trust, outside the limits of the County Council, would doubtless receive a very considerable measure of approval. Yet the Council would possibly prove strong enough to prevent the adoption of such a measure. If there is any popular demand for superseding the London Water Companies, the Council have done little else than block the way.

As the vast population of the country increases, and as new sources of water supply are more eagerly sought for, it is not surprising that those upon whom Parliament has conferred exclusive or prior rights in particular districts should insist on claiming what they believe to be their own. Competition in this respect is destined to become keener as time runs on; and the growing tendency of things is well illustrated by the recent resolution of the Monmouthshire County Council in regard to water schemes affecting the Welsh Principality. Water engineers in great cities that are afar off constantly direct attention towards the watersheds of Wales. The London County Council, as everyone knows, are advised to look thither for the supply of the future, and therefore it is not unnatural that the ruling powers in Wales should view with alarm these constantly threatened encroachments. Hence, doubtless, the resolution referred to, which touches upon the rapidly decreasing area available as a gathering-ground in Wales, and the probability of further inroads being made by English corporate bodies. The Parliamentary Committee of the Monmouthshire County Council have now been definitely charged with the duty of considering and reporting as to the steps to be taken for the conservation to the county itself of such areas as may be necessary for an adequate supply of water for local purposes.

Doubtless it was the same spirit that dictated the above resolution that led the Bradford Corporation to embark in long and costly litigation with the owner of certain lands in the vicinity of their water-works. The defendant, it seems, proposed to deal with the mines and minerals under his land in a way which would, admittedly, result in cutting off an underground stream which sent water into the wells of the Corporation. Now, it is beyond dispute that a similar question was setted by the House of Lords many years ago in *Chasemore v. Richards* (7 H. L. Cases, 349). The point there to be decided was whether an owner of land had a right to sink a well upon his own property, and thereby abstract the subterranean water percolating through the soil, which by force of gravity would otherwise have found its way into springs supplying a river in the flow of which the plaintiff had special interest. It was held that the landowner was within his rights in sinking the well, even though the results indicated would certainly follow. He might do as he pleased with his own, it was said, albeit the purpose he had in view was wholly unconnected with the enjoyment of his estate. So far, then, it must be allowed that the weight of authority was against the Bradford Corporation. There was, however, another aspect of the question upon which much judicial learning has been expended in the course of the litigation referred to—commencing as it did in 1893, and only recently ended by the judgment of the House of Lords, as reported in the last issue of the JOURNAL. By the Bradford Water-Works Act, 1842, the Company then in possession of the works obtained an enactment that, after they had acquired the springs particularly alluded to, no one should divert or appropriate, "in any other "manner than by law they might" be entitled to, any of the water then supplying or flowing from the springs in question. The powers and privileges of the Company under that Act subsequently passed to the Bradford Corporation; and the Courts had to decide what the protective clause meant and what it did not mean—a problem which appears to have been the source of a great deal of forensic argument and of conflicting judicial opinions.

In the first instance, the Corporation were successful in their contention; for Mr. Justice North stayed by injunction the injurious proceedings of the landowner, and ordered him to pay the costs of the action. But, on appeal, this judgment was reversed; Lord Herschell (then Lord Chancellor), Lord Justice Lindley, and Lord Justice A. L. Smith holding that the law sanctioned the defendant's programme. From this decision the Bradford Corporation appealed; and the House of Lords, as already intimated, could see no reason for distinguishing the case from *Chasemore v. Richards* on the broad question of a landowner's rights. The acts done or sought to be done (said the present Lord Chancellor) were done by the defendant on his own land; and the interference with the flow of water was not an interference with water flowing in any defined stream. It was simply a case of percolating water, though, undoubtedly, that water, if not cut off, would have reached the plaintiffs' wells. Lord Halsbury, Lord Watson, Lord Ashbourne, and Lord Macnaghten were unanimous in holding that, on the facts as presented to them, the Corporation had no legal remedy. That, of course, disposes of the whole matter in its elements of general interest and importance. As to the terms of the special enactment on which the Corporation also relied, the Lord Chancellor evidently thought that they had built their belief on a foundation of sand. In his Lordship's view, the Special Act only prohibited people from taking what really belonged to the Company. Doubtless the Corporation thought, as we should be inclined to think, that a prohibition thus restricted in its operation was superfluous. But there is the ruling of the House of Lords; and, for all legal purposes, the final word on the Bradford dispute has now been spoken.

The Verstraeten System of Incandescent Gas Lighting.—It is reported that the Belgian Company who have acquired the Verstraeten incandescent gas-light patents have opened a depôt in a central position on Boulevard Anspach, Brussels, where the brilliant light attracts considerable attention after nightfall.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 409.)

THERE was not any remarkable feature attending the progress of business on the Stock Exchange last week; and perhaps the most interesting item was the settlement after the long 19 days' account. This is a matter which is rarely free from some little degree of anxiety. But it was happily adjusted last week; and the effect was favourable. Fresh business was not very brisk at any time; and things grew quieter as time went on. But prices for the most part did not suffer. Consols and one or two of the choicest gilt-edged securities were a shade lower; but, on the other hand, rails and a few others that wanted a fillip were a little better. Some realizations of profits administered a check here and there; but there was no real weakness anywhere. The Money Market shows no change. Business in the Gas Market began with a great show of activity, though it was largely restricted to the leading issue; but the volume of transactions soon dwindled down, and things became quiet indeed. The tone in general was very firm; but very few changes were made in the quotations until they were corrected *ex div.*, when every issue affected was promoted. Gaslight "A" was very active and buoyant; and prices gradually hardened until at last stock changed hands at 295 *ex div.*, equivalent to 301⅜ with the dividend in it. Hardly anything was done in the secured issues; but they all rose. South Metropolitans were very inactive; but the "C" stock made a nice advance. All Commercial issues, too, were quiet—sellers being scarce. Hardly a bargain was marked among the Suburbans and Provincials; and only Brentfords advanced their figures. Business was just as dull in the Continentals; and none of them made any sign, nor did any of the remoter undertakings attract attention. In the Water Companies it was just the same—transactions being very limited. With the exception of East London, they were firm in general; and one or two made moderate advances.

The daily operations were: Gas stocks opened unchanged on Monday, and closed steady. Business was all in Gaslight issues, which commanded very good prices. On Tuesday, the volume of business was much about the same; but it was more distributed through the list. The only change in quotation was a rise of 2 in Australian. Transactions fell off terribly on Wednesday—everything being very quiet indeed. South Metropolitan "C" rose 2. In Water, Kent rose 2; and Grand Junction, 1½. But East London receded 2. On Thursday, things were just as inactive. But prices held very firm; and South Metropolitan "C" had a further rise of 3. Matters were a little better on Friday, when several issues were very lightly dealt in; but quotations remained unchanged. Saturday's operations were insignificant; and the only variation was a fall of 1 in Imperial Continental.

ELECTRIC LIGHTING MEMORANDA.

The Fortunes of the Edison and Swan Company—The Penalty Clause in Local Authorities' Contracts—The Projected Electric Lighting of York—Analysis of Electric Supply Undertakings' Accounts.

MR. J. S. FORBES delivered an interesting speech at the recent annual general meeting of the Edison and Swan United Electric Lighting Company, upon the results of the second year's working since the expiry of the Company's patents. It is always instructive to watch the further development of business in a speciality after it has ceased to be a monopoly; and in this particular example both the magnitude of the trade and its character are exceptional. Mr. Forbes admitted that, during the period of patent protection, the Company occupied a very advantageous position, being enabled to fix their own prices. When the patent lapsed, there naturally ensued a sharp competition in the trade; and the selling price of incandescent electric lamps fell very considerably. The Company, however, had made their arrangements for meeting the new conditions; and, notwithstanding the pressure of their rivals, the volume of trade done continued to increase. Consequently the Company have been able to maintain their 5 per cent. dividend. An annual turnover of nearly £115,000 for lamps, fittings, and suchlike articles, means a large (and, in this case, probably a very reliable) connection; and the Company have reason for rejoicing in what the Chairman described as one characteristic of the English people—a fondness for old favourites, and a disinclination to abandon purveyors of commodities who have served their customers well. In another way, this same characteristic may have been some slight hindrance to the commercial development of electric lighting.

The attention of all companies and others having contracts with local authorities should be directed to the case of the British Insulated Wire Company, Limited, against the Prescot District Council, reported in the JOURNAL for the 6th inst. (*ante*, p. 298), in which it was held by the Court that a contract for the lighting of the streets of Prescot by electricity was void by reason of the absence of a penalty clause from the sealed document. So far as these litigants are concerned, the difficulty has been removed, after a great amount of trouble, by the execution of a new contract; but the point is of moment for all contractors and local authorities, inasmuch as it is shown to be necessary to the validity of all contracts entered into by such bodies, under the Public Health Act, that they should contain a penalty clause. In a general way, such a clause is usually inserted in contracts for public lighting by any system; but there are contracts executed and sealed by local authorities which do not refer to any penalty in respect of non-fulfilment—sometimes because such a provision is regarded as inappropriate or superfluous. It is news to learn that, on this account, no such contract under the Public Health Act could be enforced.

The citizens of York are in a condition of very considerable muddle in regard to a proposed Corporation electric lighting scheme; and it will be some time yet before the matter is straightened out. The duty of preparing a scheme was put upon a Sub-Committee of the Streets and Buildings Committee of the City Council, whose proceedings recall the old tale of the man sent through a plantation to cut the straightest stick he could find, subject to the condition of not looking back. Like him, the York Committee came out of the wood with quite a poor stick. They have been consulting expert after expert; and no two of them were found to agree upon what ought to be done to provide York with a proper central electric lighting installation. Ultimately, they had from as many contracting firms four offers which were regarded as containing some promise of an acceptable result. But, when applied to for definite tenders, only two of these firms responded; and the Chairman of the Committee confessed that if further expert opinion were taken on these offers, it was possible that neither would be approved of. Hereupon a confused debate arose, with the result that the matter was referred back. This was the outcome of five years' incubation. We sympathize with the Committee, and think the desire expressed by several of the members to be relieved of further trouble in this regard is reasonable. It is not a grateful thing to be forced to appear either as standing in the way of the citizens obtaining a fashionable luxury which some may be willing enough to pay for, or as consenting to the expenditure of public money upon a speculative enterprise which is certain to cost the whole body of ratepayers something at the start, and probably for all time. We observe that one earnest and presumably public-spirited partisan of electric lighting assured the Council that there was not the slightest chance of additional burdens being put upon the ratepayers if the scheme were adopted. This assurance has been given elsewhere before; and it has been belied within a few months of its utterance. No representative of the ratepayers of any town ought to offer such an assertion, unless he is prepared to give his bond to indemnify those who may trust in him from all loss in the event of his being mistaken.

In its issue for the 9th inst., the *Electrician* published an analysis of the accounts of some nineteen Provincial electric supply undertakings in a form similar to that followed by the same journal in regard to the Metropolitan undertakings. The limitation of the number of undertakings included in this analysis is perhaps the most remarkable feature of it, especially when our contemporary's explanation of the reasons for this exclusiveness is taken into account. There were, it appears, about seventy Provincial electric supply undertakings working after some sort of fashion at the end of last year; but by far the greater number of these concerns had to be left unnoticed by our contemporary—mostly by reason of their insignificant size, and in many cases because of the unwillingness of the managers to submit their accounts to dissection. Hence the value of the selected abstracts is not great; but still some useful information is to be gleaned from our contemporary's table. Conspicuous, for example, is the reluctance of most of the undertakings to face the question of depreciation. Our contemporary awards a special meed of praise to the Liverpool and Newcastle Companies in this regard. One or two other Provincial electric lighting companies do a little in this way; but the local authorities without exception shirk the necessity, and put their sinking-fund payments in its place. There will some day be an awakening for these heedless ones.

The Directorate of the Ipswich Gas Company.—At a recent meeting of the Directors of the Ipswich Gas Company, Messrs. R. M. Miller and F. H. Fosdick were elected members of the Board to fill vacancies caused by death. Mr. G. A. Biddell was chosen as Chairman, in succession to Mr. Sterling Westhorp; and Mr. D. Ford Goddard, J.P., M.P., succeeds Mr. Biddell in the vice-chairmanship.

The Welsbach Commercial Company.—The formation of this Company, with a capital equal to £1,400,000, to exploit the incandescent system of gas lighting in the United States, was noticed in the JOURNAL for the 30th ult. We learn from *Progressive Age* that Mr. T. Dolan has been elected President; the Vice-Presidents being Mr. Emerson M'Millin, Mr. Randal Morgan, and Mr. C. B. Van Nostrand. The Treasurer is Mr. E. C. Lea; and the Secretary, Mr. S. Mason, who will have for assistant Mr. H. B. Wilson. Our contemporary understands that Mr. A. B. Eilbeck has resigned his position as General Manager of the East River Gas Company, in order to take the management of the new Company.

JOINT-STOCK COMPANY REFORM.

There has just been issued, as a Blue-Book, the report of the Departmental Committee appointed by the Board of Trade to inquire as to what amendments are necessary in the Acts of Parliament relating to Limited Liability Companies. The Committee was a very strong one, with Lord Justice Davey at its head. Mr. Justice Chitty and Mr. Justice Vaughan Williams were also members of it, together with several experienced financiers and accountants. Of the need for such an inquiry, it is unnecessary to speak. The joint-stock system has taken such firm root in the commercial world that the only question about it is that of preventing and curing abuses as they are found to arise; for nobody seems able to suggest any feasible substitute for it short of the nationalization of industry, which is outside the range of practical politics. The system is in an eminent degree one that calls for periodical review and revision; while at the same time the difficulty of this task is such that only the strongest and most reputable experts can attempt it with any prospect of success. In the present instance, the revisers must be deemed fully competent; and the fact of their having risen to the occasion, is proved by their having not merely investigated and reported, but also gone the length of drafting a proposed Bill for amending the existing Companies Acts.

The first subject to engage the attention of the Committee was naturally that of the prevention of frauds upon investors. Joint-stock speculation has the unenviable reputation of being cursed with much internal fraud; and the Committee had to distinguish the nature of these frauds, and formulate means for checking them. The report begins with some prudent observations upon the lines and limits upon and within which legislation can safely as well as usefully proceed in this regard. And here appears the initial difficulty. It is a trite observation, say the Committee, that the Legislature cannot provide people with prudence, judgment, or business habits. It must be remembered that the majority of companies are honestly formed for carrying on a legitimate, though it may be a speculative, enterprise or business; and the business is conducted with honesty and reasonable ability and judgment. After all is said that there is to say against companies, and more especially British companies, the fact remains that an enormous amount of business, not merely in England but for the whole of the world, is now carried on by the aid of British joint-stock capital, and under British management. This fact speaks for itself. It is largely a consequence of the facilities which exist for the formation of companies in this country, and the manner in which, as a rule, these companies are administered and managed. The Committee state that the capital embarked in English companies exceeds that represented by French and German companies together by at least 315 million pounds sterling. The natural inference from this fundamental fact of the situation is that drawn by the Committee—that legislation affecting interests of this magnitude and widespread character demands great caution and care. "Restrictive provisions, which may have the effect of either curtailing the facilities for the formation of companies which bring so much business to England, or of embarrassing the administration of companies, or deterring the best class of men from becoming directors, are not to be lightly entertained." It is therefore happily not a question of dealing "root and branch" with an organically weak or mischievous institution, but of correcting faulty details.

To come to the point, there is the question of the prospectus, which is the invitation to the public to subscribe money for the attainment of the objects ostensibly aimed at by the company. It is generally acknowledged that a person who is asked to subscribe to a new company has practically no opportunity for making any independent inquiry before coming to a decision. So the Committee offer, as a "counsel of perfection," the observation that a prospectus should disclose everything which could reasonably influence the mind of an investor of average prudence. With a view to this ideal, it is remarked that the securing of "the utmost publicity" is the end to which new legislation on the formation of companies should be directed. The law may enforce the giving of information, or supplying the means whereby information may be obtained; but after all the law cannot make people avail themselves of information. "It must be borne in mind," say the Committee, "that in a large number of cases, applicants for shares are indifferent to the terms of the prospectus, as they apply not for investment, but for speculation with a view to sale at a premium." Here, in effect, is at once the weakness and the scandal of the system. Before going into the after-details of the administration and management of companies when once formed, how is legitimate opportunity for investment to be extricated from its present confusion with sheer gambling? Possibly the question goes beyond the scope of the labours of the Committee; but, at any rate, having briefly recognized the existence of the gambling element in those who apply for shares in new companies, the report says nothing further on the matter.

Yet, surely, no projected reform of the law of joint-stock companies which omits notice of this evil of gambling for premiums, is fair to the community. The first suggestion by way of remedy that comes to the surface of one's mind, is that applicants for shares in new companies should be compelled to pay for and hold those shares for some definite period of time—say, a year. But such a proposal is probably futile. Suggestions for dealing with gambling and gamblers generally are. It can usually be demonstrated that they would not work, or would have a contrary effect to that intended, or that they would injure innocent persons. The result is that gambling increases on all hands. It is childish to devise means for keeping promoters and directors straight, and for ensuring that prospectuses shall convey "the truth, the whole truth, and nothing but the truth," while in point of fact both directors and promoters are merely agents whereby the gambler for premiums carries on his little game. Several of the newspaper writers and correspondents who have criticized the Committee's report, admit that, in the case of new companies, the initiatory stage is the all-important one. But while commenting upon the suggestions of the Committee with regard to the prospectus, they fail as a rule to shake off the superstition that the deluding of widows and orphans is the object of the wicked promoter. It is nothing of the kind. What the astute promoter (whom the law should look after) seeks to do is to prepare a taking scheme, which shall strike a sufficient number of gamblers as good enough for them to participate in at the start, with a prospect of getting out of again at the earliest possible moment with a profit made out of somebody else's later confidence in the thing. It is, indeed, a form of the "confidence trick;" and it is played in very much the same way as the original swindle. The gambling applicant for shares does not ask himself whether he believes or disbelieves the statements of the prospectus. All he cares to make up his mind about is whether the scheme is likely to go in the market; and the consideration that most weighs with him in this connection is not what he thinks of the prospectus, but how the eventual gull is likely to take it.

One consequence of this state of things is that it is impossible to launch the fairest enterprises—meant in the best of good faith to succeed, and having good prospects of doing so—without following a long way in the paths marked out by the fraudulent promoter, copying his practice, and paying dearly for the lesson. All this is due to the impracticability under existing arrangements of differentiating the true investor from the premium gambler. If the latter could be suppressed, those of the promoter order who pander to him would find their most profitable occupation gone.

We have no space for presenting even an abstract of the Committee's report and the Draft Bill. They deal with such matters as the Memorandum of Association, the allotment of shares, the qualification of directors, the statutory meeting, and so forth. It is curious to note how repeatedly the Committee are driven to confess their inability to suggest remedies for admitted evils, or to supply the most glaring shortcomings of the existing system. Take the question of the Memorandum of Association and its signatories. The Act of 1862 states that any seven persons associated for any lawful purpose may, by subscribing their names to a Memorandum of Association, and otherwise complying with the provisions of the Act as to registration, form an incorporated company. There can be no doubt that it was the intention of the Legislature that the signatories of this document should be persons really interested in, and of some importance in connection with, the formation of the company. But the practice has become very different. The Memorandum of Association is rarely signed by the real promoter, or by anybody who intends to take an interest in the company; but the seven signatories are, as the report puts it bluntly, mere "dummies." This practice has come to be perfectly well understood. It hurts nobody, and is not without its conveniences. But, all the same, it is difficult to believe that the intentions of the framers of the provision are borne out by it. The Committee remark upon this head that "it is easy to criticize the mode of forming companies above described, but not so easy to suggest any reform which is free from objection." Accordingly the Committee do not offer any suggestion, good or bad; but it strikes one that, at any rate, the farce of the seven signatories might be discontinued in favour of something like an application for a licence to trade under a registered name.

The report comments with legitimate satisfaction upon the fact that *pseudo* joint-stock companies—like that instanced in the case of the "Duke of Plaza Toro, Limited," in which the form of a company is only assumed by individuals or firms for their own ends—are not legal. When it comes to a question of distinguishing between perfectly legitimate "private" and "public" companies, however, the Committee again confess themselves at a loss. It is the same with regard to the limiting of the amount of borrowing to be permitted to companies. There is no subject of greater importance connected with company administration, or on which the Committee were favoured with more suggestions, than the question of the restrictions and limitations to be placed on the mortgaging powers of a company. Yet the Committee are of opinion that it would be impracticable to attempt to fix any such proportion. The Draft Bill, however, fixes certain conditions which are to be fulfilled before a company can legally borrow money at all, or even commence business. If the Bill becomes law, no company will be able to proceed to allotment unless a certain minimum subscription has been received; and until shares to the same amount have been allotted and partly paid up in cash, and the directors have duly qualified themselves, no business of any

kind can be undertaken. The Bill, moreover, is unique in respect of containing clauses setting forth the general law with regard to the duties and liabilities of promoters and directors in connection with the promotion of companies and the issue of prospectuses. The Committee did all this because, as they explain, "their experience leads them to believe that the principles of law and commercial morality, long since adopted and acted upon by Courts of Law and Equity, are not generally recognized, or, if known, are frequently overlooked and disregarded." This is a strong indictment of the genus "City man;" but it is not undeserved. Fortunately, the Committee also think that these principles of law, if thoroughly grasped, leave little to be desired so far as concerns the general principles which should regulate the dealings of men of business in this matter. It is a novelty to hear of principles of law and morality being embodied in an Act of Parliament; but, after all, the new clauses do not bulk very large in the Draft Bill.

The question of when companies may or may not declare a profit and pay a dividend is another of the problems which the Committee reluctantly declare themselves to be unable to solve. Although, as we have already remarked, some of the most urgent questions of company reform are thus passed over by the report, it would be wrong to suppose that this is anything but a most instructive and valuable statement of the law and the merits of a highly complicated subject. As we are now credited with having a businesslike House of Commons, the matters dealt with in this report may be further discussed at no distant date, with a view to fresh legislation on the subject.

Mr. C. H. Priestley has been appointed Engineer and Manager of the Cardiff Corporation Water-Works, in succession to Mr. J. A. B. Williams, whose resignation of the position was announced in the JOURNAL some few weeks since. Mr. Priestley was previously the Engineer; and the Water Committee recommended the Council to entrust him with the additional duties appertaining to the managership, at an increased salary. The Council, however, decided to advertise the appointment; but in the result they followed the advice of the Committee.

Presentation to Mr. D. Ford Goddard, M.P.—A very interesting gathering took place in the St. Clement's Memorial Hall, Ipswich, last Wednesday, on the occasion of the presentation of a testimonial to Mr. D. Ford Goddard, J.P., M.P. Until a short time ago, Mr. Goddard was President of the St. Clement's People's Pleasant Sunday Afternoon Class, which ceased to exist, but has now been revived; and the members, in conjunction with those of the Men's Guild, numbering together about 500, testified their high and sincere appreciation of his work among them by asking his acceptance of an illuminated address. Mr. Goddard, in acknowledging the gift, expressed his pleasure at again taking up the work of the class and renewing associations which were fruitful of pleasant memories. He said it was very gratifying to know that what he had done had yielded some fruit. In the course of his remarks, he referred in appreciative terms to the establishment of what are known as "University settlements," and announced that, in conjunction with other gentlemen, he had taken steps to start one in Ipswich, which he hoped would be joined by a large number of working men.

Death of Mr. R. W. Brownhill.—We regret to record the somewhat unexpected death, on the morning of Sunday, the 11th inst., of Mr. R. W. Brownhill, of Walsall, whose name is so well known in connection with the introduction of "penny-in-the-slot" gas-meters. Deceased took a prominent part in the municipal affairs of Walsall; and he was elected a member of the Town Council in 1867—becoming an Alderman a few years later. He was elected Mayor in 1872, and occupied the position till the year 1874—finally retiring from the Corporation in 1880. During the greater part of his period of office, he was Chairman of the Gas Committee of the Corporation. His tenure of this position was remarkable for the large profits made at the gas-works, and it was also notable because at the same time the price of gas was, we believe, lower at Walsall than in any other place except Leeds. He rendered great service to the town in negotiating for the purchase from Birmingham of their plant, mains, &c., in 1876; thus ensuring to the Corporation the sole right to supply gas at Walsall. The deceased was well known as an inventor and patentee. His patents for brickmaking machinery and other matters were very practical and successful; but perhaps the invention that has made his name best known is the prepayment gas-meter. The deceased was busily engaged in developing this system at the time of his death. During his connection with the Corporation, Mr. Brownhill devoted nearly the whole of his time to public matters of a municipal nature; and in conjunction with the late Mr. Samuel Wilkinson, the Town Clerk of Walsall for so many years, he laboured hard and successfully to develop the rapidly-growing borough. Mr. Brownhill practised as an engineer, arbitrator, and valuer, and was 61 years of age. It is noteworthy that he belonged to a family which has given three Mayors to the borough—the other two being Alderman W. Brownhill and Mr. T. P. Brownhill, both of whom are still members of the governing body. Being of great amiability of disposition, conciliatory, resourceful, and generous, deceased made many friends, who will deeply regret his removal from among them.

NOTES.

Some American Views on Wind Pressure.

In a paper presented to the American Society of Civil Engineers, Mr. Guy B. Waite reviewed the current practice of bracing the high buildings, now becoming fashionable in certain cities of the United States, to resist wind pressure. In the paper, the maximum distributed wind pressure for the highest buildings was taken at 30 lbs. per square foot, which is the lowest given by any known standard authority. The formula used for the reduction of wind pressure from velocity was recently derived from experiments made at Mount Washington, and is given in Johnson's "Theory of Framed Structures" as follows: Wind pressure, $P = 0{\cdot}004v^2$; where v = velocity in miles per hour. This formula gives smaller pressures for corresponding velocities than most of the older formulæ generally employed in such computations. In discussing the paper, Mr. Leverich spoke disparagingly of all existing methods of determining wind pressure; declaring that but little practical value attaches to Sir Benjamin Baker's Forth Bridge experiments in this regard, because they give discrepant and unreasonable results. Mr. Leverich went on to state that in these latitudes it has almost invariably been observed, when high winds have caused destruction to buildings, that the glass in the windows, the lighter vertical walls, and sometimes the roofs, have been first thrust outward—indicating that the moving forces were consequent upon a difference at the time in pressure between the air within and without the structure, the latter being much the smaller. This seems to show that the current assumption in regard to the action of high winds, that they produce a great inward pressure on structures, is erroneous. Such information regarding the whole subject as engineers possess is based upon records of wind velocities at times of notable disturbance, measured in a manner which did not register the effects of extreme waves or pulsations of movement. The effects of the partial vacuum produced on the leeward side of structures exposed to a high wind are also little known. In replying upon the discussion, Mr. Waite remarked that the statement often made, that window-glass would be ruptured by much lower wind pressures than are usually calculated upon, and hence that such pressures are chimerical, is mistaken. By actual computation, it can be shown that a pane of glass $\frac{3}{16}$ inch thick, and 36 inches wide, fixed at its two ends (as well-puttied window-glass is held), is able to withstand pressures in excess of anything ever assumed as acting against a structure.

The Oxy-Coal-Gas Blowpipe.

Mr. H. U. Warren observes, in the *Chemical Trade Journal*, that the difficulty of manipulating with hydrogen gas in conjunction with oxygen, when a high temperature blowpipe flame is desired, has long operated to induce experimenters to accept coal gas as a substitute for the hydrogen. This agent, although suitable for use in the lime-light, develops a temperature far inferior to that obtainable with pure hydrogen. During the past season, the author says he has had occasion several times to test the comparative efficiency of the two mixtures. Various refractory substances which melted readily under the action of the pure oxy-hydrogen blowpipe flame, were observed to obstinately resist liquefaction when subjected to the coal-gas and oxygen flame. Mr. Warren asserts that a blowpipe flame fed by a mixture of coal gas and oxygen, even when both gases are at the same pressure, is very weak in action; the most serious drawback being the difficulty of obtaining a uniform flame—first the outer part of the flame is hottest, then the inside of it. Mr. Warren suggests an electric water-decomposing arrangement for overcoming the difficulty of using pure hydrogen; but the observation respecting the uncertainty of the oxy-coal-gas flame, opens the question of the value of previous perfect admixture of the gases, as in the Denayrouze light.

The Preparation of Concrete.

An interesting question respecting the origin of some of the inequalities of strength observed in different specimens of cement concrete, is raised by Mr. T. Dunken Paret in the current number of the *Journal* of the Franklin Institute. The author remarks that nearly all formulæ for the preparation of concrete and articles referring to the subject produce a general effect of vagueness. In other words, while certain facts and figures are given which are definite and specific enough, there is a general vagueness in regard to that secret of quality which (the cement being assumed to be of uniform excellence) really lies in the proportioning of the filling to the volume of the interstitial cavities. The author observes that, if an absolute rule could be discovered by which proper proportions could in all cases be arrived at, such a rule ought to be of inestimable value, not only in relation to the preparation of concrete, but also in regard to the proportioning of very many mixtures. Certain facts leading to the establishment of such a rule appeared in a series of investigations concerning the manufacture of emery wheels, which had their origin in a curious discovery respecting the durability of such wheels. A number of wheels made in exactly the same way were found to differ greatly in wearing power; and as there was ample evidence that the difference was not in the quality of the emery, inquiry was instituted, with the result that it was found to relate to the amount of interstitial space. Carrying the analogy from the composition of an

emery wheel to that of concrete, Mr. Paret argues that, while the crushing strength of the latter is no doubt largely affected by the cleanness, roughness, and angularity of the freshly-crushed stone surfaces, and by the areas of the lime and silica which are in contact, it nevertheless must be largely affected by the amount of filling being properly proportioned to the interstitial space. He accordingly proposes that, when concrete is made in large quantity, a cubic foot box should be prepared, filled with the rough material, and the amount of interstitial space ascertained by filling it with water. The result would be a guide to the proper quantity of filling required to produce a homogeneous mass.

Mr. J. W. Helps and the Polytechnic Movement.—The Committee of Management of the Croydon Polytechnics have lately issued their annual report. It is a record of extraordinary success. At the central institution in Croydon, which was opened during 1892, the individual students numbered in that session 360; and in the following year there were 678. In 1893-4 there was a slight falling off, owing to the opening of branches at South Norwood and Thornton Heath; but this year the numerical strength of the institution has been brought up to 706, and the class entries to 996. Our contemporary *London* attributes this success to the interest taken in the work by the Committee of Management, the Chairman of which is Mr. J. W. Helps, Assoc.M.Inst.C.E. To him the Polytechnic is indebted for guidance on matters affecting the mechanical department; Mr. T. Cushing, M.Inst.C.E., advising on electrical subjects.

The Management of the Ryde Gas Company.—In the report presented at the annual meeting of the Ryde Gas Company last Thursday, the Directors referred with regret to the death of the Engineer and Secretary (Mr. G. Garnett, M.Inst.C.E.), and recorded their high appreciation of the efficient services rendered by him to the Company for a period of 36 years. Mr. Garnett's decease necessitating fresh arrangements, the Directors appointed temporarily, until June 30 last, Mr. A. E. Coombes as Secretary, and Mr. F. F. Farrand as Manager. These officers having worked most assiduously in the Company's service, the Directors subsequently decided to give Mr. Farrand the position of Engineer and Manager; and they recommended the shareholders to retain Mr. Coombes as Secretary. This was agreed to. As both departments have already shown careful and successful working under the supervision of these gentlemen, who have been with the Company close upon twenty years, the interests of the undertaking will, we are sure, be perfectly safe in their hands.

The Removal of Sulphur from Iron.—A method by which sulphur is removed from iron by the agency of barium ferrocyanide has been successfully employed by M. Vathaire. The ferrocyanide decomposes by heat into iron, carbon, and barium; and the last-named element combines with, and eliminates, the sulphur. The salt is obtained by mixing boiling concentrated solutions of potassium ferrocyanide and barium chloride. If the former is in excess, a double salt of potassium and barium ferrocyanide is obtained, which gives better results than the single salt. It is necessary that the salt should be freed from water of crystallization before being used, as the oxygen therein, on the sudden decomposition produced by contact with the molten iron, would combine with the potassium and barium, forming inactive oxides. The action must be effected with the exclusion of all air and oxidizing influences. Practically, the metal from the blast-furnace and the reagent might be revolved in a vessel lined with limestone, mixed with tar, and allowed to settle to separate the sulphurous slag. This process is applicable more especially to practically pure iron, when very little reagent is necessary. In the case of highly sulphurous metal, a preliminary reduction of the sulphur by one of the known methods is recommended.

The Platinum Unit of Light.—At a recent meeting of the Berlin Physical Society, Dr. F. Kurlbaum gave an account of his determination of the unit of light made in conjunction with Professor Lummer. The unit was based on the light emitted by white-hot platinum foil. Since the radiant energy varies with the temperature, it was necessary to keep the latter constant for a prolonged period, and to be able to re-establish it at any time. This result was arrived at bolometrically by measuring the ratio of the total radiant energy from the glowing foil to the radiation taking place across an absorbing medium. This ratio is dependent upon the temperature of the radiating body, and provides a trustworthy measure of its temperature. It was necessary to find some covering for the bolometer which should absorb all rays as uniformly as possible. After many experiments, a layer of platinum black was found most suitable for this purpose. The absorbing medium employed consisted of a thin layer of water in a quartz cell. The energy radiated from the heated foil passed through a diaphragm of known aperture, the temperature of which was the same as that of the bolometer. The errors in determining the unit of light amounted to 1 per cent., due chiefly to the air currents on the surface of the foil. The unit can now be established at any time in the Imperial Physico-Technical Institute of Berlin; but in order to facilitate its accurate establishment at any other place, experiments are being made to determine the temperature of the glowing foil from the ratio of the radiation over the range of the visible spectrum.

COMMUNICATED ARTICLE.

THE SEPARATION OF CARBON IN FLAMES.

By Harold B. Dixon, M.A., F.R.S.,
Professor of Chemistry in the Owens College, Manchester.

My article in the Journal of Jan. 29 last (p. 214), on the separation and burning of carbon in gas flames, led to a letter by Mr. W. Young on Feb. 12, and to another article by Mr. Thwaite on June 18. These communications require, I think, some answer, because my position appears to have been somewhat misunderstood.

My object in writing was to expose two fallacies which have long been current—

(1) That carbon is separated in a luminous gas-flame by reason of the *selective* combustion of the hydrogen combined with the carbon.

(2) That the glowing of the separated carbon is entirely due to the combustion of gases going on round it.

I took some pains to point out that Sir Humphry Davy had given the correct theory of the separation of the carbon—viz., that it was due to the decomposition *by heat* of the hydrocarbons in the centre of the flame. Faraday, on the other hand, said that the separation of the carbon was due to the hydrogen of the hydrocarbons burning first. I quoted the passages bearing on the question from both writers. Mr. Thwaite says that the theory enunciated by Faraday was that introduced by Sir H. Davy; and that I have now challenged this theory, which he calls the "Davy-Faradaic" theory. I fear from this that Mr. Thwaite has not followed me.

My readers must bear in mind that we are not discussing whether, in a luminous gas-flame, the hydrogen burns before the carbon with which it was combined in the original gas. We are discussing the reason why the hydrocarbon is so broken up in the flame as to yield the carbon in the separate and solid form. Davy said the hydrocarbon was broken up by heat into hydrogen and carbon; Faraday and his school said the hydrocarbon was broken up by the preferential combustion of the hydrogen, because the hydrogen had a stronger attraction for oxygen than the carbon had. Like many other chemists, I accepted Faraday's view that hydrogen at high temperatures had a stronger attraction than carbon for oxygen, until I found that various hydrocarbons, when fixed with a limited quantity of oxygen, did not yield free carbon and water, but always gave carbonic oxide and free hydrogen. It has been objected to this that the conditions of a gaseous mixture exploded in a closed vessel are not the same as those of a flame burning in the open air. I grant that the conditions are not identical; but the experiments show that, at very high temperatures, where the hydrogen and carbon have equal choice of oxygen, the hydrogen has not a stronger attraction than carbon for it, but that the exact contrary is true. Professor Smithells found the same result at lower temperatures in the partial combustion of hydrocarbons with air.

I think it is perfectly legitimate to argue from these results that, in a luminous flame, the hydrocarbon is not broken up by the selective or preferential combustion of the hydrogen. But whether this argument is "obviously untenable," as Mr. Thwaite says, or not, one result has followed our discussion. In his former article, Mr. Thwaite said that the hydrogen of the hydrocarbons burnt first, and that it was in consequence of this superior activity of the hydrogen that the unconsumed carbon was separated. Mr. Thwaite now says the hydrocarbons are broken down by the high temperature in the inner part of the flame. This is exactly the point I was contending for.

Let us compare these two passages from Mr. Thwaite's articles—

Jan. 8, 1895.

As the sequence of action of luminous combustion the following equation [is given]:—

Equation A.

Combustible.	Action.
$2\,H + C$.	1st. $(2\,H + O) = H_2O$
	2nd. Interval of incandescence of liberated carbon.
	3rd. $(C + 2\,O) = CO_2$

In the non-luminous combustion, the equation may be represented as follows:—

Equation B.

Combustible.	Action.
$2\,H + C$.	1st and only action $(2\,H + O) + (C + 2\,O) = H_2O + CO_2$.

June 18, 1895.

The author's experience . . . has satisfied him that the stability of nearly all the hydrocarbons is destroyed when brought under the influence of temperatures above 2000° Fahr. This thermic influence induces hydrocarbon decomposition.

The oxidation of the free hydrogen, as well as of part of the hydrogen of the decomposed hydrocarbons, establishes a zone of high temperature. In this zone the hydrocarbon structure, still undecomposed, collapses; and both the hydrogen and the carbon are set free.

The formula of complete thermolysis, applied to one of the simple hydrocarbons, may be thus expressed:

C_2H_6 + thermolytic influence = $2\,C + 6\,H$.

Now the expression $2\,H + C$ applied to the combustible in Equation A can only mean the undecomposed hydrocarbon. For the *first action* in "the sequence of action of luminous combustion" is said to be the splitting off of the hydrogen by its union with oxygen; and in Equation B the same expression is used for the combustible which all agree is not decomposed before it is burnt. I hope, therefore, I do no injustice to Mr. Thwaite when I say that these two passages express entirely

different views. The first is Faraday's; the second is Davy's. The latter I believe to be in the main correct.

Concerning the second fallacy, I regret our discussion has not brought about the same agreement. Mr. Thwaite imagines that the solid carbon particles shining in the flame are *single atoms*, and therefore cannot give light when once they are attacked by oxygen. It follows from this that Mr. Thwaite thinks that an atom or molecule of carbon is a "solid" capable of emitting and reflecting white light, but that a molecule of carbonic acid is a "gas" incapable of doing either. Now, Mr. Thwaite has referred to Soret's researches on the polarization of sunlight by luminous hydrocarbon flames. Will he take M. Soret's word for it that light is not polarized by atoms, but only by solid particles consisting of large aggregates of atoms? "Each particle of carbon," says M. Soret, "although very minute, is composed of a great number of molecules." *

Mr. Young's interesting letter published in the JOURNAL on Feb. 12, if I rightly understand it, maintains two propositions—

(1) In a luminous gas-flame, the hydrocarbons are decomposed by heat, and the hydrogen, thus severed, burns more quickly than the separated carbon.

(2) The carbon of a hydrocarbon, whether in a luminous flame or in an explosive mixture, does not combine directly with free oxygen, but is oxidized by the steam first formed.

Regarding the first proposition, my only quarrel with Mr. Young is that he supposes that I maintain the contrary opinion. To the best of my knowledge, I have never thought or said so. The whole point of my former article was to show that carbon was not separated in the flame by selective combustion of the hydrogen. I said nothing about what happened to the hydrogen or carbon *after* they were separated. When I spoke of the superior affinity of carbon over hydrogen for oxygen, the context shows that I was referring to high temperatures and to conditions under which both had equal chance of oxidation, as in the explosion of hydrocarbons with oxygen, and the passage of steam over a mass of highly-heated carbon. I never contended that, under *all* conditions, carbon would be burnt and hydrogen left. I did not suppose, for instance, that, if a lump of charcoal were placed in a mixture of hydrogen and oxygen, and the gases were fired by a spark, the carbon would be oxidized and the hydrogen escape combustion. In the same way, in a luminous gas-flame, when the hydrocarbons are decomposed in the interior of the flame, the liberated hydrogen, by its quicker movements, would, I have never doubted, be the first to reach the oxygen molecules coming from the outside. This is precisely the gist of M. Berthelot's letter published in the JOURNAL on the 5th of March. If you explode, he says, diazo-benzene nitrate, you find the carbon is oxidized, and the hydrogen is left unburnt. In this experiment, which is analogous to mine, the carbon and hydrogen are both raised to a high temperature, and have equal chances of securing the oxygen. There is a preferential combustion in favour of the carbon. So far, M. Berthelot and I are agreed. "On the other hand," he says, "there is the progressive incomplete combustion of the hydrocarbons, which furnishes acetylene and carbon, and at the same time water. If the carbon always burnt in preference to hydrogen in the hydrocarbons, there ought not to be produced either acetylene or free carbon." Here I part company with M. Berthelot, if the translation of his phrase is really accurate. It is *not* necessary for the hydrogen *in* the hydrocarbon to burn first. The hydrocarbon may be decomposed into acetylene and free hydrogen, or into carbon and free hydrogen, after which the free hydrogen burns, and the acetylene or carbon partly escapes combustion. In a smoky flame, this is what happens. The carbon, aggregated into solid masses, does not meet with oxygen sufficient to maintain its combustion until it has cooled below its ignition temperature in air.

The second proposition of Mr. Young is a far more debateable matter. He maintains his belief that oxygen cannot attack carbon except by first uniting with hydrogen, and that it is water, therefore, that always oxidizes carbon. The part played by steam in combustions has interested me greatly for the last twenty years—ever since I discovered that the explosion of carbonic oxide gas with oxygen was brought about by the interaction of steam. At one time I shared Mr. Young's belief; for at that period experiments seemed to show that pure carbon would not unite with dry oxygen, and that cyanogen (the gaseous compound of carbon and nitrogen) required steam to be present in order to make it explode with oxygen. Prolonged investigations, however, have not borne out these views. Pure carbon, though it does not burn vividly in dry oxygen, nevertheless unites with it at high temperatures to form carbonic oxide. Mixtures of pure cyanogen and oxygen, and mixtures of carbon bisulphide and oxygen, explode just as readily when they are thoroughly dried as when steam is present. In the case of carbonic oxide and oxygen, the addition of steam to the mixture up to 5 per cent. *increases* the rapidity of the explosion; in the case of cyanogen and oxygen, the addition of steam to the mixture *diminishes* the rapidity of explosion. We are driven, therefore, to the conclusion that carbon, whether uncombined or combined, is capable of direct union with oxygen to form carbonic oxide.

* Soret, *Phil Mag.*, 1875.

By analogy, we should expect that carbon combined with hydrogen was capable of direct union with oxygen also. If we try the experiment of exploding ethylene or acetylene with its own volume of oxygen, we find as the result that the carbon is burnt and the hydrogen liberated—

$$\underset{\text{Acetylene.}}{C_2H_2} + \underset{\text{Oxygen.}}{O_2} = \underset{\text{Carbonic oxide.}}{2CO} + \underset{\text{Hydrogen.}}{H_2}$$

The reaction being analogous, in its result, to the cyanogen explosion—

$$\underset{\text{Cyanogen.}}{C_2N_2} + \underset{\text{Oxygen.}}{O_2} = \underset{\text{Carbonic oxide.}}{2CO} + \underset{\text{Nitrogen.}}{N_2}$$

Mr. Young maintains that in the former case the hydrogen is really burnt to water first, and the water so produced is then decomposed by the carbon. But if the carbon in cyanogen can burn direct, why should it go a roundabout way in acetylene? Again, the rate of explosion of gases has been carefully studied by M. Berthelot and myself. In the case of carbonic oxide and oxygen, where we know the oxidation is an indirect one, the rate of explosion is far below the theoretical velocity—whether M. Berthelot's theory be taken as correct or my own. In the case of cyanogen, the rate of explosion agrees with the velocity of a sound-wave in the reacting gases; and we find not merely one coincidence, but that the agreement is maintained in a number of different mixtures. In the case of acetylene and oxygen, the agreement between the calculated and the found velocities is very close, which was to be expected if the carbon was oxidized directly, but is unexplained on the assumption that the hydrogen has first to be burnt.

I cannot follow the argument Mr. Young has drawn from the passage of steam over heated carbon. I understand him to say that because steam, passing over carbon at a moderate temperature, gives mainly carbonic acid, and at a higher temperature mainly carbonic oxide, for the product of oxidation of the carbon, therefore the relative affinity of carbon for oxygen increases with rising temperature, and therefore carbon is always oxidized by means of steam. I am not sure if I am right in supposing the argument to be this. It can be proved that carbon decomposes steam; and this action takes place with greater facility the higher the temperature. Therefore we may readily believe this action is the main one in flames and explosions.

It is true that carbon and carbonic oxide decompose steam at a high temperature. When steam is passed over red-hot carbon, or when carbonic oxide and hydrogen are exploded with a limited quantity of oxygen, or when carbonic acid and hydrogen are heated together, there is established an equilibrium among the *gaseous products* which can be expressed by the following equation:—

$$\frac{CO \times H_2O}{CO_2 \times H_2} = \alpha$$

The constant α varies with the conditions of the experiment. If an *excess of steam* is passed through heated carbon, the temperature falls; and, as the above equation shows, the quantity of carbonic acid is large and the quantity of carbonic oxide small. When the supply of steam is *limited*, the carbonic oxide is large, and the carbonic acid small. I cannot see how these facts affect the question whether the carbon of a hydrocarbon can combine directly with oxygen.

The Autumn Meeting of the Incorporated Institution of Gas Engineers.—We learn from the Secretary of the Institution (Mr. T. Cole), that the autumn meeting is to be held in Liverpool on the 26th and 27th prox.

Boring for Petroleum in Java.—According to advices from Java, boring for petroleum continues to give satisfactory results. In the districts around Sourabaya, the oil wells yield abundantly, and a brisk local trade in the product has sprung up. In Mid-Java also the same industry has been started with success. Pipe-lines have been laid from the wells to the tramway; and tank cars are there filled for despatch to Samarang, where oil warehouses are being built.

The Gaseous Products of Wood Charcoal.—The subject of the gaseous products evolved from wood charcoal when submitted to a high temperature out of contact with air has lately been dealt with in the *Comptes Rendus;* and the matter has been noticed in the Society of Chemical Industry's *Journal.* In an attempt to obtain carbon monoxide gas by passing carbon dioxide from a gasholder over red-hot charcoal, it was found that none of the dioxide could be driven through the charcoal owing to a back pressure due to gases developed from the latter. On the contrary, the disengaged gas, to the extent of 170 litres per kilogramme of charcoal, passed to the receiver prepared for the carbon monoxide. In a laboratory experiment, the volume of gas amounted to 250 litres per kilogramme. That prepared on the large scale contained $CO_2 = 9{\cdot}14$; $CO = 18{\cdot}08$; $H = 49{\cdot}11$; $CH_4 = 16{\cdot}04$; $O = 0{\cdot}26$; and $N = 7{\cdot}37$ per cent. Its antiseptic properties were superior to those of carbon monoxide. The gas is probably due, for the most part, to the destructive distillation of solid, or condensed liquid, organic substances contained in the charcoal. Its formation shows that the equation $C + CO_2 = 2CO$ does not adequately express the result of the interaction aimed at; and it also shows that the carbon monoxide in the gases from burning charcoal is not due to incomplete combustion alone.

TECHNICAL RECORD.

NORTH OF IRELAND ASSOCIATION OF GAS MANAGERS.

Annual Meeting at Drogheda.

The Annual Meeting of the North of Ireland Association of Gas Managers was held in the Mayoralty Rooms, Drogheda, on Tuesday of last week. There was a larger attendance of members than at any previous meeting of the Association. The proceedings began shortly after half-past eleven o'clock. Mr. P. J. Salmon, of Galway, the President for the year, occupied the chair.

THE REPORT OF THE COMMITTEE.

The Hon. Secretary (Mr. James Whimster, of Armagh) read the following report by the Committee:—

The Committee, in presenting their annual report, feel gratified that they have been able to secure such an interesting and attractive programme for this year's meeting.

Last year's meeting in Armagh was a most successful one—the subjects being so thoroughly practical; and special interest seemed to attach to the informal discussion on purification. Although there was no room this year for such an item on the programme (sufficient papers being provided to profitably occupy the whole time available), these papers are of such a nature that there should be every inducement for such a full and free interchange of opinion and experience as will prove of great value to all present, and must accentuate the usefulness of such meetings.

The Committee would call special attention to the lecture by Professor Macadam, on a subject with which he is thoroughly conversant, which is of intense interest to all of us, and which in his hands (and illustrated by experiments and lime-light views) cannot fail to make it the centre of interest in the programme.

The financial statement and Auditor's report show that the Association has at its credit the sum of £23 3s. 10d.

According to Rules 25 and 26, three members of Committee retire, and are ineligible for re-election. The retiring members are Messrs. Hands, Love, and Tully.

On the motion of Mr. C. B. Tully (Sligo), seconded by Mr. T. M. Walsh (Tuam), the report was adopted.

NEW MEMBERS.

The following new members were admitted:—

Ordinary Members: Thomas J. Reid, Gas-Works, Ballina; W. A. Reid, Gas-Works, Longford; J. Shine, Gas-Works, Bandon; Patrick Egan, Gas-Works, Tralee; John O'Grady, Gas-Works, Castlebar; Geo. Kelly, Gas-Works, Kilrush.

Extraordinary Members.—W. Harding, Secretary, Gas Company, Ennis; Laurence Donegan, Secretary, Gas Company, Drogheda; Daniel Jones, Dublin; C. F. Crabtree, Dublin.

ELECTION OF OFFICE-BEARERS.

The following gentlemen were nominated by the Committee as office-bearers for the ensuing year:—

President.—Mr. T. Frizelle, Holywood.

Vice-President.—Mr. G. R. Love, Dundalk.

New Members of Committee.—Messrs. W. Walker, Hillsborough; J. Dewar, Newtownards; and W. Nisbet, Monaghan.

Mr. D. Williamson (Clones) proposed the election of the gentlemen whose names had been read by the Secretary.

Mr. M. Martin (Drogheda) seconded the motion.

Mr. Walsh proposed, as an amendment, that the name of a southern gas manager should be substituted for one of those proposed. He thought the Committee might take into consideration that there were now a good number of southern members in the Association.

The President said that the reading out of the names did not prevent the members present from nominating others.

The Hon. Secretary explained that the matter was talked over in Committee; but the difficulty cropped up that there were very few members from the South. Several had just been added to the roll; but perhaps Mr. Walsh himself was the only one they had before.

Mr. Walsh thereupon nominated Mr. T. T. Llewellyn, of Newbridge.

The Secretary stated that the three gentlemen who remained on the Committee represented Drogheda, Ballybay, and Mullingar, the latter two of which places they could scarcely call North.

Mr. A. Mackenzie (Edinburgh) thought the Association should have regard to their funds. They had not too much money in hand, and they should get members of Committee in a central position, because they could attend the meetings of the Committee very much better. He thought it would be advisable if they could appoint the Committee unanimously.

Mr. Walsh said he made the proposal with a motive. He had been speaking to a good many managers in the southern district; and they said they could not see their way to join the Association on account of its being a northern one.

The President said that a year or two ago circulars were sent out by Mr. Whimster, inviting managers to join; and he believed that he and Mr. Tully were the only members who came forward in consequence of this action. He thought it would scarcely be fair to ask all those gentlemen from the North to go so far as Galway, for instance, when there were only two members in that district.

Mr. Walsh thereupon withdrew his proposal; and the nominations as made by the Committee were approved of.

Mr. Frizelle thanked the members for electing him President. He considered it a very high honour; and he would do his best, in the office, for the interests of the Association.

Mr. G. R. Love (Dundalk) proposed that Mr. Whimster be re-elected Honorary Secretary. He was sure Mr. Whimster was the right man in the right place.

Mr. Walsh seconded the motion; and it was agreed to.

Mr. Williamson proposed that Mr. E. Stears, of Lisburn, be re-elected Auditor.

Mr. Frizelle seconded the motion; and it also was agreed to.

PLACE OF NEXT MEETING.

Mr. Frizelle invited the Association to meet at Holywood next year, when, he said, they would try to make them as comfortable as possible.

Mr. Walsh proposed that Athlone be the place of meeting.

The President: I do not think we have any member at Athlone.

Mr. Walsh did not think they should take that into consideration. If they met at Athlone, they might possibly get the gas manager there to join the Association.

The President said the matter was entirely in the hands of the members.

Mr. Williamson seconded the motion that the Association meet at Holywood, for the simple reason that since the Association was established he did not think it had met in any place in County Down.

Mr. Tully seconded Mr. Walsh's proposal.

A show of hands was taken, when, by a large majority, it was agreed to meet at Holywood.

THE PRESIDENT'S ADDRESS.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—My first duty to-day is to welcome you to this old and historic town of Drogheda; and I need not say how pleased I am to see so many here at our eighth annual meeting. My next duty reveals a failure to find words adequate to convey to you my feelings for the honour you have conferred on me of President of the Association—composed as it is of practical men, far more so than I am myself. All I can say is that I am proud of the honour, and thank you for it.

There is considerable difficulty in choosing a subject for what is known as a President's Address. We find ourselves likely to go over beaten ground, quoting the words of others, and seeming ridiculous afterwards. I shall therefore keep as clear of that as possible, by giving you a little of my own experience on the following subjects.

After leaving the meeting last year, where there was a very interesting discussion on lime for purifiers, it occurred to me to go into the matter, and see what I had been doing. This is the system we practise in Galway: I take my lime, which arrives in ten-barrel lots (the lime-barrel measures 24 in. by 24 in. by 18 in., and the contents weigh, when well burned, 165 lbs.), spread it out, and give it about 425 gallons of water. During the application of the water, the lime is turned over several times with a long-handled shovel. The ten barrels, when prepared, will measure from 20 to 25 barrels as it is put into the purifier. I use the lime with more water added than is generally done by the members of our Association. When prepared, the lime has a rough or very coarse appearance; and on removal it requires to be hacked out with pickaxes, it having at this stage the appearance of dark honey-comb. The gas has free passage from start to finish, never giving back pressure. Our lime costs 1s. 4d. per barrel, and will clean about 35,000 cubic feet of gas per barrel of unslacked lime. Our purifiers are eight feet square, with 8-inch connections, and three tiers of grids. The gas enters on the side, about 8 inches from the bottom.

Our 65-feet shaft having become very shaky—the bricks falling from time to time—it was necessary to take some action to prevent an accident. This precaution took the form of erecting a small or dwarf chimney for each bed, as had been adopted elsewhere. This, however, I considered not as good a plan as one chimney for two beds; and I resolved to try one for a season, before erecting the others. Now, having tested the first, and being fully satisfied with the result, we have erected other two—that is, one chimney to two beds of sevens. These chimneys are carried up on a level with the louvre; and during last winter there was a most satisfactory heat with the damper open 3 in. by 12 in. The lower portion of the chimneys is built with fire-bricks laid in fire-clay; and the upper portion is fire-brick inside and Bridgewater outside, with 2½-inch tile on top. Each of these chimneys has a damper for each bed, which controls the draught. The retorts are 8 ft. 4 in. by 21 in. by 18 in. ovals, except the bottom ones, which are round. After adopting the small chimneys, I did my season's work with two beds; and I got a yield of gas of over 10,000 cubic feet per ton, with retorts on their third season's work. My average for three months this year is 10,500 cubic feet per ton. Amongst other advantages derived from small chimneys, is that they can always be got at for repairs, and will show any waste from the retorts at once.

On making preparations for extensions at our works, it was necessary to cut out an old gasholder. Every precaution had been taken—the inlet and outlet pipes were filled with water; and the holder was down. It, however, contained about 4000

cubic feet of gas, owing to the tank being bad; and it was intended that this gas should escape by means of a vent-cock on the crown of the holder, by the manhole when the lid was removed, and by the holes for the bolts binding on the sole plates of the carriages. This, however, was not to be. During my temporary absence from the works, one of the men started to cut round the crown-plate, and another started at the manhole. Just as the manhole-plate was all slack, and the man at the crown-plate had cut about 15 in. by ½ in., a spark fired the gas. The men, having been cautioned, on seeing what had happened, reported the matter to me; and I, on arrival, found the crown of the holder on fire.

The flame being about 5 feet high, I ordered the manhole-plate to be put on; and calling for some wet sacks, applied them just as the flame was about an inch high and on the rise. The flame was burning fitfully—varying in height from one inch to five feet—as it burns when there is water in the pipe. On inspecting the sheet afterwards, I found it to be red hot. Now, what kept the holder from blowing up? I have always understood that a holder was comparatively safe until it had rested on the bottom, or until it ceased to give pressure; but that then, if fired, it would explode. There is one thing certain—gas will ignite by means of a spark from a chisel, pickaxe, or shovel. The plan usually adopted is to keep a little oil at hand, into which the workman's chisel is dipped from time to time. By this means, the spark is extinguished; and the only indication of it will be a hissing sound accompanied by a stream of smoke. Still, the question forces itself upon us—Why was there no explosion? I should have thought the conditions necessary for an explosion existed here; the pipes having been filled with water and the pulley carriages removed three or four days previously. But what I am thankful to say is that, although the gas was fired, there was no explosion. I can only account for it on the supposition that the holder was still more or less under pressure, which was perhaps slightly increased when a few men got on top of it. Then the heating of the plates would expand the gas, and thus maintain the pressure till I got it smothered.

On all flange joints on hydraulic main and stand pipes, I use mill-board painted, the flanges also being painted; and on all socket joints, as well as mouthpieces, I employ fire-clay and borings wetted with ammoniacal liquor. For all outside joints on mains under or over ground, I use Portland cement. Joints made in this way six years ago, are as good and tight to-day as could be desired. I have several connections made with Portland cement on street-mains for the past three or four years, which are also perfectly tight. I also use cement in the cavity of the driving main instead of lead.

I have several incandescent gas lights in use; and I must say they give the greatest satisfaction—at least, to the consumer, if not to the Gas Company, as they have reduced their bills considerably. Some of them have been in operation over twelve months, and there is no defect in the light; the mantle being in perfect order. As to breakages, the system of packing prevents this now. It seems to me that the Incandescent Gas-Light Company have left no cause for complaint on their part. As to street lighting, I have been trying some experiments; and will give the result at some future time. The trial tests were good, and much admired over the present system; but the heavy cartage over the service (in that particular district) was against the life of the mantle. I may here mention that we supply the consumers with Bray's burners free of charge, and that there is no meter-rental.

Now, as a "pound saved is a pound gained," let me take this opportunity of saying that, by attending such meetings as these, and joining in the discussions on important subjects, we may be prevented from rushing headlong into profitless expenditure; as by the simple precaution of taking advice from practical men who have had experience on those particular points, all this can be saved. This is not a time for reckless expenditure, but rather for practical improvements. There are none of us but like to experiment—in fact, it is part of our duty; but at the same time, it should be done with due consideration to the state of our exchequer. My experience of our members is, that they do not rush into every new thing that may be introduced; they prefer to take care to have the experience of older heads, or the practical results of those whose financial position enables them to give their brethren reliable advice as to its being wise for them to introduce it in their respective works. I should therefore recommend any requiring information to make use of these meetings for this purpose; and there is not a member but will be most anxious to give it.

Permit me to give just one illustration of those who think they know all themselves. Iron retorts were in use in a particular small works; and the manager, to improve things, was determined to substitute clay ones. The clay retorts arrived in due time, with loose ends. Now, as there were six inches left for expansion at the back end of the iron retorts, the allwise left the same space at the back of the clay ones. The ends were built in; and all looked well from the front of the bed. The stoker, having given the usual time, struck the lid and inserted the rake; but judge of his surprise when, shoving his rake to draw from the back end, he sent it through the retort—the loose end being driven back into the space so conveniently left for it, there to remain until it got cool before removal. The maker of these retorts was not well up in their manufacture according to that manager. Certainly either retort-maker or manager was not up to date—which I leave you to judge.

Just in such little matters will be found a great advantage to be derived from our Association. I know works where hundreds of pounds have been spent in improvements without any apparent benefit being derived from them. Had those parties realized the great advantage of our Association, they would not have made those stupid mistakes. Committees of gas undertakings might also consider that it would be money well spent to pay the expenses of their manager, so that he might be enrolled as a member and attend our meetings. They might rest assured there would be less outlay on experiments, and more on lasting and paying improvements.

As the majority of us are in charge of small works, it is important that every shilling should be well spent; and, as most of you here are practical men, doing your own work, you are the very men that possess the information we so much need. I feel that there is nothing grander than to know that you are both ready and willing to impart to us that knowledge that has taken you years to acquire, if we only ask for it. Members have themselves to blame, therefore, if they do not attend and receive the assistance we are all so willing to give and take.

I cannot close these few remarks without saying how much our Association is indebted to our worthy and painstaking Secretary, and how much he has done from time to time to make our meetings successful. How much pleasanter we could make it for him by volunteering papers early for next year, and not keeping him in doubt as to having material for debate until within a few weeks of the meeting. It is to be hoped that you will see the force of these remarks, and contribute something in due time, so that our meeting may be a most successful one under the presidency of Mr. Frizelle.

Mr. Tully proposed a vote of thanks to the President for his able address. He must say he thought the President dealt with the gasholder which was on fire in a very courageous manner; and he certainly would not have liked to have been in the same position. He thought the men on the top were in a very awkward position.

Mr. C. B. Outon (Dublin) seconded the vote. The remarks, he said, of their President had been very practical. Two or three of them struck him; and he thought he might mention them. One was in reference to the number of chimney stacks he recommended. He himself was making some slight alterations on his works; and he should certainly bear the subject in mind. It appeared to him that the employment of one large chimney—generally very much taller and out of proportion to the work which had to be performed—was much to be deprecated. The use of two or three chimneys—possibly one to every two or three benches—was much more to be desired; because, with a large chimney, the products of combustion of the bench that was farthest from the stack were checked by the products from the bench nearest to the stack, with the result that some variation was required in the position of the dampers. The employment of a greater number of chimneys also ensured greater uniformity in the adjustment of the dampers. He thought that Mr. Salmon was to be congratulated on the fact that the unfortunate accident to his gasholder occurred so soon after chipping commenced. If it had taken place somewhat later, it appeared to him that the gas and air would have had more time to diffuse, and possibly Mr. Salmon would not have been there that day to have delivered his address. He (Mr. Outon) was quite in accord with the President's remarks as to the utility of the Association. As a very young member, he could testify to the important fact that he had himself obtained most useful hints from attendance at the meetings; and he agreed that the membership should be enlarged as far as possible. He hoped that during the ensuing year they would have a great increase in the number of their members.

The motion having been heartily accorded,

The President said he was very gratified by the vote; but he might state that the things he referred to were really matters he had gone into. He found the greatest satisfaction from the small chimneys. He did not say that they would be adaptable in all cases. Perhaps where gas-works were very near houses, they would not be allowed. He might say that he was able to turn out 17 million cubic feet of gas a year by small chimneys in preference to large. With regard to the gasholder taking fire, he believed there was something they did not seem to have got right hold of yet, in the matter of explosions. He could not understand it himself. He was there; and he felt a little bit shaky, in putting on the bags he had referred to. He could not understand yet why the holder did not blow up. At one time he thought that the removal of the plate allowed air to get in lower down, and forced the gas to the crown. However, they could turn the matter over in their minds; and he would like to hear from some of the members at another time why the holder did not explode. He was pleased to say it did not.

Mr. W. A. Reid (Longford) said that, some eight years ago, he was getting a new holder put in; and while the men were cutting out the crown, a spark fired the gas, and he was just in the same "boat" as the President. He, however, got a steam-pipe from his boiler, and played into it; and by this means, he put the fire out. The men, however, were so frightened that they all left him.

The PRESIDENT said he could not understand it yet. If there was a pressure by the men standing on the holder, that might account for it; but he did not think that their weight would materially increase the pressure.

Mr. OUTON suggested that an increase of pressure might be accounted for by the increase of temperature.

THE LUNCHEON.

The meeting was then adjourned for a short time; and the members were entertained by the Drogheda Gas Company to luncheon in the White Horse Hotel. Mr. Salmon occupied the chair, and was supported on the right hand by the Mayor of Drogheda—Mr. Bernard Nulty.

The PRESIDENT proposed the thanks of the Association to the Directors of the Gas Company for their kindness to them, and the HON. SECRETARY seconded the motion.

Mr. P. M'QUILLAN, one of the Directors of the Company, in acknowledging the vote, said that when they heard from their respected Manager, Mr. Martin, that the Association intended to hold their annual meeting in Drogheda, there was only one wish among them, and that was that the visit of the members would be a pleasant and enjoyable one.

The MAYOR thanked the Directors for the honour which had been done him in asking him to be present. The local Gas Company, he knew, was ably and efficiently managed by the Directors, and he knew also that they had a most competent Manager in Mr. Martin. Complaints were sometimes made regarding the Company; but during the two years he had held an official position in the town, he knew that, whenever complaints were made, they were always attended to.

THE NAME OF THE ASSOCIATION.

Mr. WALSH (on reassembling) asked if he would be in order to move—"That the Standing Orders be suspended," so that he might move a resolution.

Mr. WILLIAMSON said they had no Standing Orders. They had rules to guide them; and he hoped they would abide by them.

The HON. SECRETARY asked Mr. Walsh to at once propose his resolution.

Mr. WALSH thereupon proposed that the title "North of Ireland Association of Gas Managers" be changed to "The Irish Association of Gas Managers."

Mr. WILLIAMSON proposed that they proceed with the next business. Perhaps Mr. Walsh was not aware that a few years ago a good deal of trouble and expense was incurred in sending a circular round, he thought, all Ireland, for the purpose of getting an assembly of gas managers at the next meeting, to see if they had any resolution to propose to change it; and he understood that the result was that one would have joined and two would have left, if the Association had been changed at the time. Some of those addressed did not think it even worth their while to reply to the circular. Surely, then, it would hardly be fair, after all this trouble had been taken, that the name of the Association should be changed so suddenly. Of course, personally, he had no objection, if the matter were done constitutionally.

The PRESIDENT said he could bear out Mr. Williamson to the letter. He believed that only two managers in his direction answered the circular, although it was, he believed, issued to every gas manager in Ireland.

Mr. WALSH said he did not get one.

The HON. SECRETARY said he sent the circular to all the managers whose names he could find in any directory. There was a section in their rules which said: "Any proposition for adding to or altering the regulations, shall be laid before the Committee, who may bring it before the Association if they think fit; being bound to do so should it be accompanied by a requisition from any five members of the Association." So that, he thought, the constitutional way for Mr. Walsh to proceed was to get up a requisition, signed by five members, and send it to him (the Secretary), and it would be laid before the Committee, and would come before the members at the next annual meeting.

Mr. WALSH hoped they would excuse him for bringing the subject forward.

The PRESIDENT said it was only what every member should do—to express his opinion.

Mr. WALSH hoped that no objection would be taken to what he had said.

The PRESIDENT: Oh, certainly not; in 1886 I raised the same question myself.

The subject then dropped.

A PAPER WITHDRAWN.

The HON. SECRETARY said that Mr. Stears had seen fit to withdraw his paper, entitled "Experience of Four Months' Working with Hislop's Regenerative Furnaces at the Lisburn Gas-Works;" which was the first paper on their list. Mr. Stears wrote: "With four months' experience with Hislop's retorts, it seemed premature to go into their working until I had some alterations made on the main flue of our chimney, which is some distance from our retort-house. This I shall not be able to do until later in the autumn." For this reason, he asked to be allowed to withdraw his paper.

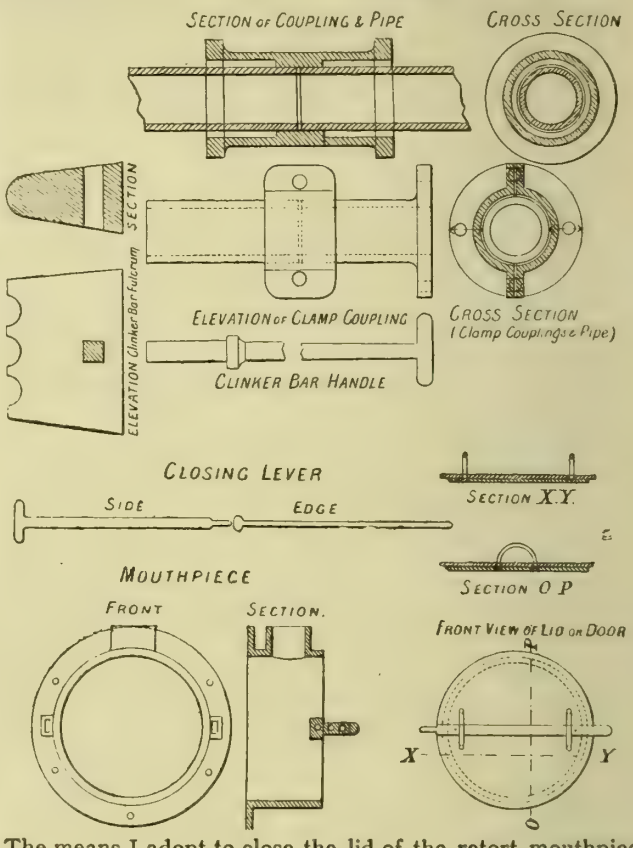
READING OF PAPERS.

Mr. M. MARTIN (Drogheda) read the following paper on

SUCCESSFUL METHODS OF DOING ORDINARY WORK IN GAS-WORKS.

I have been requested to prepare a paper for this meeting; and the title I have selected is the above. It is my intention to make it as brief as possible.

The first part of the paper will be in connection with the furnace—in order to assist the stokers in removing the clinker from the sides and back of the furnace, with the ordinary clinker-bar. I thought a good many years ago that fulcrums of different heights, with a long handle attached to them for the clinker-bar to rest on, would assist and expedite the work; so I adopted them, and, of course, found them to be a great improvement on the old system. This is a small model of both bar and fulcrum. The furnace is 10 inches wide at the bottom, and increases in width as it goes up to support the arches, which, where they spring, are 20 inches wide. The length of the bars is 3 ft. 6 in.; and two of them are in each furnace. The weight of each bar is about 90 lbs.; and they stand fully eighteen months, with a perfectly white heat all the time. This [exhibiting a model] is a perfect model of the oven and settings. I have made 120,000 cubic feet of gas in 24 hours with four of these ovens, five in each setting.



The means I adopt to close the lid of the retort mouthpiece consists of a double lever. The door is made to act as the first lever; and the second one is the principal one for effectually closing the door. The sockets are cast on each side of the mouthpiece. Into each of these are inserted short pieces of angle iron; and in the left-hand one, is a ¾-inch hole, about an inch from the face of the mouthpiece. On the door on the same side is riveted a flat strip of iron, the end of which projects, and is rounded to fit in the above hole; and this acts as a fulcrum for the door as the first lever. Then, again, the right-hand one has a hole in it, in a similar position to the other. This hole acts as a fulcrum for the main lever; and it extends right across the door, and nearly 12 inches over it. In the flat of the left-hand angle piece, are several ⅜-inch holes, in zig-zag form; the lever being kept in position by dropping a round tapered pin into these holes. Road scrapings are used for the luting of the door. These are delivered almost free in the works, and are almost entirely composed of pulverized limestone.

My means for jointing the ascension-pipes, &c., does away with flange and faucets; and the joint can be made in a quarter the time required for the others. It consists of a pair of clamps to each joint, held in their place by two ⅝-inch bolts, when properly fitted to the outside of the pipe. The jointing material may consist of any suitable substances—such as white and red lead, mixed as a putty, and, of course, fixed on the inside of the clamps, and screwed up firmly with the two bolts, when the joint is finished. Great advantage is gained in taking the pipes down for renewal. Remove the two bolts, and all comes away in a very short time, compared with the old jointing system.

In conclusion, I would refer to a new cast-iron coupling for street mains, &c. It forms a double faucet on each end of the coupling; and is made the same diameter and depth as the faucet of the pipe it is intended for. Midway in the interior, is cast a rib, about two inches broad; and the diameter

of this rib is made so as to pass freely over the outside of the pipes when placed in position. This rib is equally divided over the ends of each pipe, and keeps them in proper position. The rope yarn or packing cannot get over the ends of the pipes. This, I think, is an improvement on the old plain style of coupling.

Discussion.

The PRESIDENT said they were certainly much indebted to Mr. Martin for his very instructive paper. Though the models looked simple, they were very ingenious. If bridge-pipes or stand-pipes became stopped, a man had to stand on the top, and bear all the fumes that came out. He was himself about to make an application of something similar to Mr. Martin's; but that gentleman had a better idea. His own notion was to have an opening about 3 feet from the mouthpiece, and to have a self-sealing door upon it. So it was apparent that Mr. Martin and he had had some trouble with stopped pipes. Then, in the sleeve or collar which Mr. Martin used, it was impossible for the yarn to get into the main. He thought it was a very good way of making sleeves on mains.

Mr. T. T. LLEWELLYN (Newbridge) said he should like to ask one question with reference to ascension-pipes. Sometimes they had a difficulty in making a joint gas-tight in an ascension-pipe, owing to the expansion of the pipes with the variation of the heat; and he wished to ask if Mr. Martin found white and red lead sufficient to make a joint securely.

Mr. W. MILLER (Cookstown) asked, with reference to the same appliance, if Mr. Martin did not at times find the need of putting something like a leather in at the lugs. He needed a stopper at the corner where the two united; and he found it was of immense advantage to put in something to grip both sides while they pushed in, so as to make the opening circular all round. As to the help to clinkering, he thought the idea very good indeed, as they occasionally found that the men did injury in their endeavour to get the clinker outside the furnace.

Mr. T. FRIZELLE (Holywood) asked if Mr. Martin's furnace-bars were of cast or malleable iron.

Mr. MARTIN: Cast iron.

Mr. FRIZELLE inquired if he found them to be as good as malleable iron. He had found, in using cast-iron bars, that the heads broke off with the leverage of the clinker-bar. But perhaps his bars were not so heavy as Mr. Martin's. He had taken to 2-inch square malleable iron bars, which went right through to the bed-plate; and he found them a great improvement, for the reason that they could be shook up and the clinker picked off, especially if they were working with a coal yielding a lot of clinker, which required much picking off.

Mr. MILLER took it for granted that, whether the bars were of cast or malleable iron, they nearly all came through to the bed-plate.

Mr. C. B. OUTON (Dublin) considered the members were much indebted to Mr. Martin for his paper, as he had given them a few very good hints. It appeared to him (Mr. Outon) that the chief use of the bearing-bar, besides constituting the fulcrum, was to distribute the pressure over the two bars in use; and for this reason there was less liability of the bars bending when malleable iron was used. He did not quite fancy the position of the joint mentioned by Mr. Martin. It occurred to him that in the case of idle retorts, with the mouthpieces removed, and the retorts about to be renewed, the ascension-pipes, if left in position, would cause an undue strain on the dip-pipes—all the weight being on the one side. He thought the collar or sleeve was a wonderful improvement. It was what they should all adopt as soon as possible. The two pieces, when joined, came exactly together; and it occurred to him that on no account could the yarn get inside the pipe. He was very pleased with it; and he should try to adopt it as soon as possible.

Mr. G. R. LOVE (Dundalk) asked if it added much to the cost of the sleeve to have the part put into the interior of it. As they were all aware, they had these sleeves to buy, of standard sizes, from ordinary makers; and the question he should like to put was what the extra cost of the inside piece would be. Another very important item was that great care would have to be taken in putting on the sleeve. It was just possible that it might be put on too far either way; or in cutting the pipe they might fracture it, so that this might add to the cost. It was possible, again, that in putting in the yarn it might be all driven on the one side. These were things they could not get workmen to do aright, unless they looked after them. With reference to the joint on the ascension-pipe, he did not know that it would be decidedly to their advantage to adopt it, because, owing to the exhauster stopping, or anything of that kind, they might have considerable difficulty with the joint leaking. As to doing away with the faucit, he found it better to have a large faucit, to allow for the expansion and contraction of the bench. They were, he thought, much indebted to Mr. Martin for his paper. He had stated his own personal observations from a very practical standpoint, and had set them a good example in giving them his paper.

Mr. MILLER said he should like to ask Mr. Martin if he did not mean his arrangement also to apply to a split collar. They sometimes found there was just a hair-line which allowed the gas to escape; and it was possible to put on a collar to stop it. It would be a good idea to have the thing in two halves; he thought it would work very well.

Mr. WHIMSTER said he should like to add a word or two before Mr. Martin replied. He must say he was highly pleased with the paper, and thought it was just such papers as these that they wanted at Gas Association meetings. It had been a short paper; but, with the models and the drawings, he believed it would be a very valuable one to working managers—to those who had to look after these things themselves, and who had not foremen or sub-managers to do it for them. The various things Mr. Martin had brought forward were particularly useful. It struck him (Mr. Whimster) that the clinker-bar fulcrum was an excellent thing. He had often noticed, when his men were cleaning the furnaces, how awkward a job it was to remove the clinker from the back on to the bed-plate. An appliance like the one before them removed the difficulty at once. It enabled the work to be done quite easily; and the pressure was put upon both of the bars, and not on one place. It was an appliance they could all adopt quite easily. As to the question Mr. Frizelle had put regarding cast and wrought iron bars, he might say that he had thrown out the cast-iron, and gone in for the wrought-iron bars. The difficulty with cast iron was that they always had to leave a certain space for expansion, and this space became filled up with dust, or clinker, or something of the kind; and the result was that the front was pushed out. With the wrought-iron bar, he had no trouble. It came out below the bed-plate, and it could expand or contract as much as it liked; it gave nobody any trouble. He thought the arrangement for fixing on the retort-lid without luting was a very good one. It looked rather complicated; but it really was very simple. He was glad Mr. Martin had brought it before them; it showed his ingenuity in doing things for himself. He thought there must be a very good and tight mouthpiece with such a joint. With reference to the jointing of the ascension-pipes, it struck him as being a very useful and a very simple arrangement—not that he would use it in the way Mr. Martin did. He would not think of putting a simple spigot-end on the mouthpiece, but would stick to the socket on the mouthpiece, which would permit them to make allowance for variations in the length of the setting. Sometimes there was a question of cutting a whole pipe to get a faucit-end to go in. This appliance would just do for such a case. Some members had questioned whether the sleeve joint was sufficient. He could testify that it was, because he had used that very joint for covering blow-holes in pipes, and there was no difficulty with it whatever. Two pieces like that on an ascension-pipe would be quite sufficient. With reference to the thimble, he thought it was a splendid thing; but he saw another advantage in it, which had not been mentioned. Not only was it a preventive of the yarn getting into the pipe, but it kept the sleeve perfectly fair on the pipe; and there was an equal joint all round, without having to begin sticking in chisels and the like to get the pipes true before they ran in the lead. So far as the cost was concerned, he did not think it could come to very much; but even if it did, he thought they could afford it, because of the comfort it would be. He was much indebted to Mr. Martin for his paper.

Mr. R. ROSS (Dungannon) said the lever was certainly a very good thing; but how would they do when the men pulled out the bars altogether, and laid them on the floor? There were different ways of clinkering. Some left the bars in, and others took them out; and they would find, in many large works, that the bars were pulled out entirely.

The PRESIDENT said he agreed with Mr. Ross. They generally pulled out the bars to remove the clinker from them; and when they were removed, the men could get on much better. He had only one doubt with regard to the joint; that was as to the material of which it was made. He had tried red and white lead, and when heat was applied to them he found that they "walked away;" and then there was an outcry about the tar, or something else, running down. But there was a material employed for covering boilers which, he thought, might be used. However, Mr. Martin, after he had practised with his joint, would be able to tell them about it. With reference to split collars, he had many of them; and the difficulty was to make the joint right where the split was. He therefore considered it better to make them in one piece.

Mr. MILLER thought he was perhaps the "father," in that meeting, of the idea of split collars, and he found no difficulty in joining the two halves on the main, and making the perfectly tight joint.

Mr. MARTIN, in closing the discussion, said there were two bars in his furnaces; and his appliance was slipped in on the top of the bars, which were never removed at all. They were cast-iron bars, of considerable weight; and they stood for about eighteen months. With regard to ashes getting down at the ends of the bars, there was about an inch space left for expansion and contraction; and if they gave the thing a shake, the whole of the matter which gathered there fell down, and caused no one any trouble. With respect to joints of red or white lead, he might say he had had them in operation for the last two years on the ascension-pipes, and they had never given way. It was a very light joint—not a 20 lb. or 30 lb. one; and they were more easily taken down than when there was a faucit. With the sleeve joint, the interior sleeve was made so that it slid in; and they could make a chalk mark to keep it in position.

Mr. LOVE: Do I understand that you keep patterns of every size of your collars?

Mr. MARTIN: Yes.

Mr. C. B. Tully (Sligo) read the following paper:

THE ADVANTAGES OF A PROVISIONAL ORDER FOR GAS COMPANIES.

Notwithstanding the growth and spread of electricity as applied to illuminating purposes, its relative cheapness as compared with former rates, its facility of distribution, and its general utility, gas still continues to be the usual and popular means of light production, and to be utilized more extensively for cooking, heating, and motive power. Recent electrical discoveries have not appreciably affected the continued increase in the consumption of gas in these countries; nor have recent electrical discoveries to any extent lessened the profits of gas undertakings when properly controlled and managed. It is now an admitted fact that, even if electricity does further encroach upon the domain of gas for lighting, gas will more than hold its own in the competition, by the certain increase of its use for cooking, and the slot meter.

From the last returns presented to Parliament, the extent of the growth and the importance of gas undertakings are apparent. No less than £68,000,000 is now invested in them; and every year sees a further addition to this enormous capital. There are, according to this same source of information, 428 gas companies possessing authority to carry on the work; and these have a capital of £44,036,225. They have a total length of 14,345 miles of mains. There are 192 local authorities in the United Kingdom who have procured statutory powers for supplying their several districts themselves; and they have a capital of £23,619,082, and a total length of 8481 miles of mains.

A comparison of the statistics of growth for the period from 1883 to 1892, will show a vast increase in gas undertakings, although that occurs side by side with an unexampled development of electricity for illuminating purposes. Thus in 1883, there were 357 companies with an authorized share and loan capital of £48,000,000; while in 1893, there were 428, with a share and loan capital of £55,000,000. In 1883, there were 148 local authorities supplying gas, with an authorized capital of £21,000,000; and in 1893, there were 192 local authorities, with a capital of £27,240,458. This table shows a marked and marvellous growth in enterprise; and it is one of the most encouraging features of the industry.

In England and Scotland the advantages and utility of the systems and safeguards of a Provisional Order are being widely appreciated and adopted; and as the powers and privileges of a company so constituted are many and manifest, in comparison with its condition otherwise, I shall in a few words endeavour to explain the altered and bettered position of a company so regulated. In Ireland, this information may be particularly useful, as but in a very few instances have the benefits of a Provisional Order been sought; and it would therefore be well for the existing Irish companies to understand what they are losing by not adopting the system. In Sligo we have obtained a Provisional Order; and we find from the experiment of its successful and satisfactory working, the advantages of the course as contrasted with our position before and under our Private Act. Our contrasted position can be easily described, and will be readily understood by those acquainted with the working of gas companies.

The Provisional Order is to all intents and purposes an Act of Parliament, with the validity and rigour of a statute. Under Provisional Orders, companies obtain powers to construct or extend their works, and secure by implication a regulated monopoly. As long as companies fulfil their obligations within their Order, they acquire the sole right of gas supply in the district; and Parliament will not authorize any company or local authority to compete with them. This fixity of tenure and freedom from disturbance or competition is a great boon, of which it is impossible to exaggerate the importance, and which, if it stood alone, would be well worth the cost ten times over of obtaining the Order.

It was with a view to facilitate the obtaining of parliamentary powers for the supply of gas or water, that the Gas and Water Works Facilities Acts of 1870 and 1873 were passed. Under these salutary statutes, I will explain what can be done, and what powers can be obtained. By the fourth section, Provisional Orders authorizing any gas undertakings may be obtained in any district by any company, companies, or person. They may be obtained for: (1) The construction, maintenance, or continuance of gas-works, and the manufacture and supply of gas in any district where there is not an existing company, corporation, body of commissioners, or person empowered by Act of Parliament to construct such works, or to manufacture and supply gas. (2) The raising of additional capital for any of these purposes. (3) Enabling two or more companies or persons duly authorized to supply gas in any district or in adjoining districts to enter into agreements jointly to furnish such supply, or to amalgamate their undertakings. (4) Authorizing two or more companies or persons supplying gas in any district, or in adjoining districts, to manufacture and supply gas and to enter into agreements jointly to furnish such supply, and to amalgamate their undertakings. Under the Public Health Act (England) 1875, section 161, and by the Act of 1878, Urban Authorities are given powers to contract for public lighting, and to supply gas for public and private purposes, where there is not any company already authorized existing since the Act came in force; and up to 1893, there had been received by the Board of Trade 403 applications for Gas and Water Orders, of which 378 had been granted, and 372 confirmed by Parliament.

From the same report, it appears that in three of the Gas Orders made in that year by the Board of Trade, the sliding-scale of price and dividend was adopted; the initial price per 1000 cubic feet being fixed in the respective Orders as follows: Portishead, 4s. 6d.; Sligo, 5s.; and Swindon, 4s. 3d. In four Orders, a maximum price per 1000 cubic feet was fixed as follows: Bromyard, 5s. 10d.; Llanfairfechan and Aber, 5s. 10d.; Newent, 5s. 10d.; and Portishead, 5s. 3d. The supply of gas in bulk beyond the limits of supply, subject to the usual limitations, was authorized in the Llanfairfechan and Aber, Otley, Sligo, and Swindon Orders. In the first of these, the promoter being an individual, a provision was inserted that no sale or assignment of the undertaking should have effect until approved of by the Board of Trade. The form of the Orders varies according to the purposes desired to be effected. Except as regards applications made under their power by urban authorities, Provisional Orders under these Acts are made by the Board of Trade.

The procedure for obtaining a Provisional Order is simple and inexpensive. Notices have to be given and published, and the Order is of no effect until confirmed by Parliament. As regards opposition to these measures, they may be opposed in Parliament in the same way as ordinary Private Bills; but usually the opposition is dealt with by the Board of Trade while the Order is under the consideration of that department. It is usual to incorporate in the Orders the Gas-Works Clauses Acts of 1847 and 1871.

Unless a company are acting under the powers conferred upon them by Provisional Order, or are constituted under a Special Act of Parliament giving them these powers, they work with very many disadvantages and drawbacks. Breaking up, without parliamentary authority, public streets, roads, pavements, or footways, in order to lay down, repair, or replace gas or water pipes, is a nuisance at common law, and may be made the subject of an indictment.

The theory of the sliding-scale is to give the consumer a pecuniary interest in the economy and skill of the gas company, so that if by these means the company are enabled to make and supply gas at a lower price, they shall, on the one hand, make a reduction in the price of gas to the consumer, and, on the other hand, be able to pay their shareholders a proportionate increase in the otherwise authorized rate of dividend. And again, if they made any increase in the standard price, they must make a proportionate decrease in the standard rate of dividend. In its working, the result of the operation of the sliding-scale has been beneficial to the public, and has led to the lowering of the price of gas, and to increased dividends.

Another provision introduced into all Provisional Orders is what is called the auction clause. By a Standing Order of Parliament, it is provided (188a) that "in every Bill by which an existing gas or water company is authorized to raise additional capital, provision shall be made for the offer of such capital by public auction or tender, at the best price that can be obtained, unless the Committee on the Bill shall report that such provision ought not to be required, with the reasons on which their opinion is founded." The effect of the auction clause in working has been described as being most beneficial. It adds to the capital of the company so much money as is obtained by way of premiums on the nominal or face value of new shares. This sum so added to capital bears no dividend; and inasmuch as it necessarily helps to earn profits, it thereby increases the amount of profits divisible among the holders of the dividend-bearing capital, and helps to decrease the price of gas to the consumers.

The extent of the working of the auction clauses may be shown best by an examination of the statistics supplied to Parliament in 1893. In 1883 the amount of authorized gas capital subject to the auction clause was £9,339,760; and in 1893, it was £13,217,555. The amount of such capital sold by auction or tender was, in 1883, £2,538,709; and in 1893, it was raised to £5,417,667. The amount of premiums realized by sales of shares under the auction clauses in 1883 was £1,088,675; and in 1893, it was £2,432,970.

It is difficult to exaggerate the importance and advantages of these two. The sliding-scale fixes a standard price; and it has been found in operation a two-fold benefit. It popularizes the undertaking by giving the consuming public an interest in its prosperity; and it adds immensely to the stability of the company.

The old reserve fund, where the sliding-scale is introduced, is supplanted by an insurance fund and a new reserve fund. The insurance fund is in itself also an admirable idea. It is thus regulated and carried out: When the clear profits in any one year amount to a larger sum than is required to pay the dividend on the preference capital (if any), and a dividend on the ordinary capital at the standard authorized under the sliding-scale—which cannot exceed 10 per cent.—the excess beyond the sum necessary for these purposes may from time to time, to the extent of 1 per cent. upon the paid-up capital of the company, be invested, and then allowed to accumulate at compound interest to a sum equal to one-twentieth of the paid-up capital. This forms the basis of the insurance fund; and out of this a company can, without burdening themselves with new liabilities

or increasing their capital, meet any extraordinary demands upon their resources. They can meet the emergency of a strike or accident.

The West Ham Gas Act of 1893 is in these respects a model and a precedent. After providing for the sliding-scale and insurance fund in the usual way, it goes on to provide that, whenever such excess shall exceed the sum necessary to provide for the reduction of 1d. per 1000 cubic feet in the price of gas sold in the preceding half year, as shown by the accounts of the Company, and for the increased dividend which the Company would be authorized to pay in respect of such reduction of price, they shall reduce the price to be charged for gas in the next half year by 1d. per 1000 cubic feet.

A further advantage offered by the statutory powers of a Provisional Order is the security it offers to investors, as compared with the ordinary arrangement. This security has made undertakings so financed most popular investments. It also gives facilities for raising the additional capital necessary for extensions of business, enlargement of premises, or such like extraordinary works. This can be, under the Order, raised at about 4 per cent.; and, by this comparatively cheap way of financing, a great benefit will be derived by both shareholders and consumers.

The advantages of a Provisional Order to gas companies operating without statutable powers are so manifest that it is impossible to conceive how, in these days of competition and enterprise, any gas undertaking can be efficiently carried out in the absence of these now necessary powers. From the experience of its working everywhere it has been tried, the Provisional Order has been a source of profit and advantage to the company adopting it, and a means of strengthening and popularizing the company availing themselves of its salutary provisions.

The cost of a Provisional Order depends upon the amount of opposition it receives; but it can be roughly estimated at about £150. I hope in a very short time the present Government will see its way to bring in a Bill to enable us to carry out the work in Dublin, which would very much reduce the expense.

Discussion.

The President said there was no doubt that a great many of them would require to prepare themselves for getting statutory powers. If what Mr. Tully suggested were adopted, he thought it would give them greater foothold in their several towns than they had at the present time.

Mr. G. R. Love (Dundalk) said he had listened with great interest to the most instructive paper by Mr. Tully. He was sure they were all very much indebted to the author for bringing it forward. He thought that those members who were with non-statutory companies should bring the matter before their directors; and he was sure they would all read the paper with a great deal of interest. It would show them their exact position, and the advantages to be gained by being statutory companies. He might state that the Company he worked under had an Act of Parliament; and, though he could not give them so much information as Mr. Tully had, he would like to draw their attention to the matter of cost. Mr. Tully mentioned £150. Well, his Company spent upwards of £5000 in getting their Act, which, however, was quite a different thing from a Provisional Order. But an Act was a far more complicated matter to carry through than a Provisional Order.

Mr. Tully said they had experienced some opposition in Sligo; but he thought any way Mr. Love might have got his Act cheaper, if he had tried. A Provisional Order was quite as good when confirmed as an Act of Parliament. The only difference was that they could not get power for the compulsory purchase of land under a Provisional Order. They could get any other power, under a Provisional Order, except for compulsory purchase of land, or the like, for gas-works. He thought, however, they should try to get such matters arranged in Dublin; for he did not at all see (quite apart from politics) why they should be obliged to go to London and get them arranged there.

Mr. Williamson said he would prefer a little nearer home even than Mr. Tully suggested; and would say that each County Council should have the power to deal with these matters. He was not for going to Dublin at all.

Mr. Love suggested that, to get the advice of experts and lawyers, would cost as much to them as did going to London.

Mr. Tully thanked the members for their reception of his paper.

Professor W. Ivison Macadam, of Edinburgh, delivered the following lecture, illustrated by lime-light views:—

ON THE ILLUMINATING VALUE OF THE VARIOUS CONSTITUENTS OF COAL AND OIL GAS, AND THE CONDITIONS NECESSARY TO PRODUCE INCANDESCENCE.

The subject which I have chosen for my lecture to you is one which is at the present time receiving very considerable attention; and the theories advanced are so widely different, that it becomes a matter of difficulty to follow the many workers.

The substances present in illuminating gas, whether made from coal or oil, may roughly be said to be methane or marsh gas, unsaturated hydrocarbons of the olefiant gas type, a small proportion of benzol-type bodies, the two oxides of carbon (carbonic anhydride or carbonic acid and carbon monoxide), hydrogen, oxygen, and nitrogen, &c. Of these bodies, nitrogen and carbonic anhydride are not combustible; carbon monoxide and hydrogen give non-luminous flames; and the remaining substances are combustible, yielding more or less luminous flames. The proportion in which these substances are present varies greatly. The unsaturated hydrocarbons, for instance, may be present in oil gas to the extent of from 20 to 40 per cent.; while in coal gas the proportion may fall as low as 5 to 10 per cent., or in some few cases run up to 15 or 18 per cent.

As illustrating the composition of coal gas, I may quote an analysis given in the Journal of Gas Lighting for Jan. 8 last (p. 72). It is as follows:—

London Gas (Thwaite).

	Per Cent.
Unsaturated hydrocarbons	3·84
Benzol	1·04
Marsh gas	35·63
Carbonic anhydride	1·41
Carbon monoxide	6·15
Hydrogen	47·73
Oxygen	0·30
Nitrogen	3·90
	100·00

This gas would probably run about 12-candle power for each 5 cubic feet. Of course, these figures vary greatly with the coal employed in its manufacture, as will be seen from the following analysis of London gas of 12 and 20 candle power:—

*London Gas.**

	12 Candle Power.	20-Candle Power.
Unsaturated hydrocarbons, &c.	3·8	13·0
Marsh gas	39·5	50·0
Carbonic anhydride	0·6	0·1
Carbon monoxide	7·5	6·8
Hydrogen	46·0	27·7
Oxygen	0·1	0·0
Nitrogen	0·5	0·4
Moisture	2·0	2·0
	100·0	100·0

The temperature at which the coal has been retorted also alters the composition as well as the yield of the gas. This is shown in the following table, given in "Thorpe's Dictionary of Applied Chemistry":—

Newcastle Coal.

Gas per ton of coal, cubic feet	8250	9692	12,006
Illuminating power, candles	20·59	17·80	15·60
	Per Cent.	Per Cent.	Per Cent.
Unsaturated hydrocarbons	7·55	5·83	4·51
Marsh gas	42·72	34·50	30·70
Carbon monoxide	8·72	13·50	13·96
Hydrogen	38·09	43·77	48·02
Nitrogen	2·92	2·40	2·81

These results are perhaps better understood when they are calculated to the cubic feet of each gas produced per ton of coal. They are—

Unsaturated hydrocarbons	622·9	565·1	541·5
Marsh gas	3524·4	3344·1	3685·8
Carbon monoxide	719·4	1211·6	1676·0
Hydrogen	3142·4	4242·6	5765·3
Nitrogen	240·9	329·6	337·4

Lewes† gives the following lighting value of various carbon and hydrogen compounds per 5 cubic feet burned:—

Marsh gas	5·2 candle power
Ethane	35·7 ,,
Propane	56·7 ,,
Olefine	70·0 ,,
Propene	123·0 ,,
Acetylene	240·0 ,,

These results, while comparative, are not those obtained in every case, but will vary with the apparatus employed as a burner. Thus, 5 cubic feet of the same gas have yielded me from 25-candle power to 61·95-candle power.

The pressure at which the gas is passed to the burner is one of the most important factors in deciding the illuminating value obtained from the gas. Thus, 5 cubic feet of a gas gave me, when burned at 18-10ths pressure, only 11·14-candle power; while the same gas, from the same burner, at 5-10ths pressure, gave 20-candle power. The effect of pressure has long been recognized by burner manufacturers; and it has been very fully worked up by Mr. Hislop, of Paisley, and others. The various devices employed to this end are well known. They consist of double burners, end to end, choked by gauze discs; and, best of all, by means of regulators attached to each burner. The older double burners were not choked; and the two burners were generally of the same bore. Now the burners are both choked; and the lower burner is very much smaller in bore than the upper. This device lowers the pressure at the point of ignition, and greatly increases the luminous value of the gas. Of the regulator burners, the best I know are those made by Messrs. Peebles and Co., of Edinburgh. They are necessarily dearer than the simple varieties; but the regularity of consumption and light value fully repays the increased cost.

When we desire to consider the changes which occur in the composition of the gas during combustion, we enter a more

* "Chemistry as Applied to the Arts and Manufactures," Mackenzie.

† See Journal, Vol. LXV., p. 169.

difficult field. The light obtained may be due to substances contained in the gas itself, or it may be due to a foreign body introduced into the flame. In this last case, the gas is mixed with air before combustion, so as to produce a non-luminous flame; and this is then allowed to impinge on the body to be rendered incandescent, while certain substances which, when burned under ordinary conditions, yield non-luminous or nearly non-luminous flames, may be made to give luminous flames by subjecting them to pressure. It is generally accepted that luminosity is usually due to the presence of solid particles in the flames, which, when heated, give off light. Professor Frankland has, however, shown that it is possible to obtain light from heated dense hydrocarbons; but we shall wait for further experimental proof before accepting the theory that the luminosity of coal gas is due to this cause.

The general explanation given in text-books as to the changes taking place in an ordinary flame is that there are three distinct zones—the first or inner zone, largely caused by the pressure of the issuing gas, and consisting of unburned gas; the second, or luminous zone, in which the hydrogen is burned into water, and the heat developed during this change rendering the carbon incandescent; and the last, or outer zone, one in which the carbon is converted into carbonic anhydride. As no solid is present in this zone, it is non-luminous. This explanation has a great advantage—it is simple; unfortunately, it is also grossly inaccurate. The Bunsen jet is explained as being similar to the ordinary jet, except that the luminous zone is wanting.

Professor Smithells, of Leeds, who has done good work on this subject, has at the same time shown that these explanations are wrong, and that they are not even warranted when considered alongside of Sir Humphry Davy's original statement. Smithells started his experiments by watching the gradual development of a flame obtained from a very small amount of combustible. The small flame thus obtained is practically non-luminous, and consists of a hollow, bright blue cone surrounded by a lilac coloured border. When more gas is turned on, a luminous spot is formed, which, as the quantity of gas is increased, becomes more and more developed. The original inner cone now forms a small fraction of the whole flame, and constitutes the blue region.

If, instead of starting with a non-luminous flame, we commence with a luminous jet, and gradually admit air, the same series of changes are noticed; but, of course, in the reverse order. From these experiments, Smithells concludes that there is no essential difference between an ordinary luminous and the non-luminous flame—that the non-luminous flame may be considered as a gas-air flame with the blue and non-luminous regions at a maximum, and the yellow luminous regions at a minimum; while the luminous flame is to be regarded as a gas-air flame with the blue and non-luminous parts at a minimum, and the yellow luminous region at a maximum.

When air in excess is passed into the Bunsen flame, it "strikes back." Smithells has devised an instrument to show this process, and to demonstrate what actually happens. When the tube of the Bunsen is lengthened by means of a glass tube, and the excess of air is gradually admitted, it is noticed that the process of "striking back" takes place in two stages. First, the inner cone passes down the tube; then the outer portion. When working with a plain tube, it is difficult to regulate the process so as to arrange that the two cones will be retained in the tube for a lengthened period. By introducing a glass rod into the centre of the glass tube, however, the upward current of gas is retarded, with the result that, when air is admitted in excess, the inner cone is stopped at the apex of the rod. A still better method consists in making a constriction in the tube, or by the use of two tubes one inside the other. By the last method, especially, the flame can most readily be split into two, and the products of combustion of the two parts can be separately obtained for analysis. By these means, Smithells has shown that the blue region is one of incomplete combustion, in which carbon monoxide, carbonic anhydride, hydrogen, and water are the chief substances produced; while in the outer part, the hydrogen and carbon monoxide are burned to carbonic anhydride and water. His experiments, therefore, show that carbon is first oxidized and the hydrogen set free, to be afterwards consumed in the outer envelope. This is, therefore, directly opposite to what was held in the older theory.

Lewes, who, as you know, has done much work on this subject, holds that the hydrogen diffuses to the outer part, and is there burned. The methane also diffuses, though more slowly, and is consumed in the outer part. The combustion of these bodies raises the temperature of the flame to 500° C., and gradually upwards to 1000° C. At this temperature, the olefines are converted into acetylene and hydrogen. If the temperature does not rise above 1000° C., the acetylene polymerizes into benzol; but should the heat rise to 1200° C., it is split up into carbon and hydrogen. The combustion of the hydrogen then raises the carbon to a state of incandescence, and produces the light. The difficulty of accepting this theory lies in the fact that neither Lewes nor Smithells, nor any other worker so far as I know, has been able to demonstrate the presence of more than a trace of acetylene in the products of the inner zone. Acetylene is a colourless gas with a decidedly garlic odour, and burns with a very smoky and highly luminous flame. It is produced in large quantities when carbide of calcium is placed in water. The carbide is formed when chalk or lime, mixed with carbon, is fused in an electric furnace. There is no difficulty in producing the substance; and, if a demand for the body sprang up, doubtless it could be readily produced at a moderate cost. The plant to manufacture acetylene from the carbide need not be costly; and the process is simplicity itself. Unfortunately, however, the gas is practically useless as an enricher; and this fact alone is sufficient to condemn the process for large works. For smaller services, as in country houses, or for railway purposes, it may yet be found useful.

Various attempts have, from time to time, been made to introduce into the outer zone of the ordinary flame solid bodies which might be raised to a state of incandescence, and so utilize this non-luminous area. Scholl's platinum plate was a step in this direction. None of the patents have, however, been successful so far. In 1868, Hogg, of Edinburgh, took out provisional protection for a process to render platinum cones incandescent. He, however, did not carry out his patent; and it was reserved to the Welsbach Company to bring the idea to a successful issue. They work with a burner which is essentially a Bunsen burner, into which a slight excess of air is drawn. The openings by which the gas passes into the tube are very small; and the amount of gas is therefore comparatively small. The gas is burned to complete combustion; and the heat so obtained is used to raise to incandescence a cone made of various oxides of metals and other bodies.

The apparatus is made in three different sizes—known as the "S," "C," and "D" burners. I have tested the two first of these sizes; and the results show that in the case of ordinary burners, the best results for the gas burned are yielded by the larger sizes. Working with a gas which, when tested with ordinary burners, was equal to 25-candle power for each 5 cubic feet consumed, or to 5 candles per cubic foot, I obtained from the "S" burners a light equal to 10·66 candles per cubic foot, or 53·30 candles per 5 cubic feet. The "C" burner gave 21·25-candle power per cubic foot, equal to 106·25 candles per 5 cubic feet. The consumption of gas with the "S" burner was 3 cubic feet; and with the "C" burner, 3·2 cubic feet.

Tested with high-class oil gas, there was a heavy deposit of carbon on the mantle, which quickly destroyed its efficiency. By reducing the quantity of gas passing through the burner, and increasing the quantity of air, the Company have produced a fairly good oil-gas consumer. With 1·8 cubic feet of an oil gas which, when tested in the ordinary way, was of 56·60-candle power per 5 cubic feet, I obtained a light equal to 83·30-candle power per 5 cubic feet. For oil gas, however, the Company will yet require to modify their burners.

That a still greater result can be obtained from the gas, is shown by a modification of the Welsbach burner made by Mr. W. Penman, C.E., of Edinburgh. Mr. Penman's burner was constructed for photographic lantern work; and its peculiarity lies in the introduction of a very slight proportion of oxygen into the flame itself. By this simple addition, a gas of 5-candle power per cubic foot, which, with the ordinary Welsbach "C" burner, gave 12·39-candle power, was raised by Penman's burner to 18·81-candle power; or, in other words, for every candle power given by the ordinary burner, the Welsbach gave 2·47 candles, and the Penman 3·76 candles. This burner burns oil gas splendidly. Working with oil gas of 12-candle power per cubic foot, and which without oxygen gave 16·25-candle power, I got 67·64-candle power, or equal to 338·20-candle power per 5 cubic feet. This is, therefore, very much higher than even the extraordinary results obtained with acetylene.

Penman's burner having been manufactured purely for photographic lantern work, the oxygen was only introduced in front, and a platinum plate is placed behind. Lately I have been working with a burner built on the same principle, but with an oxygen-feed all round. My results are satisfactory; but, as they are not yet completed, I do not desire to quote them.

In the preceding remarks, I have endeavoured to place before you as simply as possible the results of the latest researches. They show that gas need not yet "throw up the sponge" in favour of electricity or any other illuminant. How far we may yet compel gas to yield us still greater illuminating value, must rest with the future. Even "second sight" cannot soar to the heights of possibility.

The Hon. Secretary thought there were very few there who were capable of making any very pertinent remarks on such a lecture as that to which they had listened; and he thought it only remained for them to express their heartiest thanks to Professor Macadam for the great trouble he had put himself to, in coming from Edinburgh with all his various appliances, in preparing the lecture, and presenting to them some facts concerning their profession in such a lucid and interesting manner. He had great pleasure in proposing that their heartiest thanks be accorded to Professor Macadam for his valuable lecture.

The President was sure it was the wish of everyone who had listened to the lecture to follow the proposal of their worthy Secretary. He did not think he could add anything to it. The members were under a great debt of gratitude to Professor Macadam for the splendid lecture he had delivered.

Professor Macadam said he was very much obliged to them for their vote of thanks. He had very pleasant recollections of his visit to Ireland two years ago; and he could assure them it had given him the greatest pleasure to come again.

VOTE OF THANKS TO THE PRESIDENT.

Mr. LOVE proposed a hearty vote of thanks to the President for the able and efficient way in which he had conducted the meeting. Mr. Salmon had, he said, a way of his own, which endeared him to all of them; and he thought he had that day shone in the position in which they placed him. He had filled the chair not only with credit to himself, but with credit also to the Association.

Mr. TULLY, in seconding the motion, endorsed all that Mr. Love had said.

The PRESIDENT said, in his opening remarks, he stated that he could not find words in which to express his sense of the honour they had conferred upon him. He could assure them he took it as the very highest honour which could be conferred upon anyone, to be made President of an Association like theirs.

In the evening the members dined together in the White Horse Hotel, under the chairmanship of Mr. Salmon; and on the next day (Wednesday) a very successful excursion was held in the finest possible weather for such a purpose. The places visited were: The round tower and ancient sculptured crosses in the churchyard at Monasterboice; the ruins of Mellifont Abbey; the site of the battle of the Boyne; and the Druidical caverns at New Grange. A small party proceeded further and visited Slane, where St. Patrick is reported to have lighted the paschal fire on his landing in Ireland. Almost any one of the above objects would have proved sufficient, in itself, to provide the required entertainment, but when, in addition to the rich programme presented, it is taken into account that, in order to visit the places selected, it was necessary to drive through more than twenty English miles of charming landscape, it is superfluity to say that everyone who was present was highly delighted with the day's outing arranged for them by Mr. Whimster and Mr. Martin, the Manager of the Drogheda Gas-Works.

Oil-Gas Tar Paint for Ironwork.—MM. Kolker and Naphtali have effected some improvements in the production of paints suitable for coating iron and other surfaces. They take the tar obtained in the production of oil gas, and subject it to fractional distillation up to a temperature of 250° C., when about 11·35 per cent. will have distilled over. The remaining 88·65 per cent. forms a glossy black mass, having the consistency of honey, and a specific gravity greater than that of water. It is dissolved by the aid of heat to about half its weight of volatile hydrocarbons, such as benzene and the like; and a paint is thus obtained which dries very rapidly, adheres well, and does not crack or fall off. It is claimed for it that it will penetrate through iron rust, and prevent further oxidation of the iron. Manganese or lead driers may be added, if desired.

Electrolysis of Gas and Water Mains in Brooklyn.—The Board of Commissioners of Electrical Subways of Brooklyn lately submitted to the Mayor a report calling attention to the danger of corrosion of the water-mains by currents of electricity escaping from the trolley railways. The Board had a survey made by an expert, who suggested a means of preventing the destruction—at all events for a time. It consisted in the attachment of a conductor to the water-mains at frequent intervals; and it proved effective. The Trolley Company proposed to apply the remedy in other places. But the Commissioner of City Works refused to grant the necessary permission; and the Company will consequently have to rely upon one of the other methods for the return of their currents to the power stations. These are: (1) Welding the rails at every joint; (2) employing a heavier copper bond at the rail joints; (3) making frequent connections between the rails and a return conductor of suitable dimensions, which may be either buried in the ground or preferably carried on the pole-lines back to the station. All three of these methods have been employed in various parts of Brooklyn; but the report says that in many places the current still escapes from the rails, and is conducted by the gas and water pipes.

The Effect of the Last Coal Strike.—In a recent issue of the JOURNAL, we alluded to some remarks made by Lord Claud Hamilton, in his capacity of Chairman of the Great Eastern Railway Company, on the effect of the coal strike of 1893 on the carriage and consumption of coal. Lord Stalbridge spoke in much the same strain at the meeting of the London and North-Western Railway Company last Tuesday. He said there had been a decrease of something like £80,000 in the Company's mineral traffic; and it looked very much as if the effect of the coal strike had been to lose this country some trade which it would never regain. The loss in the mineral traffic of the Midland, which was a heavier mineral line than their own, coupled with that on their line, was very large indeed. He hoped it would not be the case that this country had actually lost for ever some of her trade in conseqence of that great strike. The Right Hon. D. Plunket, M.P., when presiding at the meeting of the North London Railway on the following day, told the shareholders that there had been a slackness in the coal traffic all over the country; and he said he was afraid they must realize that they were still suffering from the effects of the disastrous coal strike of 1893. What was still worse, he added, certain portions of the coal traffic seemed to be permanently leaving this country—a circumstance most prejudicial to the interests both of capital and labour.

AMERICAN WATER-WORKS ASSOCIATION.

Water-Works Management—Water Supply by Meter.

At the last Annual Meeting of the American Water-Works Association, a paper on "Water-Works and their Management" was presented by Mr. L. M. Case, the Superintendent and Secretary of the Detroit (Mich.) Water-Works. The following extracts from the paper are taken from the report of the proceedings in the *Engineering Record*.

In the establishment and conduct of water-works, three important subjects for consideration stand out prominently—the quantity pumped, the quality of the water, and the just and equitable charge to be made for its supply. As regards quantity, I think I may say that 60 gallons daily per head is a generous supply; and therefore it is the duty of the purveyor to use every reasonable and lawful means to prevent greater consumption. The restriction of lavish use and waste correspondingly lightens the burden resting upon the consumer to provide engines, pipes, fuel, &c., which such use and waste necessitate.

The services rendered to the people in the construction and operation of water-works are threefold in their nature; and, being of entirely different and distinct characters, the payment therefor is required to be made each upon a different basis. The first and most important, and also the most comprehensive, of these services is the furnishing of an article of consumption, which includes water for all manufacturing and business purposes and for family and household uses. The expense of supplying this article of consumption, like every other, depends upon the quantity supplied; and it should be met entirely upon that basis. This necessitates the making of water assessments under a schedule of rates, framed upon the basis of such consumption, and from which all expenditures necessary to such supply should be paid. This is an individual service, depending upon individual needs and wishes, and should not be thrown into the class of general taxation to be paid for on the basis of valuations.

The second service rendered is the protection of property from fires, and the supply of water for public purposes in public buildings, parks, &c. The benefit derived from this service is largely protective, and is directly in proportion to valuations; and it very properly should come from the general tax levy. Estimates for this expense must be largely theoretical; but, taking into careful consideration the necessary operating expenses, and also those for construction, required to afford this protection and supply, I have placed it at about 20 per cent. of the entire expenditure of the department.

The third service is the extension of distributing-mains in new territories. This expenditure is to satisfy a local necessity; and it seems eminently just that the locality requiring it should meet such expense, and that consumers of water, who have already, in the water-rates, paid for the pipe in front of their own premises, should not have the additional burden imposed upon them of being required to assist in paying for such extensions in other localities. It often arises, however, that other needs require the laying of larger pipes in a street than the necessities of the street itself would call for; and therefore some fixed size should be established, and the cost assessed to abutting property. The minimum pipe, it is fair to say, would answer the purposes of any lot, were that lot and its occupancy alone in question; and therefore it is only equitable that the expense of laying that size should be met by such special taxation, and the increased expenditure for laying a larger main be taken from the water-rates. In accordance with this idea, the Board of Water Commissioners of Detroit applied to the State Legislature for an Act authorizing the imposition of a special assessment upon abutting property by which water-piping is laid; but no lot or lots were to be assessed for a larger sum than a proportionate share for laying and constructing a pipe or main 6 inches in diameter.

With the expenditure of a water department provided and arranged for under these three classifications, it seems to me that all claims for justice and equity in this particular will be satisfied, ordinary rates materially reduced, and individuals required to pay for such expenditure only as their needs and necessities create or cause.

In regard to the establishment of rates, both "assessed" and "meter," there seems to be a wide range throughout the cities of the United States, varying as much as the habits and characteristics of the people. While it may be impossible to establish a uniform basis of rates, owing to our different conditions and environments, I am satisfied that a much greater uniformity than now prevails could be obtained. To me the idea of a community composed of free and independent citizens, all with equal rights before the law, establishing a water-works for their mutual and individual benefit, and then arranging the rates so that one individual would pay more for the water he consumed per unit than another individual, is inexcusable. It is true that a larger quantity can be furnished at less cost than a smaller quantity; and were each individual supplied through a separate pipe from the works, there might be some excuse for a difference in the rates for large and small consumption. But, inasmuch as the waters are driven by the same pumps, at the same time, through the same pipes, and each gallon therein

costing exactly the same amount, the idea of one individual being obliged to pay more for a gallon than another seems to me to be unsustained by any law of reason or justice.

The construction and operation of works should be conducted economically; bearing in mind, however, that penuriousness is not economy. The purchase and placing of meters, commencing during my first year as Manager of the works, and continuing systematically since, has been denounced as outrageously extravagant; and yet the Board of Water Commissioners have saved to the people at least $200,000 over and above the cost of the meters (which they still have), in their operating expenses, and in the interest upon, and depreciation of the values of, the construction that the excessive consumption demanded. In regard to the prevention of waste, I think it is not generally understood how thoroughly these little tireless and sleepless machines accomplish the desired results. I feel perfectly confident, from my experience, in stating that the saving, over and above such cost, is double the expense of the purchasing and placing of meters.

The paper was followed by a discussion, in the course of which Mr. F. A. W. Davis, of Indianapolis, remarked in regard to the suggestion that there should be a uniform rate, that the cost of the plant, the number of consumers, &c., ought to be duly considered. Mr. Linneen said a fixed schedule of water-rates, however suitable it was in Detroit, might not be equitable in other cities. A large consumer should, he thought, pay a lower rate than a small one. In the case of plant pumping 3 million gallons daily, the water could be sold at a lower rate than was charged where only a million gallons were pumped. Mr. Benzenberg said he gathered, from conversations he had had with the writer of the paper, that he did not believe in uniform rates throughout the country; absolute uniformity being out of the question. A gravity system could furnish water for less than a pumping system. Another point was the expense of reading meters. This was naturally less in the case of a single consumer using (say) a million gallons a month, than in that of a large number of small consumers. Mr. Denman pointed out that a 1-inch pipe might be sufficient for certain premises; and therefore he did not see why the occupier should be taxed for a 6-inch pipe. Mr. Milne remarked that there were often cases requiring the introduction of a larger water-main in a city. The application of the tax to raise money to pay for that main was what was evidently in the author's mind. He believed Mr. Case to be right in one thing—viz., one rate for the consumption of water through a meter. The question of rates had been under consideration in Brooklyn for a number of years; and now it was 1 c. per 100 gallons for all consumers. The water-rate in Brooklyn was uniform; and one-fifth of the entire revenue came from the meter system, and four-fifths from the sugar refineries. Mr. Davis said he did not think it possible to furnish water at the same rate in all cases; and he cited various local conditions which made varying rates necessary. Mr. Benzenberg referred to a property tax for water-pipes as being in the same line as the tax for sewer or street work. This idea was criticized by Mr. Linneen. Sewers, street work, &c., did not, he said, bring in any revenue; whereas a water-pipe did. To tax property for a water-main on a frontage tax was, in his opinion, unjust.

On the same occasion, a paper entitled "Our Experience with Water-Meters" was read by Mr. J. B. Heim, the Superintendent of the Madison (Wis.) Water-Works. The following are the principal points in the paper:—

The question of selling water by measurement has taken rapid strides within the last few years; but it is as yet in its infancy. The plan still prevailing in most cities is to connect meters only with the services of large consumers, manufactories, &c., in order to check the waste. The advocates of that plan, however, lose sight of the fact that the waste is really greater on the domestic services, taken as a whole, than on those of the larger concerns. Nevertheless, the adoption of the meter system is the only course to pursue to meet the emergencies which must arise; and the plan, when once adopted, must be followed consistently and fearlessly. If that policy is inaugurated, then the result will be, as it has been with us, a general demand for the introduction of meters.

Madison has an artesian well supply, which is in general limited. The excessive sprinkling of lawns and streets in the summer, and the continuous flow in the winter to prevent freezing, were causes of a waste which steadily increased in proportion to the consumers. Finally, on a December night in 1886, during a fire which lasted nearly three hours, the pressure was gradually reduced from 120 lbs. to 65 lbs., which meant only 33 lbs. in the business portion of the city. We finally lost suction; but, fortunately, not until the fire was under control. This at once led to an inspection, which seemed to aid us to some extent.

The meter question had been discussed in our city for several years before that time; but even the occurrence just detailed was insufficient to overcome the prejudice which existed. The following season, as soon as sprinkling commenced, our troubles began again. On April 24, 1887, our pumping for 24 hours was 455,400 gallons; and it gradually increased until, on Aug. 9 of that year, it reached 1,016,500 gallons. We were then obliged to cut off all sprinkling; and we carried on an inspection until the season closed. But when cold weather came, inspection proved a failure; and a different method had to be adopted. More wells were added; but this step was accompanied by an increase in the number of takers, and so resulted in no permanent relief. Finally, we were driven to the adoption of meters. It was an unpopular measure, and was fought inch by inch by its opponents.

We began the placing of meters on May 21, 1888; and by the 20th of August following, we had 130 in place connected to services where we had discovered the greatest waste. Our pumpage was immediately reduced by an amount reaching 19,677,300 gallons when compared with the corresponding five months of the preceding year. The consumption of coal during the same months showed a difference of 66,500 lbs. in favour of the latter year. Anthracite grate coal was used, costing $6·24 per ton in 1887, and $8·33 in 1888; and, notwithstanding the additional cost of $2·09 per ton in 1888, the total cost of coal in that year during the sprinkling months, with but 130 meters attached, was only $142·33 more than during the corresponding season of 1887.

To overcome the prevailing prejudice, the Board of Water Commissioners decided to furnish the meters free, with no monthly rental, and also to connect them to the services free of charge for the years 1888 and 1889. The plan was adopted of first metering all services paying $15 and upwards per annum, then those paying $12, then those paying $11, and so on. A low rate was adopted, with a sliding-scale—the minimum rate being placed at $5 per annum. The maximum rate is 20c. per 100 cubic feet for those using 6000 cubic feet or less in six months. For those using more than this amount, the rates are fixed at 19 c., 18 c., 17 c., and so on, until we reach 5 c., per 100 cubic feet, which is the minimum rate, and is that charged to consumers of above 60,000 cubic feet in six months. On Sept. 30, 1894, we had 1820 takers and 795 meters.

In order to fully appreciate the results accomplished by the adoption of the meter system, the author of the paper gave a comparison of the years 1884 and 1885, when there were no meters attached, with the years 1893 and 1894, with 795 meters connected. The accounts were very fully analyzed; and it was stated that the saving of fuel in the six years since the adoption of meters had alone been sufficient to cover all expenses of purchasing and placing them.

Mr. Heim's concluding remarks were as follows: The meter system has become popular; and the Water Commissioners are under the necessity of strictly adhering to the rule that no one who pays less than $8 per annum is entitled to a meter, unless he uses the water through a yard hydrant for sprinkling purposes, or desires to do so. Before one is set, it is thoroughly tested from a 1-32nd to a ½-inch jet—a variation of 2 per cent. either way being accepted. We guarantee every meter that is placed. In case of a disputed bill, we re-test the meter for the consumer, if so desired; and if found incorrect, water-rent for the next six months is not charged. Thus far the city has not been under the necessity of extending this favour. In the office, we have a meter with a glass top with which to show its working, in order to demonstrate to patrons that no more water can be registered than passes through it. We buy our specials; and in case any parts are destroyed, the city replaces them at cost price. The licensed plumber has to remove and replace them. The system has brought with it a better class of work, and the most improved fixtures. The problem of additional water supply which stared us in the face has been solved. Our engines and pumps have been fully adequate, notwithstanding the increase in the number of takers; and instead of expending at least $200,000 for an additional water supply and machinery, we have been able to meet all demands, and at an outlay of only $21,733, which has been fully saved upon the cost of coal by the decrease in the amount of pumping since the inauguration of the meter system.

The Heating Value of Coal Gas.—With reference to the paper on the above subject read by Mr. D. Vass at the recent meeting of the North British Association of Gas Managers, and given in the JOURNAL last week, we learn that Messrs. Alexander Wright and Co. have a form of calorimeter, devised by Mr. J. Emerson Dowson, which is easy of manipulation, compact, and inexpensive. Mr. Frank Wright hopes soon to be in a position to publish some interesting data as to the calorific value of gas of varying candle powers; but, in the meantime, he will be pleased to furnish particulars of the apparatus to anyone interested in the subject.

Quinoline Bases in Brown Coal Tar.—An account of some investigations into this subject has been given by Herr O. Doebner in the *Berichte*. In experiments made with brown coal tar taken from Riebeck's works at Webau, the higher boiling portion (220° to 280° C.) was found to contain a mixture of quinoline bases and probably pyridine bases. Quinoline itself was isolated from the fraction of the oil distilling over between 235° and 245° C. The other bases contained in the higher boiling oil and also in this fraction of it, have the properties of quinoline bases, but were not isolated. The occurrence of these quinoline bases in brown coal tar, in which pyridine bases, benzene and its homologues, naphthalene, picene, chrysene, phenol, and the cresols have already been detected, affords a further proof of the analogy between the constituents of brown coal and hard coal tar.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Gas-Flames and Luminosity.

SIR,—In your article on my paper, where you refer to the statements I made *re* the action of water on the illuminating power of gas, you infer that, in the ordinary scrubbing process, the loss of illuminating power must be very great. This, however, seems to me to be overstating the case. In my experiment, equal volumes of water and gas were employed; but in the scrubbing process—even including that condensed from the mains—the proportion of water to gas is not more than 1 to 2000, and I calculate that the loss due to this cause is not more than $\frac{1}{20}$ candle. The same holds good regarding wet meters. After a cubic foot or so of gas has passed through a meter in which there is (say) a gallon of water, that water will have become saturated with benzene, and will then cease to absorb any more; and the illuminating power of the gas will be in future unaffected by its passage through the meter.

Where the solvent action of water may cause serious inconvenience is in experimental work—say, when gas has been collected in a small gasholder charged with fresh water, the latter bearing a considerable proportion in volume to the total gas collected. Unless water repeatedly treated with gas be used, too low results are almost bound to be obtained.

Referring again to burners, it was not my intention specially to draw attention to the fact, which everyone knows, that one burner gives a better result than another on any given gas, but to show the different effects of various enrichers on different burners. I do think, however, that every gas company should inform their consumers as to the burners best adapted to the gas supplied for both household and outdoor use, and do its best to induce them to use them.

WILFRED IRWIN.

Manchester, Aug. 17, 1895.

Comparative Cost of Electric and Hydraulic Power.

SIR,—Is there not an error on p. 333 of this week's JOURNAL, when it said that 2·76d. per Board of Trade unit is equal to 3d. per brake horse power per hour?

Supposing that a dynamo had an efficiency of 90 per cent., it would require $\frac{1000}{\cdot 9} = 1111$ watts. But, as a brake horse power is only 746 watts, the unit would be $\frac{1111}{746} = 1 : 1{\cdot}49$, or (say) practically the Board of Trade unit equals $1\frac{1}{2}$ brake horse power. If the brake horse power costs 3d., the unit would cost $4\frac{1}{2}$d., and not 2·76d.

DENNY LANE.

Cork, Aug. 14, 1895.

[The statement here referred to was Mr. Ellington's, not ours.—ED. J.G.L.]

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Thursday, Aug. 15.

Pursuant to resolutions passed on the 4th ult. respecting Provisional Order Confirmation Bills, prints of the Gas Orders Confirmation Bill and the Gas and Water Orders Confirmation Bill as considered by the House in the previous session, together with a declaration in each case signed by an officer of the department by which the Orders to be confirmed by the Bills were made, were presented, read the first and second time, Committees negatived, read the third time, passed, and sent to the Commons.

HOUSE OF COMMONS.

Friday, Aug. 16.

PRIVATE BILLS SUSPENDED.

Mr. MELLOR proposed the following motion; and it was agreed to: "That the Standing Orders of July 2 last for the suspension of Private Bills, or Bills to confirm any Provisional Order or certificate, be now read, and that the same be held applicable to the next session of Parliament, excepting in the case of certain Bills to confirm Provisional Orders or certificates suspended in the last session of Parliament under the said Orders, and which are reintroduced into this House under the said Order in the present session."

WATER SUPPLY IN EAST LONDON.

Mr. PICKERSGILL asked the President of the Local Government Board (Mr. Chaplin) whether, in view of the great danger to health, inconvenience, and discomfort arising to the inhabitants of East London from the insufficient quantity and bad quality of the water supplied to them by the East London Water Company, he proposed to take any, and what, steps in order to enforce upon the Company their statutory obligation to give a constant supply.

Mr. J. STUART said, before the right hon. gentleman answered the question, he would ask him another, of which he had given him private notice—viz., whether his attention had been called to the report, dated July 30, of the Chief Engineer of the London County Council, in which, after the examination of certain facts as to the quantity of water supplied by the East London Company before and after the frost of last winter, that gentleman stated as his opinion "That what the Company are now suffering from is not an insufficiency of supply, but that their pipes became so shattered during the frost of February last as to become so leaky that the water is wasted and does not reach the consumers;" whether he was prepared to make any inquiry as to the correctness of this opinion; and whether, if it was correct, he would take any steps to require the Company to put their mains in proper repair.

Mr. CHAPLIN: With regard to the supplementary question, I am under the impression that the Engineer of the East London Water Company denies the allegation of the Chief Engineer of the County Council. But I only received the question of the hon. member a few minutes before coming to the House; and it has been impossible to refer to the reports. With regard to the question on the paper, it has been a matter of much regret to me that so large a proportion of the inhabitants, and many of them the poorest, of the district included in the limits of supply of the East London Water Company have been put to very serious inconvenience by the limitation of the hours during which a supply was obtainable; and, as I could not but feel that a continuance of this limitation of the supply might be attended with danger to the public health, the condition of things has caused me some anxiety, and the matter has been receiving my constant attention. The difficulty in which the Company have been placed has been occasioned by the exceptional drought which existed until very recently and the insufficiency of the means of storage possessed by them. It is not requisite that I should refer to the circumstances under which Parliament, in 1893, rejected the Bill promoted by the Company with a view to obtaining further powers for carrying out the additional works required. I will only say that I am assured that, since Parliament granted the necessary powers in 1894, the Company have been proceeding as rapidly as possible with the execution of the works which they were fully aware were needed. The Water Examiner under the Metropolis Water Act, 1871, has been in frequent communication with the Company, in order that I might be informed precisely of the position of matters; and I have visited some of the poorer localities in the district, that I might see for myself how occupiers of small house property were being affected by the difficulty. The Company have, in a large number of streets, set up stand-pipes attached to the mains which were constantly charged with water; and this has, no doubt, been very helpful to a great number of persons when the ordinary supply was cut off. Allegations have been made as to a very serious increase in the mortality in the district of the Company. I have caused inquiries to be made on this subject, in connection with the returns of the Registrar-General; and I am glad to be able to state that, so far as means of comparison exist, it would appear that the mortality of the district supplied by the Company has not been greater than in districts within the limits of supply of other Water Companies where there has been no deficiency. As regards the statutory obligation of the Company to give a constant supply, I must point out that, by section 15 of the Metropolis Water Act, 1871, it is provided that a water company shall not be subject to any liability for not giving a constant supply when the want of such supply arises from unusual drought or other unavoidable cause or accident. I am glad to be able to state that I am informed by the Company that they find that, through the recent rains, they may now safely extend the hours of supply from to-morrow; and that water will be turned on at about six in the morning and be left on until about five in the afternoon daily. This is the fullest information I am able to give.

The House having decided that the consideration of all local and personal Bills suspended prior to the dissolution should be further deferred until next year, the following Bills in which our readers are interested stand over: Barnsley Corporation Water Bill, Chelsea Water Bill, Chelsea Water (Transfer) Bill, Dewsbury and Heckmondwike Water Bill, East London Water (Transfer) Bill, Grand Junction Water (Transfer) Bill, Kent Water (Transfer) Bill, Lambeth Water Bill, Lambeth Water (Transfer) Bill, New River Water (Transfer) Bill, Rotherham Corporation Bill, Southwark and Vauxhall Water (Transfer) Bill, and West Middlesex Water (Transfer) Bill. The Chelsea Water Bill, the two Lambeth Bills, and the Southwark and Vauxhall Bill have been committed; the others await second reading.

The Gas Orders Confirmation Bill and the Gas and Water Orders Confirmation Bill were last Thursday brought from the Lords, read the first time, and referred to the Examiners.

The Nidd Water Scheme of the Bradford Corporation.—Some time ago, a claim made by Mr. W. Ferrand in respect to certain property, belonging to him at Cottingley, required by the Bradford Corporation as part of their Nidd water scheme, was submitted to arbitration; Mr. B. S. Brundell, of Doncaster, being the Umpire. Mr. Ferrand asked £3028. His valuer (Mr. W. Middleton, of Bingley) estimated the worth of the property taken at £1168; and they claimed £1200 for damages to his adjacent property, £500 for general depreciation of the estate, and £160 for disturbance during the execution of the works and an additional watcher. The valuer for the Corporation (Mr. T. Fenwick, of Leeds) estimated the worth of the land interfered with at £697; but they contended that the question of alleged damage was purely sentimental. The Umpire has awarded £958.

The Cost of the Litigation between the Bradford Corporation and Mr. Pickles.—This matter, the final stage of which was recorded in our "Legal Intelligence" last week, was referred to at the meeting of the Bradford Town Council on the 13th inst., by the Chairman of the Water Committee (Alderman Holdsworth). He said the Committee had done what they considered to be fair and right; and he thought the decision of Mr. Justice North, after hearing a score of witnesses, and having the assistance of three Counsel on each side, had amply justified the Corporation. He contended that Mr. Justice North was the most competent Judge to deal with the question, and to come to a correct conclusion on the merits of the case. He felt that if the decision of the House of Lords was a correct one, the Acts of Parliament of the Bradford Corporation were worth very little indeed. To set alongside of his statement on this subject, he had some very favourable figures with regard to the receipts for the use of water by meter. The income from this source had augmented to the extent of £2348 in the first quarter of the present year, by comparison with the first quarter of 1894; and the increase in the second quarter had been £3698. This showed that there must have been considerable improvement in the state of trade; and the total increase in the receipts was about sufficient to pay the costs of the Pickles case, which would be between £5000 and £6000.

LEGAL INTELLIGENCE.

A Question as to a Sale of Engines.

In the Queen's Bench Division of the High Court of Justice last Saturday week, before Mr. Justice Grantham, an action was brought by the Tonbridge Water-Works Company, Limited, to recover from Mr. Cohen the sum of £150; being the agreed price of two engines sold to him. In April of the present year, the plaintiffs had at their works two engines for which they had no longer any need; and on the 19th of the month, they advertised for offers for them. The defendant wrote: "Please let me have specification, maker's name, form of tender, and lowest price for the engines you have for sale." Specification and full particulars were sent; and on May 6 he wrote offering "£150 for the two engines, free on rail at Tonbridge." Plaintiffs replied, stating that the offer would be laid before the Directors, and wishing to know what sum would be charged if the larger engine were kept for two months as a "lay-by." Defendant said he would agree to this, provided £20 were allowed to meet the extra cost of carriage. On May 10 the Directors accepted the offer of £150, but declined the proposal as to the £20. For the defence, it was argued that there was no clear and concluded contract between the parties; and, in the alternative, that there had been no tender or delivery by the plaintiffs. His Lordship held that the letters disclosed a binding contract; and he gave judgment for the plaintiffs for £150, with costs.

A Claim in Respect of Gas-Engine Starters.

At the Newcastle County Court on Monday last week, before his Honour Judge Greenwell, Messrs. H. Watson and Son, engineers, of Newcastle, brought a claim against Messrs. Crossley Bros., Limited, in respect of some gas-engine starters, which, as they alleged, did not do the work for which they were warranted. Mr. Hedderwick appeared for the plaintiffs; Mr. Temperley, for the defendants. Mr. Hedderwick said the claim was for £15, the price of three Lanchester starters, and an implied warranty that the starters were fit for the purpose for which they were made; and, in the second place, an agreement to take the starters back at the original price paid for them. The defendants had at Newcastle a Mr. Ellis as their agent. In the year 1892, the plaintiffs built new workshops; and they desired to obtain engines of a suitable character for their business, and applied to the defendants, among other people, for engines such as would meet their requirements. On Jan. 7, 1892, the plaintiffs agreed to purchase from the defendants five gas-engines, for a lump sum of £1240. There were present at the time the bargain was made, Mr. Urwin, the Engineer to the defendants, and Mr. Huffam, who, he presumed, was their Manager; and they urged upon Messrs. Watson the desirability of their purchasing, in addition to the engines, some Lanchester starters, the price of which was £5 apiece. They were told that these starters would save hand labour, and would start the engines immediately. The plaintiffs agreed to increase their order as suggested. The engines and starters were sent; but the starters were found to be useless—requiring considerable hand labour to start them. The defendants sent their Engineer to see what was the matter with them; but he was compelled to go away leaving the starters practically no better than they were before. The plaintiffs complained, and the defendants replied that the starters were never represented as fit to start the engines with the shafting on; and they offered to take the starters back, and to supply their patent pump-starters, which would start the engines with the shafting on, at £15 each. His Honour gave judgment for the plaintiffs for £15.

Incandescent Gas-Burners for Public Lighting at Ipswich.—At the quarterly meeting of the Ipswich Town Council last Wednesday, the Paving and Lighting Committee presented a report recommending that a contract be entered into with the Ipswich Gas Company for fitting 879 public lamps with incandescent gas-burners, in place of the existing 5-feet burners, at £3 11s. per lamp where the columns belong to the Company, and £3 9s. per lamp where they are the property of the Corporation; the hours for lighting and extinguishing to be the same as at present. Mr. G. F. Josselyn, in moving the adoption of the report, explained that from the 879 lamps to be fitted with incandescent burners a light of 40-candle power each would be derived, in place of the 14-candle power previously given. He said the Gas Company, who had met the authority very fairly in the matter, were prepared to spend from £800 to £1000 over the installation of the new lamps; and the cost to the town would not exceed £90 or £100, or about £20 less than the estimate of the year for improved and better lighting. The result of the change would be that Ipswich might lose the unenviable reputation of being a badly-lighted borough. The report was adopted The new contract is to run for three years.

Completion of the New Water-Works for Baildon.—The official inspection which the members of the Baildon District Council recently paid to the reservoir at Hawksworth Moor, marks the completion of an extensive and costly scheme. The construction of the reservoir has been a work of four years' duration. Almost from the date of the formation of the Baildon Local Board, in 1852, the water-works have entailed serious charges upon the township; and it is a matter of much satisfaction that the district has now a provision which is calculated to meet the requirements of the next thirty years. In pursuance of parliamentary powers granted in 1890, the Board entered upon a scheme which was estimated to cost £16,000, and which would provide a reservoir of 30 million gallons capacity. About 21 acres of land were secured; and work was proceeded with for the construction of a reservoir measuring 8 acres at the top water-level, and capable of storing, at the deepest point, 30 feet of water. The specifications have been complied with, except in regard to cost. The soil proved to be rocky, and the puddling was insufficient, with the result that some of the work had to be done over again; and it is probable that, when the whole cost comes to be reckoned up, it will not be less than £30,000.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Bridge House Hotel, London Bridge, last Wednesday—Mr. George Livesey in the chair.

The Secretary (Mr. Frank Bush) read the notice convening the meeting, and the minutes of the last meeting; and the report of the Directors was taken as read.

The Chairman said that, before proceeding to deal with the very important business in paragraph 6, to which he would have to ask their patient and earnest attention presently, it was necessary for him to make a few remarks on some of the other paragraphs in the report. The first point he would refer to was mentioned in the first paragraph —the reduction in price. They had now come down to the old figure of 2s. 3d. per 1000 cubic feet. They would perhaps ask why they had reduced the price. His answer was that a low price meant an increase of business, which strengthened their position. It also meant that it enabled them to add to their reserve; and to restore it to something approaching what it was before. This was the only way in which they could increase the reserve fund. When he reminded them that the reserve, which formerly exceeded £250,000, was reduced three years ago to about £40,000, he thought they would agree that it was necessary to build up the fund again. Ultimately, too, the reduction of price was the only means by which they could increase the dividend. At present, as had been explained to (and approved by) the proprietors, it was not thought advisable to increase the dividend while the reserve fund was at a low figure; but when they got the fund up to a satisfactory amount, then unquestionably the reduction of price would entitle the shareholders to, and they would have a right to expect, an increase of dividend. He did not, however, think he could promise that yet. While on the subject of the reserve, he might mention that of the £5896 added to it on the present occasion, £3437 came from the "A" stock—being 1⅜ per cent. on their capital; £1687 from the "B" stock —¼ per cent. on their capital; and £771 from the "C" stock—½ per cent. on their capital. The "A" stock had therefore contributed about three-fifths of the increment to the reserve. This was according to the Act of Parliament, and could not be altered. There was another way of building up a so-called reserve; but the Directors considered that this was not the legitimate method. It was possible to accumulate a very large undivided balance. They could keep up the price of gas, so retarding business, but adding to surplus profits, and carrying them forward half year by half year, till a very large amount was accumulated. This was not a violation of the letter of the Act; but it was certainly a violation of its spirit. When the Act was passed in 1876, it was set out that there should be no increase of the reserve fund except by the shareholders foregoing dividend; but they were allowed to carry forward an undivided balance. They might depend upon it, however, that those companies which carried forward an unreasonable undivided balance, would find trouble in store for them when they next went to Parliament. They themselves preferred to carry out the spirit of the Act, and build up the reserve fund in the way provided by it. There was another reason why they did not propose to increase the dividend just yet—because they felt that every increase of dividend was now a very serious matter, considering the very high price their stock had reached in the market; and if they were to add ¼ per cent. to the dividend, it was probable that the stock would go up another 10 in the market. People who bought the stock at these very high figures would be much disappointed, and very angry probably, if in the course of a few years it should be found necessary to reduce the dividend, and thus diminish the market value of their property. They therefore felt that it was not right to increase the dividend until they were as sure as anyone could be that the advance would be maintained. Another paragraph in the report related to the price of coal. They had had some little difficulty in renewing their contracts. In 1894, there was a combination of coalowners, who succeeded in putting up the price somewhat, and they and the other companies had to pay a higher price; but this year the combination had fallen to pieces, and they had been able to make their contracts at the market prices. But there had been a little difficulty. Their friends on the other side of the river put into their contract for 1894 a clause that if any of their contractors should sell in 1895 to the South Metropolitan Company at a lower price than their 1894 rate, their contractors were to give them a rebate on their 1894 prices equal in amount. They themselves had to circumvent this in some way; and the result was that they bought their coal this year at the market price. Their friends did not get the rebate, because this Company did not buy of their contractors; and the only thing he regretted about the matter was that in one or two cases an old-standing connection had been broken, and contractors with whom they had dealt for the past thirty years had been shut out in consequence of the absurd restriction to which he had alluded. He might refer incidentally to the effect of this increase in the cost of coal. It had caused a rise in the price of gas all over the kingdom; but he would only deal with London. They first of all tried to meet it out of their reserves, which were depleted very considerably to pay for the strike. This they would have got over; but the price of coal afterwards went up in consequence of the nonsense about the living-wage, strikes, and one thing and another, until it was found absolutely necessary to raise the price of gas. They took £370,000 from their reserve; and then they raised the price of gas, which took £220,000 from the consumers. In the case of their Company alone, therefore, the losses and expenses in connection with the labour troubles and coal strikes had been nearly £600,000. As to the rest of London, the increase of price of the big Company north of the river amounted to £1,870,000 in the three years; and that of the Commercial Company, to £90,000. The consumers of London, in consequence of the labour troubles and the high price of coal, had thus had to pay in the last three or four years £2,180,000 more for their gas, and something approaching that figure was also lost by the

Companies into the bargain. What the better were the men for it? They had gone back to their old wages, and thousands of them were to-day out of work. It was stated by the Chairman of the North Eastern Railway Company, at their meeting last week—quoting from the Board of Trade—that in the midland districts, where they had got the living-wage fixed, the men were working 3·65 days a week on the average; while in Northumberland and Durham, where the men were wiser, and had settled their differences as to wages by agreement, they were working 4·91 days, or nearly 5 days against less than 3¾ days in the other case. He could not see that any good had been done to anyone, but infinite harm all round, by the action of the men. It was now ten years since they had their last amalgamation, which dated from the beginning of 1885; and he was therefore able to make a comparison showing the Company's progress in this period. He found that the increase of business amounted to 70 per cent. The gas consumed in the June half of 1895 was 70 per cent. in excess of that in the June half of 1885. In that time, they had increased their capital 43 per cent., and the capital charges had only increased 25 per cent.—that was, their business had increased in a greater ratio than their capital, and they had raised their capital at a lower rate than before, mainly through the issue of debenture stock. He thought that this at all events proved one thing—namely, that an endeavour to meet the public by giving them every possible facility for obtaining gas, and by trying to sell gas at the lowest possible price, had told its tale; and he believed their increase of business of 70 per cent. in ten years was sufficient proof of this. It had had another effect. In the June half of 1885, they required 13¾d. per 1000 cubic feet to pay interest on debenture stock and a dividend of 12½ per cent., whereas in the June half of 1895, they required only 9¾d. to pay interest and dividend of 13 per cent.; so that, by the increase of business and the raising of capital at a lower rate, their capital charges were reduced by 4d. per 1000 cubic feet sold in the ten years. This was the best proof to his mind that their business was sound, and that it would remain so. Comparisons were said to be "odious;" but it was not always possible to form an opinion without them. He found that The Gaslight and Coke Company had increased their business by 24 per cent. in the ten years; and that whereas ten years ago the gas sold by the South Metropolitan Company was only 29 per cent. of that sold by The Gaslight and Coke Company, it was now 40 per cent. They were therefore gaining on the other Company hand over hand. He had now to correct one or two mistakes which had recently been made; and paragraph 7 of their report led him to it. This paragraph was as follows: "The Directors have again to express their satisfaction with the good and loyal spirit that animates their officers and workmen." They had what was called the Bonus Festival this year, as they had had it every year since the strike; and statements were made about the result of the profit-sharing business. Some of the newspapers had put the bonus in the year at £41,000; but this was not the case. The amount of accumulated bonus and savings of their workmen deposited with the Company up to a year ago was £38,000; whereas it was now £41,000. But beyond that, a year ago the workmen and employees had invested, in connection with the profit-sharing business, something like £17,700 in the Company's stock. That was now increased to £25,000; so that altogether on the 30th of June there was £66,000 standing to the credit of the workmen as the result of the profit-sharing arrangement. This he thought was pretty good proof that they had the workmen's confidence, and also that the arrangement was a success. He had never from the chair said one word about the electric light. As far as they were concerned, the electric light had gained no footing in their district. The Company, however, had shown them no antagonism, and their people had given them help in altering their mains when they—the electrical people—wanted it. But they were now getting a little spiteful. He had read in the *Electrical Review* this passage: "Their consumers' meters always seem to run very fast, as though trying to outrun the works meter." Farther on, the article continued—referring to the profit-sharing bonus—"They have such opportunities of squeezing another ten or fifty thousand out of the public by increased charges, or of saving at the works by reduced cleansing of the gas or a reduction of lighting power, that the great bane of profit-sharing—viz., a year with a loss—never occurs." This amused and pleased him, because when people began to get spiteful, it was a tolerably clear proof that they were losing. He now came to the important part of that day's business. Paragraph 6 of the report was as follows: "The Committee of the House of Commons having refused to sanction the conversion of the Company's stock from a nominal 10 per cent. into double the amount of 5 per cent. stock, the Board thereupon withdrew the Bill. In these circumstances, the Directors desire the opinion of the proprietors as to the expediency of re-introducing the Bill next session." He might as well, perhaps, quote what was said by the Counsel for the London County Council, who opposed their Bill, although really he did not think that Counsel had any instructions to specially oppose the stock-splitting proposal. He said: "What was good for gas companies was good for water companies. Grant this to water companies, and mark what would happen. . . . In case of purchase, that would involve an immediate and unquestioned rise in the purchase price of the water undertakings, as against the ratepayers of London." This was absolute nonsense; and there was not a shred of foundation for it. However, it had its effect on the Committee. This Counsel did not prove what he said by calling witnesses; and by not putting in evidence, he deprived the Company's Counsel of the opportunity of replying. After the Committee had deliberated, the Chairman said: "The Committee are not prepared to approve the preamble of the Bill, so far as the stock-splitting clauses are concerned." When that was announced, there were three of the Directors of the Company in the room. As that was the main object, their Counsel was instructed to withdraw the Bill. After that, the Committee of the House of Commons made this special report to the House: "That the Committee considered that the subject of conversion of stocks was one of so far reaching importance, that it ought to be dealt with by a Committee specially appointed to consider the same as affecting gas and water companies." There might be some members of Parliament present at that meeting, but one could not speak with the utmost respect always of members of Parliament; and at the very time when this sapient Committee were framing this resolution, the House itself was passing another Bill. In the very same week that the Committee rejected their stock-converting scheme, the House of Commons passed the Newmarket Gas Bill, which authorized precisely the same thing to be done; and a fortnight later the House of Commons passed the Scarborough Gas Bill, with a precisely similar clause authorizing the splitting of the stock. As to the objection of the Counsel representing the London County Council, he had said that it was nonsense, and that there was not a shred of foundation for it. The fact was that the conversion of stock would not affect the public in any way adversely, although it might benefit them by enabling the Company to issue stock at a little higher price. But with all the schemes of purchase with which he was acquainted, the market value of the stock had not been taken as the basis of purchase, but always the dividend or earning power. So many years' purchase had been given, based on the dividend or earning power of the undertaking. He therefore thought it was pretty clear that the objections raised by the Counsel of the London County Council were groundless. Moreover, in addition to the two Bills passed this year, when the House of Commons entirely ignored the recommendation of their own Committee, in 1891 the Bristol Company, in 1892 the Oxford Company, in 1893 the Crystal Palace District Gas Company, and in 1894 the Plymouth Gas Company, all obtained similar powers without any objection whatever. They were now going to ask the shareholders' opinion as to the advisability of reintroducing the Bill. He was not going to ask their opinion as to the principle of the Bill, as he considered that that was conclusively settled at the last meeting, and by what followed from that meeting. The Bill was laid before them for converting the stock. There was some little question as to the "A" and the "B" stock, and whether one of them was to get a little the better of the other. But the result of the meeting was a unanimous vote. There was one hand held up in the back of the room against it; but this person disappeared, and they could never find out his name. The probability was that he held up his hand against the resolution by mistake; and they might say that the meeting was unanimous. After the meeting, they endeavoured to get the assent of the shareholders; and although there were a few—perhaps half a dozen holders of the "A" stock and half a dozen holders of the "B" stock—who objected, when they got the Bill into Committee everyone had withdrawn his objection, and they were able to tell the Committee that their proprietors were quite unanimous in their desire for a conversion of the stock. He was therefore not going to suggest that the present meeting should redetermine that question. What had to be decided was whether they were to reintroduce the Bill. The advantages of unification and conversion of the stock were so clear that he need not dwell on them. One advantage not mentioned as to the unification was that at present there was a feeling or sentiment of—he did not like to use the word jealousy, but something approaching it, between the "A" and the "B" stockholders. One might think he did not get enough; and the other that he gave too much. It would be a very grand thing to have a perfectly united proprietary, to have one uniform class of stock held by the proprietors, and all possessing (and feeling sure that they possessed) perfectly identical interests. The great rise in values which had occurred since last year had raised the question whether they should split or double the stock—whether it would not be well to convert the stock into a 4 per cent., rather than a 5 per cent. stock. That, however, would be a matter for consideration if the meeting determined that the Bill should be reintroduced. He now came to the critical part of the subject. It was not usual for Directors to issue a report on an important question without making a recommendation. The fact was, as probably they were aware, the Board were divided. He was very sorry for it, but it was the fact; and therefore they must appeal to the shareholders to put them right. The report as originally drafted—he himself always drafted the reports—contained a clause about the matter, which read thus: "The Directors have carefully considered the question, and have decided, subject to the approval of the proprietors, to reintroduce the Bill next session." That was unquestionably his desire; for he believed that if they did not reintroduce the measure next session, their chance would be gone. They now had the "A" and the "B" stockholders together; and he thought they would be together for another year. But if they were to wait for a couple of years, it might be hopeless. His own feeling was that the Bill should be reintroduced next session; but a majority of the Board took the view that it should not be reintroduced, and said that "the Committee of the House of Commons having refused to sanction the conversion of the Company's stock from a nominal 10 per cent. into double the amount of 5 per cent. stock . . . the Directors think, looking to all the circumstances, it is not advisable to reintroduce their Private Bill." They did at last become unanimous as to the report which was issued, in which they said that they would leave it to the proprietors to express their opinion as to the expediency of reintroducing the Bill next session. He would now tell them what divided the Board. He wanted to have inserted in the Bill a proposal for extending the area of representation; and he had to ask the shareholders kindly to dismiss everything like prejudice, and to consider that they were all animated by a desire for what was for the good of the Company. At their last meeting, some little prejudice was created by a premature publication in a newspaper; but that feeling, he hoped, was past and gone. It was necessary that he should explain the matter rather fully. It had been the growth or development of some years. They began at the time of the strike with the profit-sharing arrangement, for the purpose of attaching their employees to them; and this measure had been admitted on all sides to have been very successful. But that was not sufficient. The men merely taking so much percentage on their wages year by year would do good in its way, but it did not go far enough—at any rate, not to his mind; and therefore they made an extension of the profit-sharing. They offered to increase the percentage on the wages, if the employees would consent that half of the annual bonus should be invested in the Company's stock. That was begun last year; and, as he had said, there was now something like £25,000 of the employees' money invested in the Company's stock. What followed from this? Where a man had his money, he had a right to a certain control over it. He was not going to say the employees' holding or possible holding for a good many years would be sufficient to give them a right, on a

strictly proportional basis, to representation on the Board; but it was sufficient to warrant something being done. The most important question, he thought, that affected them commercially and industrially, was that of reconciling capital and labour. If these at present antagonistic interests were not reconciled, it would be a bad day for England. Although apparent peace existed at the present time, there was a few years ago a violent attack on capital. This was dying out; but they might depend upon it that the time of trouble would come again, and what he and some of his colleagues wanted to see was that when that time did come (when times of prosperity returned, and labour thought it had its chance again), it should find them a perfectly united body—shareholders, directors, officers, and workpeople all united together to promote the good of the Company. To arrive at that point, however, it was necessary that they should show their confidence in their people; and he thought, too, that a step of this kind was necessary to combat "the advent of Socialism," which Herbert Spencer said, in a recent letter, "will be the greatest disaster the world has ever known." What they had to do, as employers of labour, was that which should tend to win their people from the side of the socialists to the side of those who were anxious to preserve all that was good in our system. It was not a new thing; it was brought to his notice when he was sitting on the Labour Commission three years ago; and the more he thought of it, the more convinced he was that it was a right and proper step—that it was unquestionably right that their employees, when they became large investors in the Company's stock, should have some representation on the Board. He might have known six months ago, but he knew it now, that the workman-director, as the JOURNAL OF GAS LIGHTING said, existed. The system had been tried for nine years by Mr. Thompson, of Huddersfield, who had sent him a letter in which he said that three of their men were on the board of management; and that, instead of causing any difficulty, they had helped make the thing go. Mr. Brownfield, of the Potteries, had converted his business into a Company, or co-operative guild, and had workmen-directors doing well. In London, there was a "Co-operative Lighterage Association," or Company; and they had two of the workmen on the Board of Directors. These men worked all the time when they were not attending the Board; and when they did attend the Board, they were paid a fee of 10s. each. He knew a good many of the labour leaders—some of the best, and some of the worst. Of the best, he could say that there were no men he more highly respected than some of them, whose desire was to bring capital and labour together to work harmoniously for one common good. As regarded the aim of the others, he would not say anything, except that their object was not, at any rate, for the benefit of capital. He had received the permission of the Duke of Devonshire to read his Grace's opinion. He sent the Duke a statement of what was proposed; and he replied: "I have read your memorandum with much interest, and can see nothing but advantage from a public point of view, if you are able to overcome the practical difficulties." Sir Michael Hicks-Beach (whose authority he had to make the statement) said: "My own feeling is that the fact of such a representative being in the Company's service, would make his presence on the Board rather more valuable than otherwise. I do not see how the contrary view could be maintained by anyone who approved of the principle of workmen being shareholders." Well, they had all approved of that. At the time their Bill was passing through Committee, the House of Commons itself was giving an expression of opinion on the subject of profit-sharing. Mr. Mundella moved an "Instruction" to the Committee that a clause should be inserted in the Bill authorizing the shareholders at the proper time to make arrangements for the election of workmen-directors. This "Instruction" was moved by Mr. Mundella, seconded by Sir Michael Hicks-Beach, and supported by Mr. Bryce. These three gentlemen had held the position of President of the Board of Trade. Mr. Mundella remarked—quoting from *The Times* report of the debate on the subject—"If this system of profit-sharing which Mr. Livesey advocated were adopted, he (Mr. Mundella) believed it would have the very best possible results when it came into operation." Sir Michael Hicks-Beach said that he "entirely agreed with the spirit which dictated this proposal. He thought they all felt that if some provision even of a tentative character were made for the representation of the workmen on the Board of Directors, it would be desirable; and any company which took the initiative in carrying out such a scheme, really would deserve well of those who desired to promote good social relations between the employers and the employed." Mr. Bryce said he "thought the object aimed at would command approval in every part of the House. He thought there was nothing more desirable than that the principle of profit-sharing should have a fair chance." That "Instruction" was passed unanimously by the House of Commons. He (Mr. Livesey) thought that what he had said justified bringing this matter forward. He liked Sir Michael Hicks-Beach's suggestion that the thing should be merely tentative. All he (the speaker) suggested was that they should have the restrictions removed which prevented them from doing this. If theirs was a private concern, not bound by Act of Parliament, and the Directors and shareholders thought it desirable that there should be this representation on the Board, they could act upon their feeling in the matter; but they were themselves fixed hard and fast by Parliament. They had seven Directors, each of whom must have a qualification of some thousands of pounds; and it was impossible to do anything in this direction unless the existing ties were relaxed. All he asked was that a clause should be inserted in the Bill giving the Company permissive powers; and when the workmen's investment had increased to, say, £50,000, the Directors should have authority to prepare a scheme to be submitted to the shareholders and approved by the Board of Trade, to enable the employees to select one or more representatives to sit on the Board and assist in the management of the Company. It was said that it would very likely not succeed. He did not believe that—he thought it would succeed; but to meet the fears of those who said it would not, the workmen's representative must have certain qualifications in the first place. They would not elect a man who came into the Company's employment yesterday. Just the same with ordinary Directors, they must have been shareholders for some time, and hold so much stock; and the same rule would be applied to the men. They must have been in the Company's service not less than seven years, and have invested (say) £100. At any rate, he would have it provided that the scheme should only be for three years. If it worked badly, it would then expire by effluxion of time; while if it worked satisfactorily, it could not go on without again receiving the consent of the shareholders and the approval of the Board of Trade. If the proprietors wanted the Bill to be passed, and wished him to help in passing it, this clause must go in; for in face of the "Instruction" of the House of Commons, and of the view he held, he would not be a party to reintroducing the Bill without it. He believed that in this matter, as in others, "faint heart never won fair lady." He held that labour was the "fair lady;" that she was worth winning; and if they could win her they would have a period of prosperity such as they had never known before. (Applause.) He had been the pilot of this concern since his father's death in the year 1871. The present was not the first time that they had had a divided Board. They had a difference over the sliding-scale; and the shareholders put the matter right. One Director retired, and another was elected in his place. They had a divided Board when the question of amalgamation came up—a question of vital importance to the old South Metropolitan Company. In this matter, again, the shareholders took the case in their own hands; and when the election of a certain Director came round, another was put in his place, and the amalgamation was the starting-point of the increased prosperity of the Company. So long as God gave him the ability, and he had the shareholders' confidence, he would serve the Company, not for the fees, but because he was proud of his connection with the Company. But at the first sign of failure of ability, or of want of confidence on their part, his resignation would be given. If they had confidence in him, they would express it at that meeting. If not, they would know what to do; and he would also know what to do. He concluded by moving the following resolution: "That the report and accounts now presented be received and adopted, and, with an instruction that the Bill be reintroduced next session, the report be entered on the minutes."

Mr. R. MORTON remarked that on several occasions he had seconded the adoption of the half-yearly report; but he never before rose with such a sense of responsibility as he did on the present occasion. He felt quite sure that the shareholders would agree with him that rarely, if ever, had the report and accounts been more satisfactory than those now submitted for their approval. He need not dwell on this, or say much more in addition to what the Chairman had said on the first part of the sixth paragraph. He thought the instruction to reintroduce the Bill for the consolidation and conversion of the stocks would be given unanimously. He was greatly impressed with the new departure which the Chairman had dwelt upon, not only in the advantage it would be to the undertaking in carrying out its varied operations—and he believed it would be of great advantage in that respect—but also in the justice and righteousness of the proposal as one for general adoption. He considered that, if it were anything like generally adopted, it would be the means of getting rid of a very large proportion, at all events, of those labour troubles to which the Chairman had referred, and make the working of joint-stock and private concerns more harmonious. It would also tend to elevate those in whom they were all interested. Moreover, he believed that if the shareholders gave an instruction for the introduction into the Bill of the labour-director clause, it would not only not militate against the passing of the other clauses of the Bill, but would greatly help them on. He had a profound conviction, from what passed when the Bill was before the Parliamentary Committee previously, that this would be the case.

Mr. HARRIS said he thought the resolution should be divided. He believed they would all agree in receiving and adopting the report; but there might not be agreement regarding the Bill.

The CHAIRMAN said there was no harm in separating the adoption of the report from the reintroduction of the Bill.

Mr. STOCK inquired if he gathered that the Bill was lost before because the clause approving workmen directors was not in.

The CHAIRMAN replied that in his opinion that was so.

Mr. STOCK said he regarded the proposal as a very good one; and he would support it to the utmost of his power. He thought the majority of those present would endorse the Chairman's opinion as to his knowledge of gas companies, and of the best way to work them. He considered that when the men had £50,000 invested in the Company, it would be a very proper sum for justifying them in having a representative on the Board.

Mr. FOSTER remarked that the Chairman had given this subject his attention for the last three years, and was still of the same opinion. They had followed their Chairman implicitly for many years. He had their entire confidence; and in the way in which he proposed that workmen directors should be appointed, he (the speaker) saw no objection whatever. He thought their great effort in these times must be to amalgamate the interests of capital and labour. They too often found these interests antagonistic; and if, by adopting the system recommended by the Chairman, they could do away with these difficulties, he said let them give it a fair trial. The Chairman had asked for three years; and he himself was quite sure that at the end of that time they would not want to discontinue it.

Mr. J. EWART said that at their last meeting the views of the majority of the Board were expressed somewhat late; and he thought they were under considerable disadvantage, perhaps, from that. He now proposed to say a few words in which he would endeavour to express the views of the majority of the Board. They were extremely sorry, of course, that the question had come to this point; and he might say, personally, that the majority of the Board were still more sorry that the Chairman had put the matter to the shareholders in the form he had done. It seemed to him that it was not a question of such vital importance, as the Chairman had said, as to amount to a vote of want of confidence if the proposal was rejected. To his mind, this was putting rather a severe strain on the loyalty of the shareholders. They were adopting a very unusual course. In all companies, as a rule, the opinion of the majority certainly guided the policy of the Board, and these questions were not brought before shareholders; and shareholders might very fairly say, as one of them said to him after their last meeting, "You are paid as Directors to settle these questions among yourselves. I do not know why you should appeal to us when you are in a better position to form an

opinion than we are." As the Chairman had said, the matter had come to rather a critical point among them; and it seemed best that the shareholders should settle which course they preferred to follow. As regarded what had taken place since their last meeting, the Chairman had told them what his view was of what took place before Parliament. With respect to the "Instruction" of which the Chairman had spoken, he himself differed very strongly from Mr. Livesey regarding the importance he attached to this matter; and he believed that, when he explained the circumstances as they were within his knowledge, the proprietors would agree with him. This "Instruction" of Mr. Mundella was only put on the paper the day before the motion was brought forward. This was on a Wednesday, when the House met at twelve o'clock. Therefore members of Parliament were only in receipt that day of the information that there would be such a motion. He heard of it a little after eleven o'clock; and Parliament was to meet at twelve. He immediately went about to see various members he knew, to ask them to go to the House to oppose the motion. but there was no time. It was a surprise motion, and did not express in any way, to his mind, the intelligent view of the House; and he might also say that the House as constituted now was a very different body from what it was at that time. They also differed very strongly from the Chairman as to the question of the representation of the workmen. The Bill expressly provided, as he said at the last meeting, that the voting qualification should be very materially reduced, and at the same time the voting power be substantially increased; and in that way the workmen shareholders, like all the other shareholders, were amply protected. Besides that, there was this further difficulty—that with this special qualification they would also be qualified to vote for ordinary directors, and therefore they would be entitled to double votes—[The CHAIRMAN: Certainly not]—unless some special provision was made for that, of which they had not heard. The instances the Chairman had mentioned—of three or four companies where this system of workmen directors had been introduced—really did not bear much on their position. These were quite small companies, with a very small number of proprietors. In one case, the family held nearly all the shares; and if any disaster should happen from this arrangement not being a success, no great harm would follow. Theirs, however, was a very important concern, with between 5000 and 6000 shareholders, many of them ladies and people in moderate circumstances; and therefore, if this scheme did not succeed, they would suffer very much. Beyond that, the Directors had a responsibility to the public; and the consumers would also be adversely affected by anything that caused the Company to increase the price of gas. His colleagues at the Board for whom he was speaking and himself saw no reason to change their views since their meeting in the spring of this year. As he had said, the "Instruction" of the House of Commons was not of the importance attached to it by the Chairman. The various gentlemen the Chairman had quoted had had opportunities themselves of introducing this form of representation on Boards with which they were connected; and they had not done so. It was the old story of the cat, the monkey, and the chestnuts. They would be very glad to see this scheme adopted by someone else, and prove a success; and, if so, it might be time enough for this Company to adopt it. Moreover, there was no desire on the part of the men, as far as they could ascertain, to be represented on the Board in the manner suggested. One would have thought that since the last meeting, the Directors would have received some expression of opinion from the men on the subject; but this had not been the case. There had been no meeting of the men, no representations, no petition, no anonymous letters of any kind, saying that the Directors were doing the men any injustice. On the contrary, from information he had, they took no interest in the matter; and the very few who did were rather puzzled than anything else about it. It seemed to the majority of the Board that the whole thing was premature; and it could not take effect for a number of years, when circumstances might be completely changed. On every ground, it seemed to them that it was extremely undesirable to adopt such a proposal.

Mr. SIMPSON ROSTRON remarked that he was unfortunately not able to be present at the last meeting, as he had been ordered abroad by his doctor. They might therefore expect him to make a few remarks on this very important question. As to the consolidation and commutation of the "A," "B," and "C" stocks into a 5 per cent. stock, he supposed that none would doubt the advantage of the proceeding. Their only difference was whether the Bill for this purpose should have clauses enabling the Directors, after the aggregate amount of stock held by the Company's workmen had reached a certain sum, to take steps, with the approval of the Board of Trade, to secure the appointment of a workman director, and whether such appointment would be of advantage to the Company. In his opinion, the proposal was neither so new nor so startling as it at first sight might appear. It was the outcome and development of the root idea of the sliding-scale principle. Having referred to the origin of the sliding-scale, and alluded to its successful working, he stated that, when the amalgamations were carried out and the Greenwich works completed, and the new capital began to be remunerative, Mr. Livesey (who meanwhile had become their Chairman) once more turned his attention to the reduction of the price of gas. To get below a certain figure was not always easy; and to give a larger dividend with what might be a less revenue was like burning the candle at both ends. A larger dividend did not come automatically with a reduction in price; and the Company's business, therefore, needed pushing and greater exertions in order to obtain the necessary increased consumption. With this object, Mr. Livesey proposed—and the Board adopted his proposal—that a bonus should be given to the staff, if by their exertions the increased dividend was earned. The plan worked well; and then it was that this principle of identity of interest was developed another stage in the Chairman's mind by his bringing forward the profit-sharing scheme. Part of the bonus had for some time been invested in the Company's stock; and he had never concealed from himself that, if they had workmen shareholders, it was only a question of time when there must be a workman representative on the Board. To his mind, this was the logical result. He desired to notice an objection which had been urged, which at first he had felt disposed to admit, and which, so far as he knew, was the only one involving a principle—the other objections being rather suggested by timidity or feeling than based on principle. It had been said: "You propose a special representation; and all special representation is bad. Are not these workmen shareholders represented by the Board, like the other ordinary shareholders?" Now, this was one of those half-truths which were proverbially dangerous; for though, of course, the Directors represented every shareholder, it left out of sight the fact that the workmen were not ordinary shareholders. They could not go and buy the stock when the market was low, like ordinary shareholders, but must take it at the price of the day. It was a condition of the profit-sharing scheme that they should do so. They were a creation of the Company's action; and, as such, they were entitled, under proper regulations, to representation. Sectional representation of part of a class who were on "all fours" was bad; but special representation in certain circumstances was another thing. And this was already acted on in some companies. The scheme was optional, not compulsory. It was not to come into operation until the men's holding amounted to a large sum. No one could be eligible for election to the Board unless he had been seven years in the Company's service, and had had for twelve months previously what, for him, was a large amount of stock. No one would be allowed to canvass; and the duration of the scheme was limited. If not found satisfactory, it need not be renewed. Finally, the whole scheme was subject to the approval of the Board of Trade. Was the proposal, after all, so great a departure? Was it not much less so than that of 1876? The object of the proposal was to establish and strengthen the good relations now existing between the Company and their workmen. It was to encourage the workman to take an interest in his work, giving him the powerful motive of self-interest. Another object was to make the workman acquainted and familiar with the considerations and responsibilities of management and policy—in short, to enable him to see through the Directors' spectacles, and to consider what were the interests of the Company in its corporate capacity, taken as a whole, and also to render the other Directors more familiar with the feelings of the workmen and with the details of everyday work, as well as to receive hints and suggestions, which might be of practical value. In brief, it was to bring employers and employed closer together; and if it were successful, the Company would be immensely strengthened. There might be at first some little difficulties. What, however, he ventured to think would determine their vote that day, was the recollection that the proposal was brought forward, and if adopted would be carried out, by one in whom they had faith and confidence. Mr. Livesey accepted the responsibility of recommending it, for he believed in its success; and he might inform them that their Chairman was by far the largest shareholder in the Company. This was not either the first or second occasion when another step forward by Mr. Livesey had been objected to by some of his gas friends. In 1875, in his (the speaker's) judgment, Mr. Livesey took a stronger course than now. His advocacy of the sliding-scale, and with it the willingness to surrender the shareholders' right to all new capital at par, and of a certain 10 per cent. dividend secured by the revision clauses, was the occasion of his being disapproved of by one important member of his Board, who shook his head and declared that the Company's position was being endangered—that the public would never consent to higher dividends than 10 per cent.; and in Mr. Forster's Committee, the Counsel for the Gas Companies called him "Queen's Evidence" and "a traitor to his cause." But Mr. Livesey was not frightened; he persevered, and what had been the result? Larger dividends had been declared and acquiesced in, and the gas world had had peace for twenty years. Again, he had strong opposition when he proposed amalgamation; and recently, when profit-sharing was first started, there were friends who said: "Wait until you are forced to put up the price, and then you will see." Well, the price was later on put up, and the bonus was reduced; but nothing happened. On each of these occasions, after-events had justified the Chairman's action; and so he believed the objections or fears on the present occasion would prove to be groundless. Mr. Livesey and himself regretted that some of their colleagues differed from them; and therefore the question had been laid before the proprietors for their decision. Mr. Livesey believed that the inclusion of this permissive scheme would help to pass the Bill. He agreed with the Chairman; and he believed that the adoption of the scheme at the proper time would broaden and deepen the foundations of the Company. He asked the shareholders to adopt the principle, and so show their confidence in the ability of the man who had made their Company the first of its kind.

Mr. E. H. CARDWELL asked the meeting carefully to consider the use of obtaining parliamentary authority to make a great change in the constitution of the Board some years in advance of the time when that change could be carried into effect. He could not see, when they were anxious to make this change in the representation at the Board of some of the shareholders, what the difficulty would be in going to Parliament for a short Act, which would deal with this question, and it only. He thought the question should be dealt with quite separately. It was a very important one, and they had not had much time to consider it, and, moreover, they had not heard all the arguments against it.

Mr. DONKIN inquired whether he understood correctly that, if the scheme went forward, it would only last for three years, when they would be asked for another vote on the subject.

The CHAIRMAN replied in the affirmative.

Mr. DONKIN expressed his pleasure at seeing that the reserve fund had been so largely increased, and said he hoped the Directors would year by year see their way to augment it.

Mr. CARDWELL desired to add that, when parliamentary authority had once been obtained, although the scheme might, in a certain sense, cease on a certain day, yet that parliamentary authority would not be withdrawn; and there was no doubt in his mind that efforts would be made by persons altogether outside the Company, and not in any way responsible for its management, to induce them to bring on the scheme again.

Mr. HOGARTH said he had listened attentively to the remarks which had been made respecting the proposal; and having seen how it had acted elsewhere, he could assure them that he had never found a single

instance of failure. It had produced harmony, and had furthered the interests of any company that had adopted it.

A SHAREHOLDER, whose name did not transpire, said he most heartily supported the motion both for the adoption of the report and the instruction.

Mr. GRICE inquired how many employees of the Company were now shareholders.

The CHAIRMAN: Over 2000. Continuing, he remarked that it was a perfect illusion to say that, by reducing the voting qualification, the employees' position would be strengthened. The Board, for many years, could out-vote the whole of them. It was not necessary for him to go through his notes in order to reply to Mr. Ewart, who had said nothing practically against the proposal. If those who were opposed to his views would suggest some better plan, or show how the object could be better attained, he would be the first to listen to it. He then put the motion as he originally proposed it; adding that he might divide it to suit Mr. Harris, but this was the form in which the Board agreed that it should be put to the meeting.

The resolution was then carried, with not more than half-a-dozen dissentients in all.

The CHAIRMAN thanked the meeting, and remarked that their vote was the best answer to what had been said.

The DEPUTY-CHAIRMAN (Captain T. B. Heathorn, R.A.) then proposed the following resolution: "That a dividend at the rate of 13 per cent. per annum be now declared, and that such dividend, with the exception of the sum of £500, be apportioned amongst the three classes of stock as prescribed by the Scheme of Amalgamation, 1880; and that the warrants be transmitted to the registered addresses of the proprietors by post."

Mr. ROSTRON seconded the motion, which was carried unanimously.

A resolution was afterwards proposed electing Mr. G. M. Footner an Auditor, in the place of Mr. A. Footner, deceased; and a cordial vote of thanks was passed to the Chairman and Directors.

The CHAIRMAN, in reply, stated that he rose on that occasion with peculiar pleasure, to thank them for their vote; and he was glad to think he could do so for his colleagues as well as for himself. There had been divisions of opinion among them; but he hoped that the meeting had settled them. He trusted now that they would be a united Board, as they had heretofore been, for a disunited Board was simply intolerable. The object of all of them was to do what they considered best for the interests of the Company. Their interest was with the Company; and they intended to do the best for the Company in the future, as they had done in the past. He could not conclude without recognizing the admirable services which were rendered to the Company by their officers. His brother, the Engineer, was head of one department, and Mr. Bush was head of another. Both these gentlemen had the deepest interest in the Company, for which they were doing their best, as were also the officers and workmen who were under them. He would not say that every man did his best, because there were some who took no interest in anything. They were, however, finding out who these were. But on the whole, he thought they were served by a thoroughly good set of officers and workmen.

Mr. ROSTRON seconded the motion, which was carried unanimously.

The CHIEF ENGINEER (Mr. Frank Livesey), in acknowledging the vote, stated that one of the Directors had reminded him that their leakage looked rather heavy; but it was not really so.

The CHAIRMAN: It is under 5 per cent.

The CHIEF ENGINEER, continuing, stated that there was also so much gas now used in the daytime that they had to give a much heavier pressure. The works were being maintained in the most efficient condition; as they desired to conduct the business of the Company in the most economical way.

The SECRETARY also replied, remarking that it was a source of great gratification to the officers to think that they had been able to get the price down again to the old figure of 2s. 3d. He did not know whether they would ever reach the ideal figure of 2s., which had been so often talked about; but they would try for it.

The proceedings then terminated.

Plymouth Corporation Water Supply.—The Consulting Engineer to the Plymouth Corporation (Mr. James Mansergh, M.Inst.C.E.) and their Water Engineer (Mr. E. Sandeman) have just presented to the Town Council a report on the condition of the works at the Burrator reservoir up to the end of June, with an accompanying statement of expenditure. The Engineers repeat what they previously said—that at Burrator the cost would probably not exceed the estimate, but that at Sheepstor it would do so. This, however, is regarded as being relatively an unimportant part of the work. The quantity of material taken out of the Burrator dam was 25,070 cubic yards; and that taken from Sheepstor dam, 8041 cubic yards, as against 7000 yards in the estimate. The total amount spent on the reservoir since the commencement of the works has been £25,160 12s. 1d. The preliminary work of clearing the site, trial pits, &c., cost £610. The expenditure on plant has been £6506, and on workmen's dwellings, sheds, stores, offices, cottage, magazine, stables, and water supply, £2251; while the cost of the works connected with the diversion of the river has been £929. After charging to the Burrator dam the wages, salaries, cost of pumping in full, and making a proportionate charge for plant and the auxiliary works, the cost of the excavation amounts to £8487. From this amount, the value of the rock suitable for building—about 10,000 cubic yards, worth £4000—may be deducted. When this is done, the cost per cubic yard of the excavation works out to 3s. 7d., as compared with 4s. in the estimate. Owing to the great depth to which the Sheepstor trench has been taken, and the large quantity which it has been necessary to pump, the cost of the work there has been much in excess of the estimate. The total amount chargeable to this dam is £3090; and the cost of the excavation per cubic yard has been 8s. 11½d., or 8s. 6½d. after making allowance for the excavated rock. This stands against 3s. in the estimate. A very serious item of cost in this trench has been the timbering necessitated by the greatly increased depth to which it has been necessary to go on account of the pervious vertical veins. Upon this, £2268 has been spent.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Half-Yearly Report and Accounts.

The report of the Directors of the above-named Company, with the accounts for the six months ending June 30 last, has been issued in view of the ordinary general meeting next Friday. The Directors report with pleasure that there was a large increase of business during the half year, to a considerable extent due to the prolonged and severe frost in January and February; but, beyond this, the increase in the second quarter was at a very satisfactory rate. This enabled the Company to meet the very considerable fall in the value of coke and ammonia, and to present accounts which show that the full dividend of 5¼ per cent., to which, under the sliding-scale, the shareholders are entitled, has been earned. The price of coal, which last year was forced to a figure above its market value by a combination of the coal-owners, has, on the collapse of that combination, fallen perhaps to a lower point than it would otherwise have reached. The Directors have consequently made their new contracts at an appreciable reduction. The benefit of this, however, was not felt in the past half year. It will now assist in meeting the depreciation in the value of coke and ammonia; and it also enables the Directors to make a reduction of 1d. in the price of gas, which from the June quarter will be 2s. 7d. per 1000 cubic feet. There is no falling off in the demand for automatic meters. The Directors state that the profit-sharing system started last year is working satisfactorily with the Company's officers and workmen. Many of them are becoming shareholders; and they have deposited with the Company at interest the large sum of £4107 5s. 7d. This, they remark, is satisfactory evidence of confidence in their employers. The Directors recommend dividends at the following rates per annum: 5 per cent. on the preference stock, and 5¼ per cent. on the ordinary stock—amounting, inclusive of income-tax, to £15,543 15s. There will remain a small surplus to be added to the undivided balance, which will then amount to £5349 1s. 7d., to be carried forward. The Directors recommend an addition of £50 per annum to the Secretary's (Mr. Charles M. Ohren's) salary from the 1st of January last.

The accounts accompanying the report show that a sum of £4996 was expended on capital account in the six months ending June 30 last. Of this, £1621 was for buildings and plant, £1535 for new meters and fixing, £1181 for new gas-stoves; and the remainder for new mains, services, and lamps. The total capital expenditure was brought up to £633,399; leaving a balance of £28,994 still available out of the £662,393 called up. The total gas-rental in the half year amounted to £64,266; the rental of meters (12,458 ordinary, and 2316 automatic), to £1025; the rental of stoves (3516 ordinary, and 1416 automatic), to £505—together, £1530; residuals, to £18,855; and the total receipts, to £84,683. The expenditure on the manufacture of gas came to £54,166, of which £35,563 was for coals; on its distribution, to £5683; management cost £2969; and the total expenses were £67,671—leaving a balance of £17,012. The amount available for division is £20,892. The works, under the supervision of Mr. Charles Gandon, M.Inst.C.E., produced in the past half year 501,740,000 cubic feet of gas, of which 484,533,550 cubic feet were accounted for. There were 48,638 tons of coal, 1691 tons of cannel, and 37,045 gallons of carburine employed in the manufacture of gas; the estimated production of residuals being: Coke, 603,960 cwt.; breeze, 3729 yards (78,309 bushels); tar, 498,745 gallons; and ammoniacal liquor, 9320 butts. There were 424 tons of sulphate of ammonia made; making, with the 150 tons in store, 574 tons, of which 534 tons were sold.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The accounts of the Bridport Gas Company, Limited, for the year ending June 30, which will be presented at the ordinary general meeting to-day, show that the profit for the twelve months was £820, as compared with £1218 in the previous year. The revenue from the sale of gas fell off by about £250, owing to the reduction of 5d. per 1000 cubic feet in the price; and the cost of coal was higher by about £100. The Directors, however, will recommend a dividend of 8 per cent. per annum, free of income-tax, on the ordinary shares, and of 5 per cent., less income-tax, on the preference shares; leaving a balance of £429 to be carried forward. They consider the result of the year's working, on the whole, very satisfactory. They refer with regret to the death of their Secretary and Manager (Mr. T. Giles), and record the appointment of Mr. J. H. Cornish as his successor.

The Bristol Gas Company will hold their half-yearly meeting next Friday, when the Directors will have good cause to congratulate the shareholders on the continued prosperity of the undertaking. Notwithstanding the reduction, in July last year, of 2d. per 1000 cubic feet in the price of gas, the revenue account shows a balance of profit, after paying interest on the debenture stock and the dividend on the ordinary shares, of £11,326; and a further reduction of 2d. has been made as from the 1st ult. The Directors will recommend a dividend at the rate of 5 per cent. per annum on the nominal capital of the Company. The accounts for the six months ending June 30 show that the sale of gas to private consumers produced £90,888, as compared with £89,150 in the corresponding period of 1894; that sold for public lighting and under contracts, £12,471, as compared with £12,921; rental of meters and stoves, £2281, against £2127; residuals, £27,410, against £27,974—the total receipts being £133,314, compared with £132,421. On the expenditure side of the revenue account, we find that the manufacture of gas cost £76,705, against £76,414 in the first half of 1894; distribution, £4507, against £3814; and management, £4864, against £4799 the total expenditure being £94,083, as compared with £92,314. The balance carried to the profit and loss account is £39,231; while at the corresponding period last year, it was £40,107. In the manufacture of gas, 83,521 tons of coal and 5394 tons of cannel were carbonized or used in the past half year. The residuals produced are estimated as follows: Ordinary coke, 52,422 tons; cannel coke, 2893 tons; breeze, 7371 tons; tar, 897,258 gallons; and ammoniacal liquor, 1,916,257 gallons.

The 54th half-yearly meeting of the Calverley and Horsforth District Gas Company was held last Wednesday. Mr. W. Turton presided, and stated that the receipts during the six months ending June 30 amounted to £4351, and the total expenditure to £3079; leaving a balance of £1271. This added to the balance brought forward, showed a net sum of £2906 available for division. To pay dividends at the rate of 10 per cent. on the original, and 7 per cent. on the new stock, would absorb £1434; leaving £1472 to carry forward. A total of 23,826,900 cubic feet of gas were sold during the half year. The report was adopted, and the dividends declared.

The half-yearly general meeting of the Newport (Mon.) Gas Company was held on Monday last week, under the presidency of Mr. E. J. Phillips, J.P. The report presented by the Directors showed that the earnings for the past year had been £22,779, of which a sum of £5784 was available for division; and they recommended the payment of the maximum dividends at the rates of 10, 7½, 7, and 5 per cent. per annum on the various classes of stock. In moving the adoption of the report, the Chairman said it was very gratifying to the Directors that they were able to pay the full dividends without in any way encroaching upon the reserve funds. There had been a small outlay of £252 on capital account for new mains. Altogether, during the half year, 1945 yards, or a little more than a mile, of new pipes had been laid. The Company had sold more gas—realizing £16,411—than during the corresponding half of 1894. The additional quantity of gas made was 12 million cubic feet, or at the rate of 9 per cent., as compared with 7 per cent. in the first half of 1894. This was owing to the past severe winter, which necessitated more lighting and heating in houses. Altogether, they might congratulate themselves upon the excellent position occupied by the Company. There had been a steady increase in the number of gas fires and cookers put into houses. He did not think there was any cause for alarm from the competition of the electric light, because, though considerable strides were being made with that illuminant, great improvements had been effected in connection with incandescent gas lighting, which undoubtedly was more efficient for indoor use than the more extravagant electric light. In conclusion, he acknowledged the steady and ready assistance the officials had always rendered in carrying on the Company's business. The report was adopted, and the dividends recommended were declared. The usual complimentary votes were acknowledged by the Chairman, the Secretary (Mr. E. F. Marfleet), and the Engineer (Mr. T. Canning).

The report which the Directors of the Reading Gas Company will present to the shareholders at their meeting to-day is a very satisfactory one. During the half year ending June 30, they found they were justified in reducing the price of gas; and as from the end of March a concession of 2d. per 1000 cubic feet was made to all consumers. The whole of the works, which are under the supervision of Mr. E. Baker, Assoc.M.Inst.C.E., have been maintained in the highest efficiency; and favourable contracts have been entered into for the supply of coal and the sale of tar. While the reduction in price will probably lead to an extended use of gas by private consumers (the demand for cooking-stoves having markedly increased since the exhibition held in May last), the Company still retain the public lighting—their contract with the Corporation having been renewed for a period of five years. The accounts accompanying the report show that £22,456 was received for gas sold, £6763 for residuals, and £69 on stove account; making a total of £29,288. On the other hand, the manufacture of gas cost £17,988 (£12,979 being for coals); its distribution, £2770; and management, £1091—the total expenditure being £24,053. The balance carried to the profit and loss account is £5235; and the amount available for division, £16,291. Out of this, the Directors recommend the payment of the full dividends upon all the stocks and shares of the Company. The quantity of mixed coal carbonized or used in the half year was 14,804 tons; and of the gas produced and in store, 140,430,700 cubic feet were sold within the borough; 3,799,400 cubic feet outside; and an estimated quantity of 9,497,697 cubic feet used for public lighting and under contracts. With regard to residuals, the production of coke was 14,804 chaldrons; of tar, 168,306 gallons; and of sulphate of ammonia, 132 tons 4 cwt.

Water Companies.

The Chester Water Company held their 77th half-yearly meeting on the 8th inst.—Mr. W. Brown in the chair. The Engineer (Mr. G. Crowe) reported that the rearrangement of the first and second filter-beds was completed; and the latter commenced to work on the 24th of April, giving every satisfaction. The mains so extensively damaged by the exceptional frost of last winter had all been renewed. The accounts for the half year showed a surplus of revenue over expenditure of £2843. Adding the balance brought forward—£6083—made £8926. The interest on the preference capital required £450; leaving a balance of £8476. The report of the Directors and the accounts were adopted. The following dividends were then declared for the half year: 7½ per cent. per annum on the consolidated stock; 6 per cent. upon the perpetual and 6 per cent. preference shares; 7 per cent. upon the amount paid and entitled to dividend on the new ordinary stock, 1874; and 4 per cent. on the amount of calls paid in advance on the second moiety of such new stock.

The Directors of the East Worcestershire Water Company report that, during the half year ended the 30th of June last, additional services were laid on to 93 premises; making the total 3770, exclusive of Droitwich and Rednal. The yield from the well averaged 517,519 gallons daily; but, in addition to this, for some weeks after the frost, and subsequently for a fortnight during the drought, a considerable quantity, estimated at more than 100,000 gallons daily, was obtained from a bore-hole by temporary pumping machinery, which enabled the supply to the whole district to be maintained. The half year commenced with a frost which, for duration and severity, has seldom been equalled in this country. A considerable number of service-pipes were frozen, and the mains also suffered in several places. Following upon the frost came nearly three months' unusually dry weather; and the demand for water was so excessive that recourse was again had to auxiliary pumping. The total cost of repairs to the mains, distribution of water by cart, and extra pumping during the frost, was £367 12s. 3d., which, being of so exceptional a nature, the Directors decided to enter separately in the revenue account. The profit, after providing for this charge, was £776, which, added to £1689 brought forward, makes a disposable balance of £2466. It is proposed to pay a dividend for the twelve months of 2½ per cent., amounting to £1533; to add £605 to the depreciation and reserve fund; and to carry forward the balance of £328.

In moving the adoption of the Directors' report at the half-yearly meeting of the Stockport Water Company on the 7th inst., the Chairman (Mr. G. H. Hill) stated that during the six months covered by that document the receipts had increased by £771, as compared with the corresponding half year of 1894. The expenditure had also increased by £712, as compared with the expenditure in the corresponding period. The latter was largely due to the severe frost of the months of January and February, which caused the water supplies throughout the whole of the district, and even as far south as London, to be greatly affected. The frost involved an outlay of about £800; but, in consequence of the increased revenue, the Company were able not only to pay their way, but to declare a dividend of 6¼ per cent., and carry forward a larger balance than before. The balance at the close of the previous half year was £206; now they carried forward £514. The additional balance would enable them to cope with any extraordinary expenditure which might be incurred. On the whole, the Company had had a very good half year, especially when they considered the extra outlay caused by the frost, and bore in mind the fact that the frost was followed by a drought which lasted until the end of June. Referring to the well at Wilmslow, the outlay there would, he said, be a little more than £5000, of which £3000 had already been paid. The work would be completed in about two months. It was estimated that the yield would be between 700,000 and 800,000 gallons a day; and the water was excellent. The report was adopted. The Chairman proposed that a dividend of 6¼ per cent. per annum be declared on the ordinary stocks, and of 2½ and 2¼ per cent. per annum on the 5 and 4½ per cent. preferential stocks respectively; and this was agreed to.

THE GAS-COAL CONTRACTS OF THE OLDHAM CORPORATION.

At the Meeting of the Gas Committee of the Oldham Corporation on the 10th ult., a long discussion took place on the subject of the coal contracts, which, it may be remembered, had been investigated by a Sub-Committee. The outcome of it was that the Committee decided, as already recorded (*ante*, p. 188), to place with the Chamber Colliery Company a contract for 20,000 tons of coal at 8s. 9d. per ton. This came up for confirmation in the minutes presented at the last meeting of the County Borough Council. But the Chairman of the Committee (Alderman Smith) moved that this part of them should not be confirmed, as he believed the resolution had been passed under a misapprehension. He said he had no feeling whatever in regard to the people who were connected with the Company concerned; but within the last few months he considered their terms were wide of the mark, seeing that he could get coal from Wigan through a local agent at a reduction of 1s. a ton, whereas the Company had only made a concession of 3d. per ton. If they had allowed the same percentage as the Wigan people, their price would have been 8s. 2d. instead of 8s. 9d. per ton. The Manager (Mr. John Chadwick), after making tests, considered the Hyde Lane coal at 8s. a ton was better than the Chamber Company's coal. Why did the Company stand out for full prices? It was either because they had plenty of orders on their books or were able to hold their stocks. He maintained that it was not right to pay 9d. a ton more for an inferior quality of coal. It simply meant £750 taken out of the ratepayers' pockets, and put into the pockets of a wealthy Company. But there was something more than that. Oldham had a monopoly of the supply of gas to the out-townships; and this question would affect those townships to a great extent. In 1886, the Local Authorities, which paid one-third of the receipts of the Corporation gas plant and did not derive a penny in the shape of profit, tried to get powers to make their own gas; and if the present resolution of the Gas Committee were passed, they would hear of it again another day to their sorrow. In their own business, it would not take them two minutes to decide in favour of the lower tender; and he certainly believed that to place this contract with the Chamber Company would be to their disadvantage. The motion having been seconded, Mr. Shaw moved an amendment that the minutes be confirmed in their entirety. He said that since he was placed on the Gas Committee he had had many opportunities of investigating the coal question. He maintained that the figures he had previously given were correct, and showed that the Chamber Company's coal was the best in the long run. Mr. Hollingworth seconded the amendment. Alderman Jackson remarked that if Mr. Shaw and Mr. Hollingworth would move to the effect that the coal at 8s. 9d. per ton was better than that offered to the Council for 8s., it would simplify matters. Mr. Harrop stated that, if fairly reckoned up, the Corporation would lose £1000 if they placed the contract with the Chamber Company. Alderman Hood said what the Council wanted to know was whether the coal at 8s. was equal to that at 8s. 9d.; and neither the mover nor the seconder of the amendment had proved it to be otherwise. He said the matter had assumed a party character; and he contended that it would prove in the long run to be a very serious thing for the Corporation and the town generally if they began placing their contracts on party lines. He hoped the Council would make a bold stand against it. The pointed remarks of the Chairman of the Gas Committee ought, he said, to weigh with them on this question. Alderman Jackson said if it could be proved that the coal of the Chamber Company was superior to that at 8s. per ton, the matter would be settled. Mr. Hollingworth asked for the result of the analysis of the Hyde Lane coal. Alderman Smith said the relative tests made in May last gave an illuminating power in pounds of sperm of 686 for the Hyde Lane coal, as against 618 for the Chamber Company's coal; or an advantage to the former of nearly 10 per cent. Mr. Hollingworth said the three great points in the value of gas coal were the gas-producing power per ton, the illuminating power of the gas in candles, and the illuminating power in pounds of sperm. In 1888, the Chamber Company's coal, as tested by the Gas Manager, showed

738 lbs. The Mayor (Alderman Whittaker) remarked that, after all, the question was not so much one of price as of quality. It had been said that it was not disputed that the Hyde Lane coal was better than the Chamber Company's coal. But this had been disputed, and by gentlemen quite as worthy of confidence as those who had made these remarks. The fact was they had not had this coal for years. A test of one small waggon was no proof that the general body of coal was better; and they, as business men, would be surprised if the firm did not send their best coal for a sample. Alderman Smith, in reply, said he thought members of the Gas Committee who voted for the resolution in Committee, thinking that by so doing they were keeping the work in Oldham, were under a misapprehension. If the Chamber Company wished to have their coal tested, there were many gas-works in the country where the managers were allowed to test coal; and they could then have a practical test, which would be more valuable than any laboratory one. The future of the gas undertaking rested with the Council. He alluded to the deputation from the out-districts that had waited upon the Gas Committee that afternoon, and remarked that he was sure the question of price and the treatment of those districts would not rest where it was. A vote by show of hands was then taken; but the result was disputed. The names were then taken, and the amendment was declared carried. On it being put as a substantive motion, the following amendment was submitted: "That the resolutions referring to an independent analysis and the placing of the contract with the Chamber Colliery Company be omitted." When this was put, there voted for it 19. On the hands being again counted, there were found to be only 18; whereupon the Mayor said, "I will vote," and put up his hand. He was about to give his casting vote, when Alderman Brierley protested against the Mayor's action; and the amendment was again put. It was now defeated by 20 votes to 19; and the minutes were passed in their entirety.

THE OIL-GAS EXPERIMENTS AT BRADFORD.

We take the following from the *Bradford Observer* of the 14th inst.: "The two experts engaged to report upon Dr. Dvorkovitz's oil-gas process for enriching coal gas at the Thornton Road station of the Bradford Corporation Gas-Works, have just sent in their reports. Mr. Lewis T. Wright was the expert on behalf of the Bradford Corporation; and Mr. Thomas Newbigging, of Manchester, the expert acting for Mr. Isaac Smith. The effect of Mr. Wright's report is that the cost of enrichment to the extent of 1-candle power per 100 cubic feet of gas would be 0·76d. In the trials, 433 gallons of oil were used; and the cost he put down at 3·8d. per gallon. In his calculation, he reckons the value of the bye-products at 1·71d. per gallon. Mr. Newbigging puts the cost of enrichment, not at 0·76d., but at 0·36d. The difference between the two is accounted for by the first cost of the oil and the estimated value of the bye-products. Mr. Newbigging reckons the cost of the oil at 3¼d. per gallon, against 3·8d. by Mr. Wright; and this price is arrived at from the fact that the oil can be laid down in any port in England at 2⅞d. per gallon—leaving a margin of ⅜d. per gallon for bringing oil from the port to Bradford. Mr. Wright's calculation as to the cost of oil is made upon the cost of small quantities obtained for testing purposes; while Mr. Newbigging's is calculated on larger quantities, which can be contracted for. In Mr. Wright's calculation, the bye-products are reckoned at 1·71d. per gallon; this value being obtained by using the products for carburetting purposes. Mr. Newbigging, however, reckons the value of the products at 4·69d. per gallon; explaining that he has had the products analyzed by the Chemist to an eminent firm of tar distillers in Manchester, who gives 4·69d. per gallon as their commercial value. Taking the quantity of gas made by the Bradford Corporation, which amounts to 1500 million cubic feet per year, and reckoning the cost of enrichment from 16 to 18 candles at 1d. per candle, which is the acknowledged cost of enrichment, we arrive at the total cost of enrichment as £12,500 per annum. The same quantity of gas could be enriched by Dr. Dvorkovitz's process, according to Mr. Newbigging's report, at a cost of £4687 10s.; showing a saving of £7812 10s. per year, if this process were used in each of the Corporation's works. According to Mr. Wright's figures, which show a cost of practically ¾d. per 1000 cubic feet per candle for enrichment, there would still be a saving of £3125 per annum. The total cost of laying down a complete plant at all the gas-works would not exceed £3000."

Reduction in Price.—As mentioned in the report which appears in another column, the Directors of the Crystal Palace District Gas Company have reduced the price of gas 1d. per 1000 cubic feet (making it 2s. 7d.) as from the June quarter.

New Joint Stock Companies.—The Dunmow Gas Company, which was originally constituted by a trust deed in 1837, has been registered, under the Limited Liability Acts, with a capital of £3370, in £10 shares, all of which are taken up. The Helsby and District Water Company, with a capital of £5000, in £1 shares, is to supply the townships of Helsby and Alvanley, in Cheshire, with water.

Barnet District Gas and Water Company.—The result of the working of this Company in the six months ending June 30 last is a balance of £15,056, out of which the Directors will recommend, at the half-yearly meeting of the shareholders on the 30th inst., the payment of dividends (less income-tax) at the rates of 9, 8, and £6 6s. per cent. per annum on the various classes of stock. The revenue from the supply of gas and the sale of residual products amounted to £9155; the expenditure on gas account, to £6311—leaving a balance of £2844. The sale of water produced £8866; the expenditure on this account being £4029—leaving a balance of £4837. There were 3803 tons of coal carbonized, and 40,314,000 cubic feet of gas produced, of which 36,961,000 are accounted for. The residuals are estimated as follows: Coke, 3614 chaldrons; breeze, 244 chaldrons; tar, 43,642 gallons; and sulphate of ammonia, 17½ tons.

ELECTRIC LIGHTING NOTES.

In the Court of Appeal on the 10th inst., the Master of the Rolls and Lords Justices Kay and A. L. Smith had before them an appeal from the decision of Mr. Baron Pollock and Mr. Justice Wright on the special case stated in the action brought by the British Insulated Wire Company, Limited, against the Prescot Urban District Council in respect of a certain contract, which the defendants alleged was not binding upon them in consequence of its not containing a clause imposing a penalty in the event of its terms not being carried out. The facts of the case were briefly given in the JOURNAL for the 6th inst. (p. 298). The Divisional Court, it will be remembered, gave jugdment for the defendants; and the plaintiffs appealed. During the arguments on a previous day, it was stated that the defendants were willing to make the payments, but that the District Auditor and the Local Government Board had refused to sanction them. Thereupon the Master of the Rolls said it was just and right that the arrears should be paid; and if this opinion were intimated to the proper authority, the Local Government Board would doubtless allow them to be paid. He thought a new contract should be entered into containing a penalty clause. The matter was adjourned to enable the parties to go before the Local Government Board. Upon the case being called on again, it was stated that the Board would sanction the payment of the arrears; and it was arranged that a new contract should be entered into in substitution for the present one—its conditions to be settled, in case of disagreement, by some third party. Upon these terms, the appeal was dismissed.

At the meeting of the York Town Council on Monday evening last week, the electric lighting question, which has occupied their attention, on and off, for something like five years, was again under consideration. It came up on a report, presented by the Electric Light Sub-Committee of the Streets and Buildings Committee, which contained a recommendation that a tender submitted by the Electrical Construction Company for the supply of plant necessary for the electric lighting of the City, and working it, for £8650, should be accepted. The Sub-Committee had been in communication with four firms; but only two tenders had been received. Evidently, the Council are not all keen on having the new light, for two members sent letters to the Lord Mayor (the Right Hon. W. M'Kay) expressing regret at being unable to attend the meeting to urge their objections to the scheme. One condemned the system proposed to be adopted; and said if the light was to be made a success, it would have to be supplied at less than 6d. per unit, as suggested by the Sub-Committee. The other writer used rather stronger language. He deprecated the imposition of further charges upon the "already sadly overburdened ratepayers" for carrying out a costly electric lighting scheme. He continued: "With gas at the exceptionally low rate it is supplied at in York, and considering the immature and transitory condition of electrical engineering at the present time, I feel quite sure that the great majority of the ratepayers of the city would be content to wait further developments before they embarked on so expensive an experiment as electric lighting. Feeling confident that electric lighting costs nearly three times as much as the average cost of gas—notwithstanding plausible statements to the contrary—I am bound to oppose it at the present juncture." The writer concluded by referring to the figures showing the comparative cost of gas and electric lighting in the case of the Manchester firm cited in the JOURNAL for the 23rd ult.; and he also threw in a few significant remarks as to the Kingston-upon-Thames undertaking by way of example. He added that he did not hold a share in the York Gas Company—he only wished he did. These letters were read to the Council. When the subject came up, Alderman Agar moved the adoption of the report. He said the result of the Committee's consideration of the question was the recommendation that the tender of the Electrical Construction Company be accepted for seven years at 6½ per cent. on the capital outlay, and a charge of 6d. per unit. Something had been said about the charge at which the Company would supply the current. It would be to their interest to obtain as many customers as they could, and at as low a rate as possible. In order to make the electric supply a success, they had to charge a rate which would compete fairly with gas. Some had suggested that the question should be deferred; but if it was further postponed, there would be great danger of some company stepping in and doing the work instead of the Corporation. A very strong feeling had been expressed in the Council that undertakings of this kind should be municipalized; and they had now an opportunity of putting that advocacy into practice. Mr. Mann seconded the motion. He said there was not the slightest chance of additional burdens being put upon the ratepayers. The contractors proposed to give them a first-class installation; and when the Corporation had paid the money, they were guaranteed 6½ per cent. interest, and there would be no burden on the rates. The tender recommended by the Sub-Committee for acceptance was for £8650; and supposing the estimated £6000 was spent in road work and other expenses, the total cost would be £14,650. If they allowed the Company to have the working of the concern for three years, they would pay 6 per cent.; if for seven years, 6½ per cent.; and if for ten years, 7 per cent. The Sub-Committee recommended the medium time. The system was the alternate current; and it would enable any part of the city to be supplied from one station. Alderman Wragge characterized the scheme as about the worst that could be proposed. He said it was not only the immediate outlay that should be considered, but what it would accrue to in seven years. In Oxford, the system had cost £68,000. Mr. Purnell confirmed Alderman Wragge's statement. Mr. Scott said they had been "fooling around" the question ever since it had been referred to the Streets Committee. The members were afraid to consult an expert as to which was the best system for York. He proposed, as an amendment, that, in view of the fact that the scheme had been brought up with so little information, the opinion of Professor Kennedy be formally obtained as to which system he recommended. Mr. Mansfield seconded this proposition. Mr. Purnell thought an expert's opinion would in all probability be a biassed one. He considered the Committee had not approached the matter in the proper way. Alderman Wragge said they had had experts one after another; and, if they

wanted further advice, he objected to going to a gentleman they had had before. Other speakers having disapproved of the amendment, it was put and lost. Alderman Wragge then moved that the consideration of the question be adjourned. The Lord Mayor asked if the mover would specify any date. His question was met with cries of "*Sine die;*" and one member excited laughter by calling out: "For ever." The Lord Mayor then, like the lover in the ballad, tried to stop any further "shilly-shallying" by at once appealing to Alderman Wragge to "name the day." The worthy Alderman was equal to the occasion. He said he thought they should adjourn the question until they could ensure a good attendance; and he proposed the second Monday in October. Alderman Clayton seconded this amendment; but it was lost by a small majority. Mr. Shaftoe then moved to the effect that the report should be referred back to the Streets Committee, with instructions to consult an expert and report to an early meeting of the Council. Alderman Agar suggested that wider scope should be given to them than submitting to an expert only the two tenders sent in. Why should they not go broadly into the matter, get to know which was the best system, and then follow up with tenders and settle it? The Lord Mayor said the Council were in an extraordinary position. Alderman Agar had recommended them to accept a certain tender; and now he said it was possible the two tenders of which this was one were not the best. Could they wonder that the Council felt at a loss what to do under such circumstances? After some explanation from Alderman Agar, Mr. Shaftoe's amendment was put as follows: "That the matter be referred back to the Committee, with instructions to select an expert to advise them which system is the best; the Committee then to ask for tenders on such best system, and to report fully to an early meeting of this Council." Mr. Wrightson seconded the amendment, which was supported by Alderman Wragge. Mr. Mann said he wished the Council would either carry something or discharge the Committee. Simply because their pet tender or contractor had not been accepted, there were members who did not care what came first, and they wanted to throw the matter back. Alderman Coning thought it would be a mercy to discharge the Committee. He was never more ashamed of his connection with any Committee in his life than he was of this one, which had dallied with the thing for five years, and was not an inch nearer than it was two years ago. The amendment was carried. On being submitted as a substantive motion, an amendment was moved by Mr. Mann, and seconded by Mr. Gardiner, to the effect that the Streets and Buildings Committee be relieved from further duties in connection with electric lighting, and that a fresh Committee be nominated. This also was lost. Mr. Atkinson, in the course of some remarks, said that all the wriggling about that had been going on during the evening would be a disgrace to any Council, he did not care where it was. The display of ignorance was something painful. The position in which they were placed by the amendment was really humiliating. It was simply waste of time and money. The motion was carried by 15 votes to 11.

During a severe thunderstorm which occurred on the 10th inst., the electric light fittings in the Woodbourne Hotel, Douglas, Isle of Man, were destroyed. In this hotel, an arc lamp was supported on a flagstaff fixed on a turret. The flagstaff was struck by lightning, and the discharge went through the electric fittings (being the path of least resistance) to earth. Besides the destruction of the fittings, the ceiling of the billiard-room was set on fire, and several persons experienced severe shocks, though the building, as a whole, received little damage.

METROPOLIS WATER SUPPLY.

The Official Water Examiner's Report for June.

The report on the condition of the Metropolitan Water Supply during the month of June, by the Official Water Examiner (Major-General A. de Courcy Scott, R.E.), has just been issued. In view of the recent scarcity of water at the East-end, it may be of interest to give some figures from the report.

The Water Examiner states that the Thames Water at Hampton, Molesey, and Sunbury was in good condition during the whole of June. The water at its lowest point was 5 inches below the average summer level. The average daily supply delivered from the Thames during the month was 128,001,203 gallons; from the Lea, 58,894,236 gallons; from springs and wells, 45,331,111 gallons; from the ponds at Hampstead and Highgate, 5434 gallons. The last is used for non-domestic purposes only. The daily total was, therefore, 232,231,984 gallons for a population estimated at 5,506,862; representing a daily consumption per head of 42·17 gallons for all purposes. The relative proportions of the supplies from the above various sources were as follows: From the Thames, 55·12 per cent.; from the Lea, 25·36 per cent.; and from springs and wells, 19·52 per cent. The following statement compares, in the case of each Company, the number of gallons per head per day supplied during the month, with the number supplied during the same month of the previous year: Chelsea—June, 1895, 47·39; June, 1894, 42·35. East London—June, 1895, 42·77; June, 1894, 36·31. Grand Junction—June, 1895, 55·96; June, 1894, 50·64. Kent—June, 1895, 37·73; June, 1894, 31·14; Lambeth—June, 1895, 41·12; June, 1894, 32·95. New River—June, 1895, 36·39; June, 1894, 32·90. Southwark and Vauxhall—June, 1895, 45·87; June, 1894, 38·37. West Middlesex—June, 1895, 40·59; June, 1894, 34·35. In the following statement, the percentage of house supplies on the constant system in each Company's district on Dec. 31, 1894, and June 28, 1895, are compared: Chelsea—Dec. 31, 1894, 63 per cent.; June 28, 1895, 68 per cent. East London—Dec. 31, 1894, 99 per cent.; June 28, 1895, 99 per cent. Grand Junction—Dec. 31, 1894, 100 per cent.; June 28, 1895, 100 per cent.; Kent—Dec. 31, 1894, 69 per cent.; June 28, 1895, 75 per cent. Lambeth—Dec. 31, 1894, 63 per cent.; June 28, 1895, 64 per cent. New River—Dec. 31, 1894, 64 per cent.; June 28, 1895, 64 per cent. Southwark and Vauxhall—Dec. 31, 1894, 91 per cent.; June 28, 1895, 93 per cent. West Middlesex—Dec. 31, 1894, 65 per cent.; June 28, 1895, 65 per cent. The general result shows an increase up to the 28th of June to the extent of about 1988 in the number of houses on constant supply; making the total 652,313, or about 80 per cent. of the total number of supplies. From June 29 the East London Water Company ceased to supply water during the night to about three-quarters of the houses in their district. The Directors considered it necessary to take this step in consequence of the rapid depletion of the stored water which was taking place, and the continued absence of rain. The mains on which fire-plugs were fixed continued, nevertheless, to be constantly charged; and houses, the pipes of which communicate with these mains, continued to receive a constant supply.

Following Major-General Scott's report are those of Dr. E. Frankland and Professors Crookes and Dewar, which were given in the JOURNAL for the 30th ult.

The Supply of Water at the East-End.

A meeting of the Directors of the East London Water Company was held last Thursday, at the offices, St. Helen's Place, E.C., under the presidency of Mr. G. Banbury, the Chairman of the Board. Mr. W. B. Bryan, the Company's Engineer, reported that, notwithstanding the heavy rains of the latter end of the preceding week, only a slight increase had been notified in the volume of water stored in the several reservoirs of the Company. Since Tuesday, however, there had been an addition of upwards of 40 million gallons; and this, added to the increase in the storage of the past few weeks, justified the Directors in announcing a further addition to the number of hours of the intermittent supply. With respect to a statement which had been made that the death-rate in those districts supplied with water by the East London Water Company had greatly increased, Mr. Bryan pointed out that, according to the Registrar-General's latest returns, it was altogether contrary to facts. It had also been asserted that, in spite of the great scarcity of water in East London, the Company was selling every day to a "neighbouring Water Company" 4 million gallons.* This report, as the Directors knew, was perfectly untrue. In fact, the East London Company were purchasing a similar quantity from the New River Company every day. The Directors sanctioned the issuing of a notice to the inhabitants of East London to the effect that the water would be turned on about six a.m. and left on until about five p.m. daily, commencing on the 17th inst. Consumers were requested not to allow taps to run water to waste carelessly, as otherwise it might become necessary to again restrict the hours of supply.

The Secretary of the Company (Mr. I. A. Crookenden) has addressed the following letter to the Clerk of the County Council (Mr. H. De la Hooke): "I am desired by the Directors of this Company to acknowledge the receipt of your letter of 3rd inst., enclosing prints of Mr. Cripps's memorandum and of Mr. Binnie's report, both dated the 30th ult., and which were read to the London County Council at their meeting on that day. [See *ante*, p. 299.] In reply, I am to state that my Directors do not consider that either the memorandum of Mr. Cripps or the report of Mr. Binnie calls for any recognition or reply at their hands, as they are not concerned with any opinions which these gentlemen may have expressed to the London County Council. My Directors wish me to add that the Company's Solicitors have, in a letter published in *The Times* of the 8th inst. [*ante*, p. 354], shown the inaccuracy of Mr. Cripps's assertion, as also of the conclusions arrived at by Mr. Binnie."

In the course of an interview last Friday, Mr. Crookenden stated that what had been described as the "water famine" was undoubtedly over, and no further fears need be entertained by the East-end population as to the future supply of water. The printed notices that had been issued intimating the increase in the supply would be carried out to the strict letter. At present, the pipes and mains of the Company were in an excellent condition of repair, notwithstanding the severity of the winter and the allegations that had been made to the contrary. The real cause of the deficient supply in a majority of instances was the fracture, through the severe frost of last winter, of the private pipes conveying water from the Company's mains to the premises of the consumers. It had already been ascertained by Mr. Bryan, the Engineer to the Company, that no less than 40,000 of these fractures had taken place; and in only too many cases the owners of the house property, he regretted to say, had not yet made good the damage to the pipes. This alone, he added, would account for an enormous amount of waste.

A Petition to Parliament.

Last Friday, Mr. Percy Thornton, M.P. for Clapham, presented to Parliament a petition embodying resolutions on the London Water Supply which were adopted at a public meeting of householders and ratepayers of Clapham, held at the Clapham Assembly Rooms in June last. The resolutions expressed the opinion that in no case ought any company to have the power to charge for water not supplied to the consumer, unless by reason of some default on his part; that, in any future enactments relating to water companies, it shall be required that all existing mains be relaid, where necessary, at a sufficient depth to secure a full supply of water at all times of the year; that all service-pipes from the mains to the premises served, with all intermediate stopcocks and plugs, shall become the property of the companies; that all new service-pipes, with their stopcocks or plugs, be made, and the existing ones, where necessary, relaid at a sufficient depth, and repaired and maintained at the expense of the companies; and that all such mains, service-pipes, &c., be placed under the inspection of some independent body possessing parliamentary powers of supervision and requirement; that the charge for water made on the rateable value of premises shall include the cost of water for all domestic and sanitary purposes, including high service.

The "Surprise" Pendants.—Messrs. Best and Lloyd have just received advices that they have been awarded the Diploma of Honour at the Toulouse International Exhibition for their "Surprise" pendants; this being the highest possible award in the class in which they exhibited (Gas Lighting Apparatus). These fittings have also been selected for exhibition at the meeting of the Iron and Steel Institute now being held in Birmingham.

*The statement referred to was made in the *Daily Chronicle*.—ED. J.G.L.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Chief Engineer's Report on Available Sources of Water Supply.

In the JOURNAL for the 30th ult. (p. 248), we gave an outline of the scheme proposed by the Chief Engineer of the London County Council (Mr. A. R. Binnie, M.Inst.C.E.) for providing the Metropolis with an additional supply of water, to be obtained from Wales. The scheme is fully described by him in a report presented to the Water Committee, of which the following are the principal portions :—

I.—*Introduction and General.*

It will be within the remembrance of the Committee and those who have studied the recent inquiry of the Royal Commission on Water Supply, that the Thames basin down to the intakes of the Water Companies comprises an area of about 3542½ square miles, containing a present population of upwards of a million persons; and that upon this area the rainfall varies probably from 24 up to 30 or 32 inches—averaging possibly about 27 inches per annum. This is the total average rainfall of many years, making no allowance for long periods of dry weather or years of extreme drought; and the Royal Commissioners have stated that, with a certain but undefined storage, they consider that 300 million gallons a day can be obtained from the Thames, provided that certain important works of sanitation and regulation are undertaken, and that the storage provided be made sufficient to avoid the necessity of drawing on the river in periods of flood or of extreme drought. It will also have been observed that the water from the river will first have to be pumped into the reservoirs, where it will subside and be stored, and after filtration will again require to be pumped for the supply of the Metropolis.

It must also be borne in mind that the investigations of the recent Royal Commission under Lord Balfour of Burleigh were directed not to inquire into what was the best and cheapest possible scheme for the supply of London, but as to what were the capabilities of the Thames and Lea Valleys for the purposes of the Metropolis. The decision at which they have arrived, limited as it is by the very serious restrictions which they say should be enforced to secure the purity of the water and to prevent the depletion of the river, may be considered as the best that can be said for the Thames and Lea Valleys, irrespective of other sources of supply more or less distant from London; and one impression I think must be left upon the mind of the reader of that report—viz., that, under any circumstances, the consideration of some enlarged scheme of water supply must be undertaken within the next twenty years, as the valleys of the Thames and Lea become more thickly populated, and the sources spoken of by the Royal Commissioners approach exhaustion.

I hope to be able to point out, in what follows, that, by resorting to a district of greater rainfall, a much smaller area than the above will suffice for the purposes of Metropolitan supply, while giving ample compensation in water to the streams from which it is abstracted; and that the works can be constructed at such an altitude as entirely to avoid pumping, except for the small areas on the summits of Hampstead, Highgate, Shooter's Hill, and the Sydenham hills.

In laying out such a scheme, regard must be had, even in a district of large rainfall, to the incidence of the fall during the wetter months of the year; so that, by storing up the bountiful supplies of those months, we shall be able to provide against the drier months in such a manner as to ensure, both to the Metropolis and to the streams from which water is derived, a certain instead of a fluctuating flow, which at present in all cases takes place in the state of Nature—the result being that the great bulk of the rainfall passes from the ground in the form of floods during the wet months, not only in a useless, but often in a very harmful manner to the valleys below. For it must be remembered that water flowing from hilly and mountainous ground passes off with much greater rapidity after a fall of rain or the melting of snow upon the hills than it does in the Thames Valley.

My investigations into the flow of the River Thames clearly point out the exceedingly large amount of evaporation and absorption of the rain which falls during the months extending from March to November; and it is to counterbalance this, if the supply from the Thames is to be continued, that the construction of large storage reservoirs becomes a first necessity of the case. A requirement of paramount importance in the case of a new supply, after a heavy rainfall and sufficient altitude are secured, is that the geological structure of the country may be such as to be more or less non-absorbent. It can hardly be doubted that on the steep impervious slopes of clay, slate, and the Silurian formation generally, as well as on the cystalline rocks, a far larger proportion of the rain which falls, rapidly flows from the ground, and that the evaporation is consequently in all seasons reduced to a minimum quantity; whereas in the case of the Thames Valley we have seen that, fed as it is by the flat slopes of the porous beds of the chalk and the oolite, the evaporation during certain months of the year amounts to as much as 80 to 88 per cent. of all the rain that falls upon them.

In attempting to carry out the instructions of the Committee, it would be presumption in the time at my disposal to pretend that I could lay before them all the possible schemes that can be laid out in England for the supply of the Metropolis. But having been associated with the London Water Supply more or less since 1865, I have been able to form some kind of judgment of the district most suitable and most economical for the supply of the Metropolis. Having been engaged for some years in my earlier life on the setting out and construction of the Mid-Wales, and Neath and Brecon Railways, I am personally acquainted with the district to which in the first instance I propose more particularly to direct your attention.

As far back as 1862, I had observed the capabilities of the districts of the Wye, the Ithon, the Usk, and the Towy for a large supply of water to the Metropolis. It will be remembered that the late Mr H. H. Fulton, M.Inst.C.E., laid before the Royal Commission of 1869 (the Duke of Richmond's Commission) a scheme for supplying London from the district of the Wye. But the project was only general in its character; and no detailed estimate was submitted to the Commission. In recent years, Messrs. Hassard and Tyrrell, MM.Inst.C.E., have laid before you (in various pamphlets) the suitability of the Usk and Wye sources; and in 1891 I was commissioned by your Committee to make a personal inspection of the Wye, the Usk, and the Towy, with their tributary streams. So that in this particular case I do not think anyone could claim priority in the suggestion, but that a concurrence of testimony, extending over many years, exists, that this area, drained by the above rivers, affords at all events a most suitable district from which a supply of water can be derived. It is, moreover, a district in a portion of which the Corporation of Birmingham are at present constructing works whence to draw their future supply; so that its general suitability to the purpose is well established. And as regards quality of water, there can be no doubt that, from its sparsely populated areas and steep mountain slopes, water can be obtained in every way desirable for the supply of a large population.

With regard to the question of hardness, which I need not point out is an all-important feature in the case, it will, I think, be found, as our investigations proceed, that the vast bulk of the water available will be soft water. The hardness of water generally depends on the amount of the salts of lime held in solution. It cannot be said that these salts of lime are injurious to health; but, on the other hand, a soft water supply lends itself with remarkable facility to all the purposes to which water is applied. Its cleansing properties as compared with hard water are enormously enhanced; its power of producing vegetable infusions, as in making of tea, &c., are greatly augmented; and it does not, in boiling, cause deposits of mineral matter which are so much to be avoided. Nor can its use be said to cause unhealthiness or disease among the people supplied. The experiment has been tried on a large scale by Aberdeen, Edinburgh, Glasgow, Liverpool, Manchester, Halifax, Bradford, Leeds, Sheffield, Belfast, Londonderry, Dublin, and many other towns. The places above enumerated alone contain a population of 5,318,200 people, the water supplied to whom is from 0·8° to 6·5° of hardness; and the health of these towns is in no way injured by the use of soft water.

It is a well-known fact that certain very pure and soft waters, such as distilled water and water derived from recent rainfall, act more or less energetically upon bright lead; and consequently some persons are inclined to assume that all soft waters are necessarily dangerous to health. But, although they so act on bright lead, they fail to do so when it is tarnished—in fact, such water tends to produce a coating which protects the lead. It is also a well-known fact that such waters when mixed with others, especially after filtration, cease to act on lead; so that I feel confident that no apprehension need be entertained on this point, more particularly when we take into account that such large towns as Manchester, Liverpool, Glasgow, Aberdeen, and Dublin are supplied with water of less than 2° of hardness, and that we have the recent case of Birmingham resorting to this very district to obtain a soft and pure supply of water.

Feeling, however, how important this question of the purity of the proposed water supply must always be, I have, after consultation with your Chairman, requested Mr. Dibdin, the Chemist of the Council, to himself visit the proposed sources of supply in Wales, collect samples, and make the necessary analyses. The general result of his investigations may be thus briefly stated: That the waters in question, running as they do in their natural state in the various rivers from which the samples were taken, are all of greater purity than the waters supplied to London after filtration, and remarkably so when considered from a bacteriological point of view. But this is not the whole of the advantage they possess; for, being drawn from mountain slopes, they are not liable in the future to be contaminated by animal or town refuse. So that the possible danger which must always hang over a water supply derived from such rivers as the Thames and Lea, which at present receive the drainage of nearly 1¼ million persons, who are rapidly increasing in numbers, will be avoided. Again, it is well known that all waters when stored in large volume improve by settlement and subsidence; so that the natural purity of the waters of these districts will be much enhanced by the storage to which they will be subject in the large open reservoirs, exposed to pure mountain air, to which I shall have to direct your attention in the course of this report.

Another characteristic of water is its colour when stored in large volume. When derived from areas of chalk and limestone in its greatest purity, it is, when viewed through a deep stratum, a slightly green, verging on a blue colour. In the case of waters derived from mountain drainage areas, they appear, owing to the presence of peat on the mountain slopes, at times, when viewed through a deep stratum, to present a clear crystalline, though slightly yellow, appearance. This tint, however, rapidly disappears when exposed to the action of light in large reservoirs. In other words, the water is bleached; and after filtration it betrays little or no trace of colour, until at a depth of 15 or 16 feet a small coin, such as a sixpence or a threepenny piece, can be clearly distinguished. These facts I have had occasion to study on the Bradford Water-Works, with which I was connected, as the Committee are aware, for many years.

Taking into account what I have said with regard to the rainfall and the necessity of ample storage, suitable reservoir sites are the first necessity of any scheme of this character. In this district, the geological character of the ground and the contour of the valleys lend themselves remarkably to the creation of large storage reservoirs. The character of the rock, being of the compact old red sandstone, Devonian, or Silurian type, at once affords water-tight basins in which the water can be stored; and various contractions in the valleys are of such a nature as to permit of dams or embankments being thrown across them so as to retain the water without the necessity of excavating—as has been proposed in the Thames Valley—huge ponds to contain water. And these reservoirs can be constructed at such an altitude as to enable the water to flow naturally into them, and by gravitation through masonry conduits and iron pipes, so as to be delivered on the northern and southern outskirts of London at such an altitude as to ensure at all times a gravitation supply under constant pressure.

In the construction of such an aqueduct as that which would be required from Wales, about 150 to 170 miles in length, economy in the of water is a prime necessity. Consequently, in laying out a line

of aqueduct from Wales, it is desirable so to design the works as to introduce as great a length of masonry aqueduct as possible for the purpose of economizing not only the head, but the cost of construction generally, as the necessary masonry of the aqueduct can easily be constructed at less expense than pipes of the required diameter to convey the same quantity of water.

I must here for one moment notice an objection which has often been raised to making a large city like London dependent on a long line of aqueduct for its water supply. I can but say that, if a supply of pure water is to be obtained, we must go to great distances to secure it; and that no danger is to be apprehended from so doing. Liverpool already draws water from the Vyrnwy by an aqueduct more than 77 miles long; Manchester will shortly draw its future supply from Thirlmere by an aqueduct 100 miles in length; and Birmingham is now constructing one 80 miles long from the Elan and Claerwen, in the Upper Wye Valley.

It may be said that, in case of war or civil tumult, a long aqueduct might be a source of danger to the community, as being likely to fall into the enemy's hands. This again is hardly a tenable position, when we consider the case of Paris—a city which within our own time has suffered a siege from a foreign invader, and a no less disastrous calamity from revolutionary tendencies among its own citizens. Yet we find the Paris water supply is derived from distances of as much as 80 to 100 miles. We can hardly, therefore, seeing that a conduit from Wales must of necessity pass through the centre of England, apprehend much danger under this head, as the supposed enemy to our water supply will have to take possession of the whole country north and south of the Thames before being in a position to cut off the water supply of London; and, as will be explained hereafter in the course of this report, I have so designed the works that the total quantity of 415 million gallons a day can be conveyed to London in two separate and distinct aqueducts. These, as will be described, can, if thought proper, be carried near to, and parallel with, each other; or, if thought more desirable for safety, they can be so located as to be many miles apart. This mode of treating the question also lends itself to economy in construction in the gradual development of the whole project. This, I think, will dispose of the fear which some might entertain in the event of the whole water supply of the Metropolis being dependent on one single line of communication.

I may also point out that, although Glasgow was originally supplied from Loch Katrine by a single aqueduct, opened in 1859, it has been found expedient within the last few years to duplicate this, by the construction of an entirely independent and parallel channel for the conveyance of water to the city, as it is obvious that it would be most expensive and inconvenient, if not impossible, to enlarge an existing aqueduct through which the water must continue to flow.

(*To be continued.*)

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

A state of matters very satisfactory to the gas supply exists at Coatbridge, where Mr. T. Wilson is Manager of the Gas Company, which, by the way, is the only remaining gas company in Scotland which owns an incorporating Act of Parliament. In Coatbridge, an Electric Lighting Company was, a year or two ago, started under the special care of the greatest of all electrical scientists, Lord Kelvin; but notwithstanding this opposition, the business of the Gas Company goes on improving. During the past half year, the sales of gas increased by two million cubic feet over what they were in the corresponding period of the previous year. About 400 additional consumers of gas were obtained during the year, by the adoption of automatic prepayment meters, which have given every satisfaction, both to the consumers and to the Company. The Electric Lighting Company, though they sell their current at 5d. per unit, have only from 30 to 40 customers. They commenced business with a flourish of trumpets regarding the great things they were to do, by reason of their having adopted gas as the motive power for driving the dynamos. The gas was not that which Mr. Wilson's Company make and sell in the place, but was a special light manufacture of their own, which was produced by some of the water-gas methods, at a price which was to bring in a new era in electric lighting, by reducing the cost of current. But, from some cause which I do not know, the gas installation has been discontinued, and the motive power is now steam, which has been introduced at great cost, and which does away with the Company's prospect of revolutionizing the lighting problem. They also had the lighting of one of the streets in the town entrusted to them. But that also proved a failure; and the thoroughfare is now again lighted by gas. So long as Mr. Wilson can sell 26-candle gas at 3s. 4d. per 1000 cubic feet, he has nothing to fear from electricity, even though it be under the direction of one of the master-minds of the age.

From the report of the Gas Committee of the Kilmarnock Corporation, regarding their working for the past year, I learn that the gross revenue amounted to £14,260, and the gross expenditure to £13,303; leaving a profit on the year's operations of £957. There was a balance of £7752 at the credit of the profit and loss account at the beginning of the year, which raised the balance to £8709; and as only £169 was required to be provided, the balance of the profit and loss account is now £8540. The revenue from the sale of gas was £12,024, as compared with £12,256 in the previous year, which was considered highly satisfactory, as the price of gas was reduced from 3s. 4d. to 3s. 1½d. per 1000 cubic feet, and meter-rents were abolished. The mortgage debenture debt stands at the same as it was a year ago; but there is a balance at the credit of the sinking fund of £700. Coal carbonized amounted to 9250 tons, as compared with 9230 tons in the preceding year. The cost was £5839, against £5498. The output of gas was 87,874,000 cubic feet, an increase of 3,885,100 cubic feet; and the average yield per ton of coal carbonized was 9500 cubic feet. The leakage was 12 per cent., the same as last year. The tar produced amounted to 148,635 gallons, an increase of 6657 gallons over the previous year; and the revenue from same was £825, as compared with £656. There were produced 98 tons of sulphate of ammonia, a decrease of 2 tons; and the revenue under this head was £1042, or £808 less than in the previous year. The mortgage bonds upon the undertaking amount to £21,625; but against this, the assets amount to £25,736. The profit on the year's working was equal to 4¼ per cent. on the capital. I can only repeat what I wrote last year regarding the accounts, which are presented by Mr. W. Fairweather, the Manager, that they are remarkably full and clear, and that altogether nothing but congratulation is to be given to Mr. Fairweather for his manner of conducting the whole undertaking.

An enterprising Dundee newspaper has, "for the information of householders, who are always keenly interested in the question of public rates," put itself to the trouble to collect the prices at which gas is sold in the large towns in Scotland, and in places contiguous to their own city. Ten other towns, besides Dundee, are included in the list. In Dundee, the price remains at 3s. 4d., as last year; in Aberdeen, at 3s. 5d.; in Perth it has been reduced from 3s. 9d. to 3s. 6d.; in Edinburgh and Leith, from 3s. 6d. to 3s. 2d.; in Glasgow it is stated to have remained at 2s. 4d., but that is a mistake, as it was reduced from 2s. 6d. to 2s. 4d.; in Greenock it remains at 3s. 2½d.; in Forfar it has been reduced from 4s. 3d. to 3s. 9d.; in Arbroath it remains at 4s. 2d.; in Montrose, at 4s. 7d.; and in Broughty Ferry it has been reduced from 3s. 9d. to 3s. 4d. The compiler has been wonderfully accurate, having only, so far as I can perceive, as to price, made the one mistake which I have pointed out; and he, very strangely, has no recommendation to give to the Town Council or the "householders" for whose benefit the information has been collected. All the comment he makes is that it is found that, with the exception of Aberdeen, Dundee has to pay the highest price for its illuminant, while Glasgow is in the fortunate position of getting off cheapest; and that, among small places, Broughty Ferry possesses the lowest rental. "Of course," he added, "with gas, as with other things, quality was an important factor; but that aspect of the matter had not been touched, the financial standard being alone considered. However, it might be mentioned that, while in Dundee the illuminating power was generally equal to 25 candles, in Edinburgh and Glasgow it seldom exceeded 20 candles." That is the second mistake, for in Edinburgh during the whole of last year, the average illuminating power was nearly 26 candles, and in Glasgow it was about 22 candles. So far the compiler is moderate in his conclusions; but he has left out the town which, of all others, would have made his comparison of any value. I refer to Paisley, which is nearly as large again as Greenock, and where gas of 27-candle power is sold at as low a figure as 2s. 6d. per 1000 cubic feet. If he wished to give a comparison among small places, he might have mentioned Hamilton, which certainly has a population larger than Perth, and where gas of 27-candle power is sold at the price of 2s. 1d. per 1000 cubic feet. This would have been information which might have been appreciated by the householders; but it would possibly not come within his ken. At the same time, I scarcely see what good purpose is to be served by giving, if a comparison is attempted, such a limited one as the price only. There are so many matters which affect the working of a gas undertaking, that the price is by no means the only test of good management; and therefore any attempt to found conclusions upon the mere basis of price would be a mistake. The enterprise, therefore, of the *Dundee Advertiser*, unless it is to be followed up by something more exhaustive, may be looked upon as practically wasted.

It is reported that, by an explosion of gas in an electric lighting culvert at the junction of Ingram and Queen Streets in Glasgow, on Saturday night last, the cover of a manhole was blown off; but none of the passers-by were injured. The danger of these explosions is therefore not yet removed; but this incident would seem to point to their severity having been modified by the adoption of the precautions which have been recommended.

At Port Glasgow this week, the Gas Committee of the Corporation had under consideration the estimates of revenue and expenditure in connection with the gas department for the current year, in which a surplus is brought out of £317. It was resolved to reduce the price of gas for illuminating purposes from 4s. 2d. to 3s. 11d. per 1000 cubic feet, but that the price of gas for motive power should remain the same as at present—viz., 3s. per 1000 cubic feet.

It was reported to the Johnstone Town Council on Monday that the revenue in the gas department for the past year was £5132, of which £4586 was derived from the sale of gas, £379 from the sale of residual products, and £110 from coke and waste lime. There was an ordinary expenditure during the year of £3375, and a net loss of £97. The severe frost of the past winter, it was stated, cost the Commissioners £60 for repairs to mains and service-pipes. Johnstone is not unaccustomed to deficits.

Intimation has been given in the Millport Town Council by Commissioner Allan that, at the next meeting of the Council, he will move that the Commissioners adopt the Burghs Gas Supply (Scotland) Act of 1876.

The Dunbar Gas Commissioners have again come out badly with their year's working. Though they used to have profits ranging from £350 to £530, or thereabouts, they have this year a deficit of nearly £200. Last year they had a loss of about £80. The Commissioners have accordingly raised the price of gas from 5s. 3d. to 5s. 10d. per 1000 cubic feet. An ex-Convener of the Gas Committee urged them rather to reduce the price of gas to 5s., so as to encourage its use; but his advice was not heeded. I am not surprised at bad results in connection with the Corporation Gas-Works at Dunbar. The Commissioners do not work together; and it is therefore impossible that the department should flourish.

The output of gas in Perth still continues to rise. At the monthly meeting of the Gas Commissioners on Monday, it was reported that the quantity of gas manufactured during July was 3,903,000 cubic feet, or 635,200 cubic feet more than during July of last year. The average illuminating power was 25·53 candles. After deducting the quantity of gas made from oil, the amount derived from coal was at the rate of 10,505 cubic feet per ton. The illuminating power given above was that recorded inside the works. As showing how the gas manufactured from oil by the Peebles process affects gas supplies, in the matter of condensation, it may be pointed out that the return of the Gas

Examiner, taken out at the testing-station outside the works, gave an average illuminating power of 26·50 candles. I have before observed that the independent test in Perth, of gas which had been in store for some time, gave a higher illuminating power than was obtained by the Manager (Mr. Whimster) from gas tested while on its way to the holder. The Commissioners will meet on an early date to discuss Mr. Foulis's report on the proposal to remove the gas-works to a new site. A summary of the report was given in the JOURNAL last week.

When Mr. Forbes Waddell went to Forfar, less than a year ago, he had to make good his right, as Manager, to engage and dismiss men in the gas-works. He seems not only to have accomplished this, but to have also acquired power to put the Commissioners, his employers, to work. On Thursday he had some of them charging retorts. It is not said whether they laid the coal evenly; but it is recorded that, after they had concluded their labours, they assuaged their thirst with wines, and were fed upon cake. The occasion was the inauguration of a new setting of retorts which Mr. Waddell has just had erected. It is exceedingly pleasant to find the Commissioners taking so active an interest in the gas-works. Their presence at the inauguration is an earnest both of their desire to see the undertaking prosper, and of their wish to support the Manager in his efforts to improve the gas supply of the burgh.

Notices have been given by the Caledonian Electric Supply Company, of Glasgow, to the Town Councils of Perth and Montrose, of the intention of the Company to apply for Provisional Orders giving them the right to supply electricity for lighting in the burghs. In neither case do the local authorities appear to be very much frightened at the notices.

The West Kilbride Gas Company have this week been registered as a limited liability company, under the name of the West Kilbride Gas-light Company, Limited. The capital is £2500 in £1 shares. The Company's registered office is at Main Street, West Kilbride.

I have been asked to state, with reference to the death of Mr. Allan Gillespie, of Edinburgh, referred to in last week's JOURNAL, that the cause of death was an affection of the lungs, and was not due, as implied in the paragraph of last week, to other causes.

The annual accounts of the Denny and Dunipan Gas Commissioners show a revenue during the year ending May 15 last of £2086, of which £1784 was derived from the sale of gas; and there was a balance of profit of £14. The balance at the credit of the profit and loss account amounts to £1043.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 17.

Sulphate of Ammonia.—There has been a fair amount of business done during the week, induced, no doubt, by easier prices. Consumers seem to look for a still lower level; and they are not buying freely. But dealers have been availing themselves of the opportunity to cover their August sales; and any improvement would seem to depend upon the extent of their commitments. At the close, they appear rather indifferent about covering further. The quotations are £9 3s. 9d. Leith, £9 5s. Hull, and £9 7s. 6d. f.o.b. Liverpool. There is inquiry for forward delivery; but buyers' ideas are for the most part too low to induce business.

Nitrate of Soda is unchanged; and the spot value of fine quality is 8s. 3d. per cwt.

LONDON, *Aug.* 17.

Tar Products.—Benzol, toluol, solvent and heavy naphthas go from bad to worse. Buyers are continually clamouring for lower prices; and very little business is being done in them. There is a little more inquiry for carbolic acid; but there is no improvement in price. Pitch is firm; indeed, it is practically the only tar product that can be sold at all easily. Any collapse in the value of pitch (which may easily happen) would be disastrous for distillers in the present state of the other products. Tar would be of little value. Common tar oils are weaker. There is no change in anthracene. There is a market now for crude naphthalene, but at a price which does not pay to extract it from the oils. Quotations during the week are as follows: Tar, 17s. 6d. to 21s. Pitch, west coast, 35s.; east coast, 37s. 6d. to 38s. 6d. Benzols, 90's and 50's, 11d. Solvent naphtha, 1s. Toluol, 1s. Crude, 30 per cent., naphtha, 4½d. Liquid creosote, 1¼d. Naphthalene salts, 23s. 6d. Cresylic acid, refined, 1s. 1d.; brown, 11d. Carbolic acid, 60's, 1s. 6½d. Anthracene, "A" quality, 1s.; "B" quality, 9½d.

Sulphate of Ammonia is a little more sought after, but not to such an extent as so far to have improved its price. Transactions have been done during the week at £9 to £9 5s., less 3½ per cent., according to port of shipment; while gas liquor is offered at 6s. 6d. to 7s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Practically all the gas-coal contracts of any weight have now been settled, so far as this district is concerned, at about the prices previously given, with the exception of Salford, with reference to which I have not heard anything definite. The demand for all other descriptions of fuel shows no improvement. Pits are, as a rule, working scarcely more than half time; whilst some of the commoner mines are being closed for the present, owing to the exceedingly low prices ruling for the inferior descriptions. Steam and forge coals continue a drug; and the excessive competition of surplus supplies necessarily gives a weak and irregular tone to prices. Engine fuel meets with a moderate demand; collieries in this district having no difficulty in moving away their limited output of slack. There is, however, no scarcity of supplies; considerable quantities being now offered in this district from Yorkshire, with the result that prices, although fairly steady, are not more than maintained at about late rates. At the pit mouth, best Wigan Arley coal is quoted 10s. to 10s. 6d. per ton; Pemberton four feet and seconds Arley, 8s. to 8s. 6d.; common house-fire coals, 7s. to 7s. 6d.; ordinary steam and forge coals average about 6s.; and engine fuel, 3s. to 3s. 6d. for common slack, to 4s. 6d. and 5s. for best qualities. In the shipping trade, only a very slow business is reported; and orders can only be secured by quoting extremely low-cut prices—the average figures for ordinary steam coal being about 7s. 3d. to 7s. 6d. per ton, delivered at the Garston Docks or the High Level, Liverpool.

Northern Coal Trade.—There has been a considerable increase in the demand for coal in the past few days, especially for steam coal; but the rush seems to have now passed, and though the price is maintained there is not the advancing tendency that there was. Best Northumbrian steam coals are in most cases quoted at 9s. per ton f.o.b. There were, however, one or two sales as high as 9s. 3d. per ton; and as some of the producing collieries had a very long turn, the exact price was more a matter of bargaining than of any very settled market conditions. Second-class steam coals were relatively lower, at from 8s. to 8s. 6d. per ton f.o.b.; and steam smalls were tolerably abundant at from 3s. to 3s. 6d., according to quality. There is little alteration in the price of manufacturing coals. In regard to gas coals, there is an increasing demand, both locally and for shipment; and as the tendency of freights in the autumn is usually upwards, some of the large users of gas coals are stocking as freely as they can, so as to take advantage of the low freights that at the present time rule, and at the same time to accumulate a full stock of coals now that deliveries are under contracts that have low prices. For odd cargoes, the price of best Durham gas coals varies from about 6s. 3d. to 6s. 6d. per ton f.o.b., though in the case of one large producing firm 6s. 9d. per ton is asked—that firm having booked very heavy contracts. There is a rather better demand for smithy coals; the exports having been heavy. As regards coke, the local demand is fully up to the recent average; and the price varies from 13s. to 13s. 3d. per ton f.o.b. There is a slight increase in the production of gas coke; but it is well taken up, and the price shows no alteration this week.

Scotch Coal Trade.—There is a distinct improvement in the coal trade in Scotland. Values are not increasing much. But inquiries are more numerous; and the output is moving off well. Considering that many of the larger consumers of coal, and particularly the railway companies, have laid in large supplies, to enable them to tide over any future strike, the tone of the market is decidedly encouraging. Splint coal is not, as yet, sharing in the improvement. Small coal is in great demand. The prices quoted are: Main, 5s. 10d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. (full); splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week have amounted to 169,580 tons—a decrease upon the preceding week of 19,302 tons, but an increase, as compared with the corresponding week of last year, of 159,875 tons. For the year to date, the total shipments have amounted to 4,304,448 tons—an increase upon the quantity in the corresponding period of last year of 545,556 tons.

The Bolton Water Undertaking.—The members of the Bolton Corporation paid their annual visit to the water-works last Thursday week; and each was furnished with a concise report as to how the supply is derived, as well as information in regard to the holding capacity of the various reservoirs, and other interesting statistics. As previously explained in the JOURNAL, the Corporation derive their water supply from three separate places—Sharples, Heaton, and Entwistle. The supply is by gravitation; and the collecting-ground is chiefly moorland or high mountain pasture of the millstone grit formation. The water is filtered at Sweetloves and Heaton through a filtering area of 13,658 square yards; and it is delivered into the town pure at a high pressure with a constant supply. The following is a list of the reservoirs and their holding capacities in gallons: Belmont, 468 millions; Springs, 134 millions; Dingle, 79 millions; Sweetloves, 90 millions; Rumworth, 95 millions; Heaton, 91 millions; High Rid, 130 millions; Entwistle, 625 millions; Wayoh, 550 millions; and Crowthorn, 3½ millions. The annual statement of the Borough Finances just published by Mr. G. Swainson, the Borough Treasurer, says the water-works are slightly on the down grade; the revenue being £53,734 for the twelve months ending in March last, as against £55,903 in the previous year. In fact, the meter supply is less than has been the case since 1890; probably due to the fact that the Local Boards of Leigh and Hindley are now obtaining their water from other sources. As the result of the reduced income, the profit transferred in aid of rates is only £10,000, as against £12,000. The additional capital expenditure on the works last year was £5331.

Wolverhampton Corporation Water Supply.—At the quarterly meeting of the Wolverhampton Corporation on Monday last week, the Water Committee presented their report, with the accounts for the year ending the 31st of March last. The profit, after paying interest charges on the capital, and providing for the sinking fund, amounts to £4675 4s. 7d. The income from the sale of water was £501 in excess of the previous year. The surplus of £3000 shown in the revenue account will be forthwith transferred to the credit of the improvement fund, in accordance with the resolution of the Council of the 11th of March last. With the approval of the Council, and subject to parliamentary sanction, an agreement has been entered into with the Urban District Council of Bilston for the sale to them of the water rights and mains of the Corporation in the Coseley area, and the water-main from Goldthorn Hill to the boundary of the township of Bilston, for the sum of £7750. In the latter part of last year, a complaint was preferred by the County Council of Salop, under the Highways and Locomotives (Amendment) Act, 1878, against the Corporation, for expenses incurred by them in repairing damages caused by "extraordinary" traffic conducted thereon by the Corporation. On the case being heard before the Shifnal Justices, they found that the traffic was extraordinary within the meaning of the Act; but they stated a case for the opinion of the High Court of Justice. The Divisional Court upheld the decision of the Justices. The number of houses in the municipal borough of Wolverhampton is estimated at 17,970, of which 17,320 are supplied from the Corporation water-works. There are, therefore, about 650 houses the inhabitants of which depend upon wells for their supply, or obtain it in some other way. There are outside the borough 8675 houses served with Corporation water, exclusive of those supplied through the Bilston Commissioners. The number of meters in use by consumers is 406.

Leeds Gas Stokers and their Work.—It having been discovered that the conditions of labour agreed upon between the Leeds Corporation and their gas stokers, after the dispute some few years ago, are not being quite carried out, and that the men are, on an average, only carbonizing 52·2 cwt. instead of 60 cwt. of coal per shift, the Gas Committee have decided to have the coal for each man properly weighed in future.

The Proposed Water Trust for West Kent.—Our local correspondent writes: "Whatever may be the result of the Bills promoted by the London County Council, the local authorities in West Kent are evidently determined that, now they have entered upon the work necessary for the formation of a Water Trust, not to turn back. A Committee has been established on which all the District Councils interested are represented; and at a meeting held recently it was resolved as follows: 'That, in the opinion of this meeting, the Kent authorities within the area of supply of the Kent and Lambeth Water Companies should promote a Bill for the constitution of a Water Trust and the purchase of the Kent Water Company's undertaking and so much of the Lambeth undertaking as is situate within the county of Kent.' 'That such authorities be recommended to hold the necessary meetings, and pass the necessary resolutions for this purpose.' 'That, if it be found advisable to do so, the Kent County Council be asked to promote such Bill, on their being indemnified by the authorities interested, or a majority of them; and that the expense of such promotion be borne jointly by the said authorities in proportion to the rateable value of the districts included in such area of supply, and be repaid out of money to be borrowed under the powers of the Bill.' Of course, before the West Kent authorities or the County Council can promote a Bill in Parliament, it will be necessary to obtain the sanction of the ratepayers in public meeting; and arrangements are being made to comply with the provisions of the Borough Funds Act in this respect."

Projected Extension of the Walsall Gas-Works.—At the last quarterly meeting of the Walsall Town Council, the Gas Committee reported that, if the demand for gas increased as it had done for the last five years, about £50,000 would shortly be required for new plant and buildings; and they recommended the Council to apply to the Local Government Board for alterations and additions to the local Acts and Provisional Orders, so as to allow of the borrowing of that sum. The report of the Borough Auditor (Mr. G. R. Ridsdale) was appended. It stated that the value of the gas sold to private consumers was £6970—an increase of £250 as compared with the corresponding quarter of last year. In reply to Mr. Hughes, the Town Clerk (Mr. Cooper) explained that the further capital for the gas-works was for additions which were expected to be required in the next few years. If the increase of the last five years was maintained, they would have by the winter of 1897 to put up new retort-benches and a new gasholder and tank. The latter would cost about £16,000; and the additions to the retort-house about £12,000. They had purchased six acres of land to add to the works; and this would have to be enclosed and workshops put on it. Beyond this, they had erected a retort-house twice as large as they originally intended; and, in consequence, had an overdraft of £10,000 on their capital account. Mr. Clare urged that the matter should be adjourned for a year, in order that the Council might see what was the effect of the electric light undertaking. It was pointed out by several members that the money would not be sanctioned probably until next year, and then it could not be spent without coming again before the Council; while the works would take some years to carry out. Immediate application had, therefore, better be made. The Town Clerk stated that the increase in the demand for gas last quarter was 15 per cent. over the corresponding quarter of 1894. The recommendation was agreed to; Mr. Clare alone voting against it.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 383.)

Issue.	Share	Whe ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest-ment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23—24	..	4 7 6
100,000	10	,,	7½	Do. 7 p. c.	10	15½—16½	..	4 10 11
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	106—108	+2	4 12 7
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5¼	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253 258*	+2	4 13 0
180,000	,,	,,	9	Do. New	100	200-210*	+2	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
888,500	Stck.	28 Feb.	5	Bristol	100	125—130	..	3 16 11
320,000	20	28 Mar.	11¼	British	20	54—56	..	4 0 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c.	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¼—8¼	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	28—30	..	5 10 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	299—304	..	4 8 9
165,000	,,	,,	10½	Do. New	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	265—275	..	4 14 6
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	292-297*	+1¼	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107-112*	+2	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280 285*	+2	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130-135*	+2½	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197-202*	+3¾	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	187-192*	+½	3 12 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277-282*	+2	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163-168*	+1	3 11 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	131—134	..	2 19 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	200—205	..	2 18 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	249 -254	−1	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	16½—17½	..	5 14 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	..	6 7 3
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	355—365	..	4 4 11
1,350,000	,,	,,	12	Do. B do.	100	305—310	..	3 17 5
308,685	,,	,,	13	Do. C do.	100	315—320	+5	4 1 3
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172—176	..	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	228—233	−2	3 8 7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	115—120	+1½	2 18 4
708,060	Stck.	14 Feb.	12	Kent	100	309—314	+2	3 16 5
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—264	..	2 16 9
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Aug.	12⅔	New River, New Shares	100	385-395*	+1¼	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157—163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	292—297 *Ex div.	..	3 7 4

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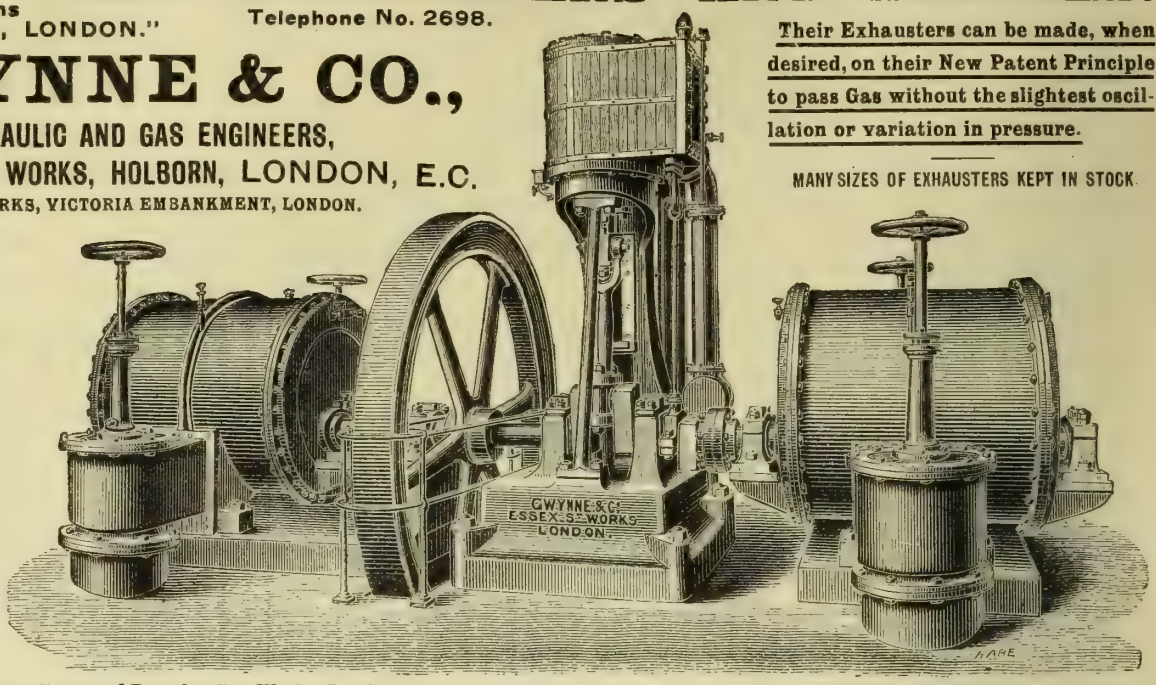

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The Directors do not bind themselves to accept the highest or any tender.
By order,
WILLIAM E. VINSON,
Secretary.
Gas Offices, Gloucester,
Aug. 8, 1895.

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No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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EDITORIAL NOTES.

One or Two South Metropolitan Points.

IN the course of a week or two, when current journalistic criticism of the workman-director scheme to be submitted to Parliament by the South Metropolitan Gas Company shall have had its say upon the idea, we shall devote some space to a discussion of such of the more noteworthy of these *a priori* criticisms as may appear to call for particular examination. Whenever this is done, our readers may rely upon our not passing over or minimizing any seriously hostile opinions that may have been put upon record respecting the proposal, from whatsoever source arising. But we shall reserve the liberty of disregarding all comments that seem to spring from mere individual prejudice or fancy. Difficult as some people find it to comprehend the fact, there is really nobody of so much importance in the world as to be able to settle an economical problem by merely declaring that he "does not like" any particular solution that may be offered by somebody else. Mr. Podsnap, we know, had a trick of ignoring social problems which were calculated to disturb his complacency. But, unfortunately, this short and easy way of treating the realities of life is only possible for people who like to dwell in a "Fool's Paradise." In effect, the gentleman who thinks he can dispose of a social or industrial question with sole reference to his own predilections in the matter, is a near relative of the immortal Podsnap, albeit he may not suspect the existence of the relationship.

Meanwhile, in order to prevent the growth of misunderstanding, it is desirable that the character of the vote at the recent South Metropolitan meeting should be recognized. It was, as the Board by the reference to the subject in the report clearly indicated that it would be, merely an expression of opinion on the part of the proprietors. The meeting in question was not competent to settle the matter out of hand; and the real executive order in this regard can only be issued by the Wharncliffe meeting to which the new Bill will have to be submitted in due course. This being so, all talk about the way in which the subject was laid before the late meeting is irrelevant to the main issue. It would have been impossible, in the circumstances, for the meeting to have been allowed to pass without the subject having been mentioned at all; and it was proper that this should be done with the utmost publicity, by a special reference in the report. This seems perfectly clear; and the question whether the matter was rightly deal with, by being included in the motion for the adoption of the report and accounts, therefore only possesses academic interest. The main thing was that each proprietor was warned beforehand that the subject would be brought forward, so that everybody was given an opportunity of speaking his mind upon it. There will be another chance of the same kind, or even better, at the forthcoming Wharncliffe meeting, which may or may not have a different result from the last meeting.

It will be as well on the present occasion to devote some little attention to the most serious point urged by Mr. John Ewart against Mr. Livesey's proposal—that the employees mainly affected by it had not given any indication of interest in the idea of a special representation, whence it might be inferred that they do not want it, would not be disposed to take advantage of it if they had it, and would not miss it if it were to be withheld altogether. Several newspapers, with that curious blindness to historical illustrations which is one of the weaknesses of the hurried journalistic writing of the day, have repeated this point, and admitted its gravity as making against the expediency of Mr. Livesey's scheme. The truth is quite the contrary. To cite only one illustration in support of this view, it may be assumed that nobody nowadays will seriously argue that the parliamentary representation of the people of this country is unnecessary, or that, on the whole, the system has not justified its originators. Yet it lies on the surface of the history of the British nation that in the early days of the institution of Parliament the constituencies had the greatest reluctance to send representatives to Westminster. Over and over again, cities and boroughs petitioned to be excused from this obligation; duly elected members of Parliament shirked their duty as far as they could; and it was only the persistence of the Crown, in forcing the people to share the responsibilities of government, that eventually made the system part and parcel of the national life. Of

course, we do not here suggest that Mr. Livesey's workman director scheme is on "all fours" with the invention of the parliamentary system, but only to show that the mere fact of any proposal in government being apparently uncalled for, is no argument at all against its intrinsic value. Indeed, as we have remarked on a former occasion, when discussing the same subject, there is all the difference in the world between an insurrectionary demand for something preferred by an order of the community which has it not, and the offer of a thing from above by those who really do possess it. To wait until it is demanded, perhaps with threats, before granting a concession to the popular view of the necessities of a situation, is to relinquish leadership into the least experienced hands. The most fruitful reforms, like that of the institution of Parliament, are those which have come from above, and have even been forced upon indifferent or unwilling recipients. Of course, the argument must not be pressed too far. But within the proper limits it is good and helpful; and here, at all events, we propose to leave it for the present.

The Gas Affairs of Liverpool—The Forthcoming Meeting of the Institution of Gas Engineers.

The affairs of the Liverpool United Gas Company are generally worthy of sympathetic attention on the part of our readers; and particular notice may be directed to them now in view of the pending visit of the Incorporated Institution of Gas Engineers to the city. The Directors are able to recommend full dividends, and to make a further reduction in the price of gas as from the end of the last quarter. The increased use of gas due to the introduction of automatic prepayment meters is one of the features of current interest in the development of the Liverpool gas undertaking; and another is the experience of the Company in respect of the introduction on a large scale of carburetted water gas. From certain remarks by the Chairman, Mr. W. E. Lawrence, at the recent annual general meeting of the Company, it may be gathered that the distribution of the new gas has not been without some little passing inconvenience to a few of the consumers; but this seems now to have been overcome. It has been a question of burners, in connection with the specific gravity of the gas supplied; and it appears that the Company have been constrained to change the consumers' burners in some cases. A little more detailed information upon this head would be welcome; and it may perhaps be forthcoming in due time.

Another subject that is just now engaging the attention of the Directors of the Liverpool Company is that of the most economical quality of gas for the supply of the city. At present, the Liverpool gas is the richest sent out by any gas undertaking south of the Tweed; and it says much for the common sense of the Corporation that they are beginning to ask themselves and the Company whether the nominal quality is really worth the money that has to be charged for it. Wherever such a question is raised, it must be a most serious one for all parties to its solution; and this is especially the case in Liverpool, by reason of the relations subsisting between the Corporation and the Gas Company. It has long been a commonplace of municipal politics in Liverpool to abuse the Company and the Directors and all their works; and only the other day the Chairman of the Lighting Committee of the Corporation went out of his way to accuse the Company of paralyzing the industry of the city. This was, of course, mere "clap-trap;" and no doubt it was vented for a special object. But the very fact that this kind of talk "goes down" with the people of Liverpool shows how careful the Company must be to make sure of their ground when they meet their habitual detractors in a discussion upon a matter of vital importance to the undertaking. The eyes of the technical world, to use a familiar locution, will be upon the Company's Engineer, Mr. W. King, and his Board in regard to this question of illuminating power; and it is not too much to aver in this connection that, whenever Liverpool makes up its mind upon this particular subject, the gas engineers of the rest of the country will pay the closest possible attention to the favoured solution.

Altogether, therefore, it will be perceived that there is quite enough in the actual condition of the Company, and the circumstances of the local gas supply, to make it worth while for a goodly number of the members of the Institution of Gas Engineers to visit Liverpool this autumn, for the purpose of procuring information respecting these important matters at first hand. They may depend upon receiving a hearty welcome; and, whatever may be their individual and collective impressions respecting the passing vicissitudes and experiences of the Company, they will have ample reason for recognizing, in the whole administration of this great undertaking, the guidance of a high and worthy spirit striving after its traditional ideals of rectitude and devotion to duty, undismayed by carpings and cavillings of ephemeral animosities.

Some Gas Companies' Results.

The gas companies' accounts which we are now publishing week after week enable those who are interested in gas lighting to follow the fortunes of the industry as realized in all parts of the country. The Crystal Palace District Gas Company have experienced a remarkably increased demand for gas, which has enabled the Board to meet the less favourable conditions of trade created by the depreciation in the value of residuals. According to the interesting speech of the Chairman, Mr. George Livesey, at the meeting of the Company last Friday, the consumption of gas in the Crystal Palace district has grown during the last ten years by more than 60 per cent. Considering that this Company was originally founded to supply the Crystal Palace itself with a means of lighting which during the period in question has been largely supplanted by another system, and also considering that an Electric Lighting Company has for some years past been industriously endeavouring to convert the shopkeepers and private residents in the neighbourhood to a sense of the inferiority of gas lighting, this continued success of the Crystal Palace District Gas Company must be regarded as grateful and comforting to the friends of the industry at large. Writers in electrical journals might also be advised to hang up their prophets' mantles, which they don when predicting the imminent extinction of the gas industry, and apply themselves to the study of the facts supplied in this Crystal Palace record. Municipalities owning gas-works, moreover, would do well to ponder the Chairman's statement that this particular Company have reduced the price of gas 33 times in 30 years, and raised it only once.

The record of the Provincial Gas Companies is pretty much of the same character. Everywhere there has been an increased demand for gas, the profit from which has, to some extent, been prejudicially affected by the low value of residuals. So far as coke is concerned, this effect is naturally due to the corresponding cheapness of coal, and also to the circumstance that the absorptive power of a community for coke does not always increase equally with a heightened demand for gas. With regard to sulphate of ammonia, however, it is impossible to avoid the suspicion that the market for this residual is at present kept in an unhealthy condition through the mistaken policy of the largest producers. Most of the gas undertakings of the country confess to having incurred a good deal of extra expenditure in connection with the severe weather of last winter; so that this exceptional season, while showing gas to be more than ever a necessary of life for town populations, did not bring a correspondingly enlarged amount of "grist to the mill" of the suppliers. Our electrical friends may be recommended to examine the record of the Colchester Gas Company in the light of the experiences of the owners of the local electric supply company.

The Enemies of Free Trade.

The truism about the tendency of Time to revenge itself upon human inventions, was borne out once more in connection with the proceedings of the recent annual general meeting of the members of the Cobden Club, when Lord Farrer delivered a speech which was, on the whole, both interesting and instructive. Though professedly non-political, this organization for the advancement of the economic truth according to Cobden is traditionally in accord with Liberalism; while its spokesmen habitually regard Conservatism as "suspect" of sympathy with the Protectionist heresy. Of late years, however, new dividing-lines have declared themselves among our political partisans of different brands; and accordingly Lord Farrer now finds the greatest danger to the prospects of Free Trade to lie not in Tory reactionism, but in Trade Union tyranny. In the time of Cobden, the idea that the British workman could be anything but a Free Trader would have seemed monstrous. But this was because he was never regarded by home political economists otherwise than as a consumer.

The Cobdenite view of the needs of the British workman was that he ought to have the means of subsistence freed from all artificial burdens of a fiscal character; and in furtherance of this idea, the home producer of corn was deprived of protection, and the great watchword of a "Free Breakfast Table" became the distinguishing cry of the Liberal party. In course of time, the British workman developed characters which those of his political leaders who had fought the battle of Free Trade in his name never expected of the genus. He took to considering himself in the light of a producer—having got pretty much everything he could wish for as a potential consumer; and in so doing he betrayed an ungrateful forgetfulness of the late Mr. Cobden and his teaching. Those of him who became Trade Unionists under the benevolent regard of party politicians ready to recognize in every popular organization another agency for manipulating votes, very speedily manifested a weakness for drawing their economic instruction from German or American, instead of from orthodox British, sources. This is horrifying to the true Cobdenite; and accordingly we find Lord Farrer expostulating against the tendency of Trade Unions to "exercise "a tyranny, and endeavour to control all the means of "production." If this tendency were to join the constant tendency of capitalist producers to try and get protection for themselves, there would be no knowing what mischief might ensue. Recent events, however, have shown Lord Farrer that this danger has been much exaggerated. He believed that the workmen of England detested tyranny of all kinds, whether exercised by capitalist producers or Trade Union leaders; and when the latter, at the Norwich Congress, proposed resolutions which were contrary to the common sense of the country and of the freedom of employer and workman, those leaders lost their importance and their power. Quite so. But it needed a General Election, to which Lord Farrer did not allude, to demonstrate the fact. Until this mobilization of the political power of the country showed how matters actually lay, the Trade Union leaders referred to by Lord Farrer went on "leading" in their own vainglorious style; hectoring Governments, and soothed by the adulation of servile politicians and the music of their "Press Bands." Then came the election; and these same leaders were discovered to have no following. Never was there a more signal, or more unexpected, collapse of a supposed "popular" cause. Greater even than the discomfiture of the Trade Union leaders was that of the party politicians who, to please them, had surrendered those principles of individual liberty for which the true leaders of the people of England have always contended, and found in the hour of trial that they had made the worst of bad bargains. So perish all the enemies of Liberty.

WATER AND SANITARY AFFAIRS.

In referring to the present conduct of the *Daily Chronicle* on the subject of the East London Water Supply, we hardly know how to restrain our remarks within the ordinary limits of journalistic courtesy. Our contemporary may see fit to ignore the remonstrances in which we have sought to substitute truth for error and misrepresentation; but we must trust that the great majority who read our columns, whether connected with water companies or not, must acknowledge that while the *Chronicle* has pre-eminence in the language of abuse, we have the merit of relying upon facts. No doubt a weak cause demands strong language; but English journalism is generally marked by some sense of justice, and imposes some limit on the exercise of prejudice and ill-will. We can quite understand that the *Chronicle* has a cause to serve, and will fight to the death in its defence; yet it is possible to fight fair, and to conduct the warfare on civilized principles. But we begin to despair of the *Chronicle*. We demurred last week to its designation of the President of the Local Government Board as "the official apologist of that arch-sinner, the "East London Water Company;" and we at the same time protested against its description of Mr. Chaplin as a man who knew and cared "so little" with respect to the vast interests of London administration. We gave a good and sufficient reason for our protest. But last Friday the *Chronicle* really excelled its former self. A meeting of Vestry delegates held on the previous day proposed that the Local Government Board should order a full and complete inquiry into the cause of the deficient supply of water in the East of London. If any inquiry is wanted, this would seem the best that could possibly be devised. But what says the *Chronicle?* "If this inquiry is to be pre-"sided over by Major-General Scott, who is notoriously a "friend of the water lords, or by Mr. Chaplin, who has "given himself into their hands with an artless and child-"like trust which is an admirable measure of his fitness "for high office, we do not expect that any good will come "of it." No; we are told "there is one remedy, and only "one," and that is "to rid ourselves of these 'old men "'of the sea,' and supply such necessities for ourselves." The sentence is not very clear in its grammatical construction; but what the writer means may be readily inferred. The Water Companies are to be got rid of, and London is to rely absolutely on the County Council.

While it is thus evident that every official, however high in rank, who fails to serve the purpose of the County Council and the *Chronicle*, is to be branded as betraying a public trust, there is reserved for the East London Company a catalogue of accusations and epithets such as indicate an entire absence of anything like a disposition to deal justly and fairly with the subject in hand. The "callousness," the "incompetence," the "misleading "statements," the "dishonest silences" of the Company, are described as constituting "an unpardonable offence "against the public." Farther on we read of "extra-"ordinary audacity," the "game of bluff," "incredible care-"lessness," conduct "more than a disgrace," and nothing less than "a crime," though "not punishable by the law." We are almost reminded of the "terrible curse" in one of the Ingoldsby Legends, and wonder if anybody is going to be "the worse" for it. Certainly, if the poison which pervades these remarks can be infused into the public mind, mischief will be done. The *Chronicle* is especially excited over the statements made in Parliament last Thursday evening by the President of the Local Government Board, in reply to Mr. James Stuart. Our contemporary professes to think that "certain remarkable admissions "were painfully extracted" from Mr. Chaplin by the questions thus propounded. The East London Company had declared that as the County Council would not let them have storage, they were not to blame. "Will it be believed," asks the *Chronicle*, "that it is "now confessed that this amazing Company possessed "all the while by far the largest storage of any "Company in London." This was known and believed long ago, and has been proclaimed for years in the monthly reports of Major-General Scott—that "notorious friend of the water lords." There is nothing to be "confessed," seeing that the truth has long been proclaimed from the housetops. How is it that Mr. Stuart does not make himself acquainted with the contents of General Scott's reports? "Will it be believed," we may ask, that these reports are regularly furnished by the Local Government Board to the County Council, and to all the sanitary authorities in the Metropolis? Mr. Chaplin might have added that these reports are also sent to the Editors of all the London morning papers, including the *Chronicle;* though, of course, it does not follow that everybody who receives the reports takes the trouble to read them. Mr. Stuart thought that these documents should be laid upon the table of the House. But Mr. Chaplin considered it would be sufficient if he arranged for copies to be regularly forwarded to any member who desired to have them. Mr. Stuart is now so anxious to be well informed, that he wants further particulars concerning the resources of the East London Company; and there is no doubt that he will soon obtain enough of such information, having moved for a return according to Mr. Chaplin's suggestion. As for the need of increased reservoir capacity at the East London works, some few years have elapsed since General Scott reported that the time for such enlargement was close at hand. None of the present controversy was then rife; and General Scott was scarcely thought to be a friend of the East London Company in proposing that they should proceed at an early date to augment their means of storage. But, of course, the County Council know nothing of all this.

A knot of busybodies at the East-end are trying to make themselves prominent by getting up an agitation on the subject of the water supply. Hence we read of "an "influential conference of representatives of the London "Vestries and District Boards," held in the Hackney

Town Hall last Thursday, to discuss the water question. The wisdom which—with some very slight exception—characterized this assembly may be inferred from the statement of the Chairman, implicitly accepted by the meeting, that the East London Company, in bringing forward their Bill in 1893, "forced opposition on the part of the Council, "for the simple reason that they refused to withdraw a "most obnoxious clause." The utter inaccuracy of this statement has been shown on more than one occasion, notably by a letter from Messrs. Bircham and Co., published a full fortnight before the Hackney meeting. The redoubtable Mr. Kyffin naturally took a lead at this gathering, and proposed that the County Council should be requested "to take action against the Company to compel "them to carry out their statutory obligations." The East London Company have been most anxious to do this; but if there is not sufficient water in their reservoirs, no force whatever can make up for the deficiency. The question is one of hydro-dynamics, independently of parish politics and County Council strategy. However, a deputation from five of the East London Vestries is to go up to Spring Gardens to-day, to confer with the Water Committee of the County Council. Another deputation from the same Vestries, but bound on a somewhat more sensible errand, is to wait upon the President of the Local Government Board, to ask for an inquiry. We should conclude that the Board had already inquired into the matter; and something more practical is to be found in the proceedings of the East London Company, who are busy with the enlargement of their works. In the meantime, the prospect of the supply is improving; giving the Directors hope that the present eleven hours' service throughout East London may soon be extended so as to cover the whole four-and-twenty hours. The pipes belonging to the Company were all mended or replaced early in April; and repairs to the damaged pipes of the consumers are in progress. A most conclusive report from Mr. Bryan, the Company's Engineer, disposing of Mr. Binnie's "shattered "main" theory, appeared yesterday. On the question of domestic storage, it is amusing to find a Medical Officer of Health at Bow, writing to *The Times*, denying most positively, in answer to an accusation from Mr. Crookenden, that he had "ever aided landlords in the abolition of cisterns "used only for the purpose of storage." A general disavowal similar to his own is put forward by this gentleman on behalf of the Medical Officers of Health throughout East London. There can be no question that, in respect to domestic storage, the Medical Officers at the East-end have considerably modified the objections which they formerly entertained to the use of cisterns. The virtues of the constant supply are great; but the house cistern is still a "necessary evil." As we have commented on the intemperate language in which the *Daily Chronicle* has dealt with the water question, perhaps we should also express our regret that the *British Medical Journal* shows something of the same spirit, though not to the same extent. The perfectly just defence offered by the East London Company with respect to the loss of a year in the passing of their Bill, is stigmatized by this medical paper as "a very idle "and audacious excuse." Such is the invective by which it is sought to discredit an unpalatable truth. It is marvellous that so patent a fact as the opposition of the County Council to the Bill of 1893, and the avowed reason for that opposition, should ever be denied.

Prize for the Discovery of Argon.—The reports of the Committee appointed by the Smithsonian Institution to award the Hodgkins Fund prizes have been published in *Nature*. It appears that no fewer than 218 papers were submitted in competition. The first prize, $10,000, for a treatise embodying some new and important discoveries in regard to the nature or properties of atmospheric air, is awarded to Lord Rayleigh and Professor William Ramsay, of the University College, London, for the discovery of argon.

Presentation to Mr. Frank Osmond.—On Monday morning of last week, the workmen employed at the Dorchester Gas-Works presented their Manager, Mr. Frank Osmond, with a silver sugar basin, on the occasion of his approaching marriage. The presentation was made in the board-room of the Company by the Chief Clerk, Mr. W. E. Groves, who, on behalf of the men, wished Mr. Osmond happiness in the future. Mr. Osmond thanked the men for their kind expressions for his future welfare, and trusted that the same good feeling which had existed between them in the past, would be maintained. Hearty cheers were given for the Manager by the men before separating. The marriage took place last Tuesday.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 453.)

Business on the Stock Exchange was very quiet last week; and in the City generally the depopulating power of the holiday season is showing itself with considerable force. The markets thus were very inactive—even those which hitherto maintained their briskness to a fair extent. But, despite a thin attendance and restricted dealings, the general tone was good, and the tendency was decidedly firm; so that prices have not suffered in any degree. While there was less speculation, so, on the other hand, choice investment securities were in excellent demand; and among them the debenture stocks of the Water Companies were conspicuous, though the corresponding issues of gas undertakings were neglected. The condition of the Money Market remains unchanged, and without any promise of amendment. In the Gas Market, the volume of transactions was very fair indeed, considering the general slackness; and the strength of the market was generally pretty well maintained. Variations in quotations were not by any means numerous, but a few considerable strides upward were achieved, while there was only one relapse. This, however, was the leading issue. Gaslight "A" was tolerably active through the week, and the actual prices at which bargains were made showed little, if any, falling off; but the quotation was marked one point lower. Beyond a few dealings in the 10 per cent. preferences, the secured issues did not come in for any notice. There were very few dealings in South Metropolitans; but all three issues continued their upward march—the "A" making a big stride of 10. Commercials were hardly touched; but the old stock was put up a point, though no business was marked in it. The Suburban and Provincial Companies were conspicuously quiescent; and hardly one of them was noticed. There were a few dealings, at about middle figures, in the Continental undertakings; but the chief issues did not move. Cagliari rose a point. Among the rest, the only noticeable incident was a further advance in Monte Video. Business in Water stocks was very quiet indeed. The only variation was a nice rise in Grand Junction; all the rest kept very firm.

The daily operations were: Business in the Gas Market was quiet enough on Monday, and prices were not remarkable in any way. Nothing moved except Monte Video, which rose ½. Transactions on Tuesday were a trifle better, and some smart advances were scored. South Metropolitan "A" gained 5; ditto "B" and "C," 2 each; and Monte Video, ½. Grand Junction Water rose 2. Wednesday was active, especially for Gaslight "A." The best price of the week—294—was marked that day; but the quotation fell 1. Thursday was much quieter; but prices held up, and Commercial old rose 1. Business on Friday was about the same; and Cagliari advanced 1. Everything was very quiet on Saturday; but South Metropolitan "A" rose 5 more.

INCANDESCENT GAS-LIGHTS IN EXPOSED POSITIONS.

With the extending use of the incandescent gas-light for the purposes of lighting streets and open spaces, the question of the utility of the system for all sorts and conditions of situations will have to be considered; and therefore any evidence, experimentally derived, as to the performance of the light in uncommon positions will be welcome. For ordinary street lighting, it may be said, incandescent gas-lights have emerged from the experimental stage, and entered upon practical use. In many towns now whole streets are satisfactorily illuminated at nightfall by their means; and soon Ipswich and Winchester will be able to afford experience of general schemes of lighting by this system. It will be interesting, at the close of (say) six months' working, to receive for publication from Mr. Jolliffe and Mr. Dexter accounts of what has been accomplished by them in this new direction.

Testimony is now wanting as to the performance of the lights in elevated and exposed situations, where it may be presumed that the light would be adversely affected, and the life of the mantles diminished, by violent winds and storms. A contribution towards information of this kind has been kindly furnished by Mr. H. H. Jones, the Engineer of the Margate Gas-Works; and his carefully-kept records, dating from Jan. 22 last, cover a period which has been marked by particularly severe and boisterous weather. Taking his notes in the order in which they were supplied, the particulars first given bear upon the durability of the mantles. Zion Place was selected by the Corporation Lighting Committee as the most exposed spot in the whole town, and therefore the most suitable for testing the value of the light. On one side, it is open to the sea, and four roads converge to it. The lamp being situated in the centre, it catches the winds from all quarters. An experiment was commenced here on Jan. 22 last; the burner and mantle being fitted in an ordinary lantern, converted by the Gas Company to what was considered requisite, by putting an internal

copper cone at the top so as to check excessive "top draught." It will be remembered that the weather at the end of January was very severe; and the result was that the mantle had to be renewed on the 24th, after only two days' use. An improved ordinary 14-inch lantern was then obtained from the Incandescent Gas-Light Company; and since then there has been but little trouble. As will be seen from the following dates, each new mantle has had a prolonged existence. The second mantle, put in on Jan. 24, lasted to Feb. 8; the third, from that date to March 19; the fourth, to May 10; and the fifth is still in good order—having already been in use about 110 days. On Fort Green, eight lamps were fitted with incandescent gas-lights just before Whitsuntide. In our opinion, the test here is even more severe than in Zion Place; the lamps being erected along the promenade on the sea-front, with a large space at the back, into which open the main thoroughfares. They have therefore no protection whatever; being fully exposed to the winds from the land and gales from the sea. But with the special lanterns already referred to, notwithstanding the recent heavy storms, only five renewals have been required since the first installation of the lamps. With another lantern on Fort Paragon, similarly arranged to the one used in the first experiment in Zion Place, five mantles were destroyed in ten days; but since the lantern has been replaced by one of the improved pattern, the results have been satisfactory. The foregoing notes all refer to lamps in exposed situations; but it may be mentioned that, in an experiment in Cecil Square (a sheltered position), with an ordinary adapted lantern, four mantles have been required since Jan. 22—the last one having been fixed on May 10. Mr. Jones estimates that an average of eight mantles per annum will be quite sufficient in the exposed positions.

The type of burner used by Mr. Jones in his experiments is the "C" bye-pass, with glass bulbs and governors; the latter being set for a consumption of 4 cubic feet of gas per hour. In the case of the Cecil Square lamp, the glass bulb has not been employed; and an ordinary "C" burner, with a mica chimney, is used with the Company's own lantern, simply provided with an inner tube. Regarding the consumption of 4 cubic feet an hour, Mr. Jones does not admit that the generally quoted rate of 3 cubic feet an hour is sufficient for obtaining the best results. For the bye-pass, he finds that, for safety, the consumption must be regulated to not less than ¼ cubic foot per hour. It might, he says, be reduced a little; but, in exposed situations, the flash-light would be frequently extinguished, and be a source of much trouble to the lamplighter.

Concerning the illuminating power of the lamps, the best value is obtained with a consumption of 4 cubic feet of gas per hour, at a pressure of 10-10ths; the light afforded being about 53 candles with a new mantle. Increasing the pressure, causes a diminution of the illuminating power. Mr. Jones's experience in this respect agrees, he informs us, with the results of tests made by Mr. H. Leicester Greville, the Chemist of the Commercial Gas Company.

The burners so far adopted are fitted with the chain and ring arrangement for lighting and extinguishing. But Mr. Jones has good reason for holding a strong objection to it. He finds that playful, holiday-making youths, and others of an inquiring mind, are attracted by the chain and ring; and, by the aid of sticks, are given to testing the efficiency of the device. Burners are now being made with an ordinary T-tap underneath; and these, in his opinion, have distinct advantages.

In conclusion, it may be pointed out that one of the greatest difficulties experienced in seaside towns with incandescent lights is caused by sea fogs, which involve the frequent cleansing of the glasses; and this in turn is responsible for some of the fractured mantles.

WATER-RATES v. METER SUPPLIES.

It cannot be said that the dream of a universal water supply by meter is much nearer the point of realization than it was when, week after week, the subject was ventilated in the columns of the Journal some years ago. But, none the less, the incidental discussion of the subject which took place at the last annual meeting of the American Water-Works Association—of which some account appeared in our last issue—presented many interesting, if not altogether practical, considerations. The United States afford examples both of the assessed and the meter systems under conditions as varying as the habits and characteristics of the people. But the Superintendent and Secretary of the Detroit (Mich.) Water-Works believes that a much greater uniformity could be brought about than at present exists. He frankly concedes the impossibility of absolute uniformity, though regarding an unequal system in any one community as inexcusable. "Inexcusable" seems to be too strong a word. "Unfortunate" or "regrettable" would be more apposite; for, however strong and natural the desire to make practical operations accord with theories of fitness, wise men have to realize that it cannot always be done. When a thing cannot be done, it is not correct to describe what has to be left undone as "inexcusable."

One of the speakers pointed out that a fixed schedule of water-rates, though suitable in Detroit, might not be equitable in other cities. We should be disposed to go farther, and say that what might be just and convenient in one district of Detroit (or of any other great city) might involve disastrous results from a sanitary point of view if applied in another district. For a district of warehouses, the meter system might work well; for a district of small tenements, it would, if carried out *simpliciter*, offer a check to sanitation and be productive of a marked increase in the death-rate. A large consumer, it was argued at the recent conference, should pay a lower rate than a small one. But how would that suit the views of the malcontent consumers who, in England, state their grievances to the police magistrates, or ventilate them in the columns of the daily press? Another of the speakers, who hailed from Brooklyn, did not fall in with the views of those who might be styled the representatives of Detroit, Indianapolis, and other centres. In Brooklyn, he said, the water-rate was uniform. There, one-fifth of the water-rate comes from the meter system; and the remaining four-fifths from the sugar-refineries. Clearly, then, Brooklyn cannot be quoted as an illustration of what might, and ought to, be done in cities where the conditions are very different.

So far as we in England are concerned, the question of meter *versus* rates is dormant. In all the discussions of the London County Council, in all the utterances of parliamentary orators, we find nothing which suggests that a wholesale departure can be made from the present system. The Progressives, with all their progressiveness, have not progressed as far as that. Indeed, no one who with any degree of sincerity professes to have the interests of the poor at heart, could possibly advocate a revolutionary departure which, for example, would place dwellers in the East-end of London under far unhappier conditions than those to which they have recently had to submit from causes beyond the control of the East London Water-Works Company. Nor is anyone who understands the subject at all likely to commit himself to the doubly-difficult financial problem which the purchase of the water-works would involve, if the new proprietorship were to be accompanied with a proviso that the well-considered system of rates at present in force should give place to a general system of supply by meter. The system of water supply must meet the greatest convenience of the greatest number. It must have a practical, workaday basis; and, though the method in vogue may be anomalous in some of its aspects, it is necessary to remember that anomalies frequently work well—better far than schemes which look excellent on paper but which prove to be chimerical and delusive directly it is sought to adapt them to the actual needs of the population under the complex conditions of social life.

Mr. M. S. Blaker has been appointed a Director of the Lewes Water-Works Company, in place of the late Mr. George Lenny.

A Furnace-Gas Analyzer.—Messrs. Meldrum Brothers, of Manchester, are introducing a form of analyzer for ascertaining continuously and automatically the percentage of carbon dioxide in furnace gases. The apparatus consists essentially of a delicate gas-balance. Carbon dioxide being much heavier than air, the greater the percentage of this present in the smoke, the greater the deflection of the needle of the balance. A table is provided, showing at a glance the percentage of the gas corresponding to any given deflection; and this forms a ready means of ascertaining whether the amount of air admitted to the furnaces is much in excess of what it should be.

The Late Committee on the London Water Bills.—The recent General Election has not made much change in regard to the returns from towns represented by members who constituted the Hybrid Committee on the London Water Bills in the past session; so that, should an endeavour be made next year to reappoint the Committee as nearly as possible on the old lines, there will probably be little difficulty in so doing. The Chairman (the Right Hon. D. Plunket), Sir J. Kitson, Sir H. Stafford Northcote, Mr. Baldwin, Mr. Muntz, Mr. P. Stanhope, and Mr. Briggs Priestley are all in the new Parliament; but of the other two members of the Committee—Mr. Burnie and Mr. Ainsworth—the former has had to give place to Sir J. T. Dillwyn-Llewelyn, and the latter to the Hon. H. V. Duncombe.

Visit of the Iron and Steel Institute to Tangyes' Works.—The holding of the annual meeting of the Iron and Steel Institute in Birmingham last week afforded the members an opportunity of inspecting the vast establishment owned by Tangyes Limited; and a party numbering about sixty availed themselves of it. The visitors were received and conducted over the works by the Managing-Director (Mr. G. H. Haswell), the Secretary (Mr. W. J. Parkins), and the Works Manager (Mr. W. Johnson). Every department of the famous establishment, which covers about 20 acres, and in which from 1500 to 2000 men are employed, was thrown open to inspection. In the engine-fitting shops were seen in course of construction steam-engines in great variety; while in the gas-engine department, gas-engines of all sizes—of from 1 to 146 actual, or 170 indicated horse power—were being made and tested. The alterations and improvements going on in this department of the works aroused considerable interest. The extensive shops and yards devoted to boiler-making having been inspected, the visitors passed through the smithies, where the working of various huge tools, boring and shaping immense castings for the heavy engines and machinery, was critically and appreciatively observed. Several of the large pumps, rams, and hydraulic presses were seen in construction and on trial, including pumps of the "Special" and double-ram types.

TECHNICAL RECORD.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Abstracts of the Papers.

In the JOURNAL for the 23rd ult., we gave a report of the proceedings at the annual congress of the above Society, together with a translation of the principal portions of the address of the President (M. de. Lachomette). We now notice briefly the papers presented on the occasion, abstracts of which are contained in the *Journal des Usines à Gaz*, the official organ of the Society.

The subject of condensation was dealt with in a paper by M. Godinet. The author commenced by stating that condensation should be sufficiently complete to clear the gas of any redundant naphthalene vapours, but should not be carried so far as to take out the hydrocarbons so necessary for increasing its illuminating power. Contact of the gas with the tar should be as limited as possible, as this substance has been proved incontestably to cause dissolution of the light-giving hydrocarbons. The author cited, in support of his statement, several striking examples met with by him when carrying on tar distillation; and he summed up the first part of his paper by recommending that the gas should be cooled down to a temperature equal to, or even below, that of the coldest appliance it would have to traverse in its passage to the burner. M. Godinet next took up the practical side of the question—following the gas in its progress through the various parts of the plant. He described the advantages and inconveniences attending the three systems which have been employed to prevent stopped ascension-pipes; and he expressed the opinion that the one generally adopted—viz., leaving the retort mouthpiece and the pipe open to the air—is the best. The precaution should be taken to clear the pipe at each charge. While keeping the retort at such a temperature as to work off the charge in the prescribed time, unnecessary heating of the mouthpiece and the pipe should be avoided. Whatever may be the shape of the hydraulic main, its temperature should be kept as low as possible; and it is indispensable that the gas, on leaving the dip-pipe, should pass through water and not tar. The author discussed the system of hot condensation, and expressed the opinion that the benefits attributed to it are really due to attendant causes. He questioned the necessity for the gas to travel slowly, and in large pipes, from the hydraulic main to the condenser. On the contrary, he contended that the only way of preventing contact of the gas and tar is to convey the gas quickly into powerful coolers, but of small superficial area, and to remove all condensed products as soon as possible by means of numerous syphons. M. Godinet said he was a partisan of the system of condensation employed by the Lyons Gas Company, and devised by M. de Craponne, the Company's Engineer. His condenser consists of five or more groups of four horizontal pipes, through which the gas is made to pass successively; the pipes being kept cool by water. A surface of 54 square feet is ample for cooling 35,000 cubic feet of gas in 24 hours; and the gas usually leaves the appliance at a temperature between that of the water and that of the air. The author has put up at Vichy a condenser on this system, with six groups of pipes; and he cools there, in the height of summer, with a superficial area of 646 square feet, something like 212,000 cubic feet of gas per 24 hours. The gas enters the appliance at about 122° Fahr., and sometimes leaves it at a lower temperature than that of the air. This cooler would be amply sufficient in winter for a make of from 425,000 to 530,000 cubic feet of gas. For condensation by impingement, M. Godinet favours the Pelouze and Audouin appliance for large works, and the Chevalet washer-condenser for small ones. He considers that the ordinary exhauster should be placed between the cooler and any condenser constructed on the principle of impingement; whereas the steam-jet exhauster should come after it, as the naphthalene held in suspension would be sublimated by the steam, and cause obstructions. The author concluded by reiterating his opinion, that though the system of hot and slow condensation has been much praised, the opposite plan is, if not better, at least as good, as far as the quality of the gas is concerned, and more economical as an installation.

A rather long communication on "Cyanogen in the Manufacture of Illuminating Gas" was read by M. Perthuis. He pointed out that laboratory experiments show that, in all the reactions which take place in the formation of cyanide and sulpho-cyanide of ammonium, the fixation of the nitrogen is greater in proportion to the temperature and to the slow rate at which the gas passes; also that the transformations are never complete. The same reactions go on in the retort. Carbon, carbonic oxide, bisulphide of carbon, and ammonia are acted upon by very high temperatures; but, as there is an excess of ammonia, cyanide and sulpho-cyanide of ammonium are produced, and not hydrocyanic acid. All these compounds of cyanogen pass the hydraulic main, condensers, and scrubbers, and are acted upon in the purifiers. If these cyanides, both of which are very soluble in water, do not dissolve in greater quantity, it must be attributed to the fact that the carbonic acid contained in the gas decomposes these bodies in liberating the hydro-cyanic and sulpho-cyanic acids. In the oxide of iron purifiers, reactions take place between the cyanide and sulpho-cyanide of ammonium, the hydro-sulphuric acid, the ammonia, the sulphur, and the ferrous compounds. According to M. Perthuis, these reactions are as follows: The oxide of iron, in combination with cyanide of ammonium, forms ferrous cyanide, which when exposed to the air is quickly transformed into Prussian blue, according to the following formula:—

$$9\,Fe(CN)_2 + 3\,O = Fe_2O_3 + Fe_7(CN)\,18.$$

If, however, there is an excess of cyanide of ammonium, the ferrous cyanide is transformed into ferro-cyanide, thus—

$$Fe(CN)_2 + 4\,NH_4CN = Fe(CN)_6(NH_4)_4.$$

From these formulæ, the author concludes: (1) That Prussian blue is not formed directly in the purifier, but by the oxidation of the ferrous cyanide; and (2) that the purifying material retains a portion of the cyanogen in the state of ferro-cyanide of ammonium. As the latter body is soluble in water, it is evident that the old material must not be washed, in order to recover the ammonia, before it is sent away to be treated—ferro-cyanide of ammonium having a much higher value than ammonia. It has been shown that sulpho-cyanide of ammonium exists in the purifier. Ammonia, acting only upon the cyanides and Prussian blue, is not injurious; but it is the mixture of ammonia and hydro-sulphuric acid which has to be avoided in the purifier when it is desired to limit the production of sulpho-cyanides. It is therefore necessary to arrest the ammonia, by as thorough a washing as practicable, before it enters the purifier. Following Dr. Burschell, the author recommends the avoidance by every possible means of high temperatures in the purifiers or during the revivification of the spent material. In an appendix to his communication, he gave a few particulars as to the treatment of spent products in gas-works. At present, they are much in demand by owners of chemical works; but as they contain only small quantities of cyanide—rarely exceeding 15 per cent. of ferro-cyanide of potassium—their transport is expensive. It therefore becomes a question of concentrating the cyanides. In order to do this, the spent material is mixed with lime. The cyanides pass into the condition of ferro-cyanides of calcium; the sulpho-cyanides become sulpho-cyanides of calcium; and the sulphide of iron is oxidized by the excess of lime. Washing follows; and the soluble ferro-cyanides and sulpho-cyanides of calcium dissolve. As a matter of fact, there are two processes principally in use. In the first, the washing water is concentrated, and the sulpho-cyanide of calcium is decomposed by heat, with, however, the liberation of certain secondary products having a very disagreeable odour. The result of the operation is ferro-cyanide of calcium, partly crystals and partly mud. In the second process, the liquor is treated with ferrous chloride. Ferrous cyanide is precipitated, and chloride and sulpho-cyanide of calcium remain in solution. The ferrous cyanide is then exposed to the air, and becomes transformed into very impure Prussian blue; its standard ranging from 35 to 50 per cent. The second process is the better one, inasmuch as it produces the higher yield.

M. Perthuis also (in conjunction with M. Guillemet) dealt with the subject of preventing frauds resulting from the tilting of gas-meters; an appliance having been devised by them for this purpose, which they claim to be effectual. A balanced plug is so adjusted as to cover the orifice of the water outlet when the meter is tilted, and to alter the position of the tube of the syphon-level. Fitted with this appliance, it is stated that a meter will not act unless the proper level has been ensured.

M. Perthuis further dealt briefly with the cost of heating by electricity as compared with gas. Applying Joule's law, he showed that by transforming the current of the hectowatt-hour into calorific energy, there are produced 86·4 calories; and that consequently the production of 100 calories requires an expenditure of 115·8 watt-hours of electric energy. At 0·5 c. per hectowatt-hour, 1000 calories would cost 5·7 c., for which amount the same number of heat-units could be furnished by gas at 30 c. per cubic metre, or 6s. 9d. per 1000 cubic feet. These data allow of a comparison being made between electricity and gas consumed in appliances now generally in use.

(*To be continued.*)

THE GAS TRAMWAY AT DESSAU.

We have received from Herr W. VON OECHELHAEUSER, the General Manager of the German Continental Gas Company, a print of the paper on the above subject read by him at the annual meeting of the German Association of Gas and Water Engineers this year. The following is an abstract translation of the paper.

Herr Kemper read before the Dresden meeting of the Association two years ago, a paper* on the application of gas-engines to the driving of tram-cars; and the German Continental Gas Company have aided the construction of a gas-driven tramway in Dessau, of which a length of 4·4 km. (2¾ miles) has been worked by nine gas-cars since last year. At the end of four weeks' working, the results were considered so satisfactory that

* See JOURNAL, Vol. LXIII., p. 152.

an issue of additional capital of £9000 for extensions of the system was over-subscribed by the public. Since Whitsuntide, the two trunk lines have been extended to the originally planned termini; and the full length of 6·2 km. (3·85 miles) has been worked by nine 7-horse power, four 10-horse power, and four supplementary cars. The favourable results of the working of the system, and the desire to further extend it, has led to the patent rights, which on the death of the inventor, Herr Lührig, passed into the hands of the Gas Traction Company in London, being secured by the German Gas Tramway Company, of Dessau. This Company have large works in the town for the building of gas-motor cars, gas locomotives, compressing stations, and other appurtenances of gas tramways. Gas tramways will come into operation shortly in Hirschberg and Saarlouis; while a great number of other towns contemplate adopting them.

Briefly, such has been the development of the gas tramway since the Dresden meeting of the Association; and I can now dispense with further description of the Lührig system of gas-motor tramways, and comparison of it with the competitive systems, by referring you to the articles which have appeared in the *Journal für Gasbeleuchtung*,* and to a pamphlet on "Gas for the Working of Tramways" which is published by the German Gas-Tramway Company. My present purpose is to indicate, by reference to the experiences gained at Dessau, the characteristic features of gas traction; then to discuss the results achieved there; and finally to briefly allude to the relation which the gas tramway bears to gas-works.

The three important elements of gas tramway working are the storage of gas, the motor, and the machinery; and of these, the storage usually evokes the greatest interest in the general public. Here there is a prejudice to be allayed, in the bogey of an imaginary risk of explosion through the carriage of the gas on the car. We, however, know that, for the past 25 years, more than 60,000 railway cars at home and abroad have carried gas at high pressure for combustion on the car, according to the admirable Pintsch system, without a single explosion, and without giving cause for the slightest alarm to passengers. You are aware that the great pressure in the reservoirs and pipes makes it impossible for air to enter and form an explosive mixture; while leakages caused by the frequent and severe concussions to which cars are subjected, are so much more easily traced on account of this pressure. Further, the reservoirs on tramcars are either exposed or in freely-ventilated positions on the car; and there is no naked flame near, as ignition is performed electrically in the motor, and the spark only passes within the cylinder. The connection for filling the reservoirs is now outside, and on one side of the car; so that neglect in screwing up the union is not attended with danger to the occupants. If possible, there is even less risk with the gas tramcar than with the railway carriage provided with Pintsch gas; for, in the tramcar, combustion takes place only within a cylinder built to resist the explosive force of the strongest admixture of gas and air, while on the railway, the gas burns within a glass bell in the roof of the carriage.

You are well aware that gas explosions attended by an incalculable rise of pressure could not occur in the motor; and that the maximum pressure for any given mixture of gas and air has been theoretically and practically established. The "slow combustion" of the gaseous mixture introduced in the Otto engines emanating from the Deutz Company, has met world-wide recognition. Gas-engine diagrams prove that the rise in pressure which takes place in the gas-engine through the gas exploding at the dead-point relatively slowly, is not more rapid than that which occurs on the admission of high-pressure steam to the steam-cylinder. Finally, the pressures in the gas-engine, which up to the present have not exceeded 20 to 30 atmospheres, are as nothing compared with the pressures of 100 atmospheres and over to which carbonic acid is compressed in steel vessels—there are now some 150,000 in Germany alone—for the use of publicans, and no one has been injured by these. Moreover, the railways convey holders charged with gas to 200 atmospheres pressure. In gas-motor cars, more than a tenth of this pressure is seldom reached; and the storage is similar to that on railway waggons. Since, however, even people well informed on technical matters have expressed fears of these gas-driven cars, I have taken this opportunity to again protest against their utterly unfounded terror.

The next point which occurs is the quite warrantable doubt as to whether the wear and tear of the gas-engine is not too great for the working of a gas tramway. Evidently the first half-year's working at Dessau cannot suffice to answer the question; and we must still fall back on indirect deductions from the working of stationary gas-engines. An exhaustive inquiry, undertaken by the Company I represent (the German Continental Gas Company), brought very favourable answers. In most cases, the repairs were confined to the renewal of piston-rings after continued work, and the sticking of the slide with the old-pattern motors; and these repairs could be generally undertaken by the attendants. The reports on gas-driven dynamos were especially favourable. Taking the record of the repairs during the 8½ years ending April 1 last, at the small electric station at Dessau, to gas-engines of 10, 30, 60, and 120 horse power, the cost averages only 0·006d. per horse-power-hour, or 0·12 per cent. of the initial cost, per year.

* See JOURNAL, Vol. LXV., p. 22, and reference on preceding page.

On appealing to the Prague Gas-Works for information as to the repairs effected on the three 50-horse power engines at the town electric lighting station, we received the astounding reply that the cost of repairs for a period of eight years was *nil*. Presumably this meant that the necessary repairs were effected by the ordinary attendants at no appreciable outlay. The 12-horse power engine used for the electric lighting of the Prague Gas-Works was also stated to have needed no outlay for repairs in eleven years; and one of the same power used for lighting the Council Chamber, entailed an expenditure of £7 15s. in nine years. At Munich, twenty 8-horse power engines in ten years cost £44 for repairs; and at Gladbach, a 12-horse power Otto twin-motor for electric lighting, cost £3 10s. in seven years.

From these figures, and the opinions of many technical men, it may be concluded that the need of repairs with properly attended gas-engines of good construction is beyond doubt as low as that of good steam-engines similarly attended. Indeed, several of the original Otto and Langen engines of 1867 are still at work. On what ground, therefore, can it be assumed that the gas motor on a travelling car would need more repairs than the steam-engine of the locomotive? The gas-engine is not more sensitive to dust than the steam-engine. In our works, it is used for coke-breaking in the midst of sharp coke dust; and gas-engines are in operation in numbers of small dirty workshops. The steam-engine on a locomotive is exposed to the dust; while in the Lührig cars, the gas-engine is entirely shut off from it, both within and without. The motors used have valve-motion with electric-ignition, instead of the ignition-slide, which was rather sensitive to dust. Both descriptions of motor are subject to the same shocks from the rails and at switches; and the Dresden gas cars for nearly a year have crossed 26 times daily five lines of railway metals. Thus each axle is daily subjected to 260 violent shocks; yet no special wear and tear to the engine has ensued. On a recent examination of the engines of the Dessau cars, the inner cylinder surfaces were found to be polished like mirrors; and according to the gauge, no change of dimension or uneven wear had taken place. This confirms the belief that we have nothing to fear from dust, as the wear would be very evident, and would rapidly advance, if such were the case. In the Lührig cars, the machinery is encased to protect it from dust and dirt.

There is yet another misgiving experienced by many technical men—viz., whether the transferring and reversing gear of the machinery is not rather complicated. In reality, the mechanism is simpler than it appears to be, and has only a certain complexity from the multiplicity of functions it fulfils—*e.g.*, regulation of speed and control of the direction of travelling. But when the controlling lever is moved to the proper position for the particular motion desired, it is effected by simple and direct gearing.

A remarkable corroboration of my opinion that the mechanism is very simple, comes from Professor A. B. W. Kennedy, of England, who recently visited the gas tramway at Dessau. In the address which he delivered as President of one of the sections of the British Association, at the meeting at Oxford in 1894,* he pointed out that simplicity was not really incompatible with apparent complexity, when the purpose of the machinery was regarded, and that directness is allied to simplicity in this respect. Then, in his presidential address to the Institution of Mechanical Engineers in 1894, this eminent electrician, after referring to the fact that electric traction, either with overhead or underground conductors, utilizes only 35 to 47 per cent. of the indicated horse power of a stationary steam-engine, while 70 per cent. of the power is utilized in the steam locomotive, goes on to say that there is no probability of this percentage being largely augmented, on account of the "indirectness" of the process and the loss of energy in the numerous transformations. Then, speaking of the difficulty of conducting electric power to the cars, he says that it has been overcome in America by the use of overhead conductors; but he hopes such a system will never be adopted in England, and believes that the introduction of electrical traction in the streets there will not be general until a good system with underground conductors has been invented. In the meantime, it is hard pushed by the rival systems of rope and gas propelled cars, of which he thinks the latter the more formidable. Gas acts more directly than steam, which necessitates a boiler; and though it is still quite in the experimental stage for traction purposes, he is sanguine of its future success. This testimony of Professor Kennedy is substantiated by the results of last summer's working at Dresden and this year's at Dessau, and in particular by the work during the snow and cold of last winter. The direct transmission of power to the axle in the gas-motor cars, without loss of energy through conversion, is the secret of the superiority.

Finally, there are two more trifling charges made against the new system—firstly, that there is a noticeable smell from the engine; and, secondly, that there is vibration, which is especially evident when the car is at rest. Now it may be said that a large number of the visitors to the Dessau tramway failed to detect either odour or vibration, even when their attention was drawn to the possibility of their existence. This fact proves that these evils can be done away with entirely, with a little further experience in the working of the cars. A lubricator for

* An abstract of the address here referred to appeared in the JOURNAL for Aug. 21 last year, p. 375. See also p. 464.

oiling the cylinder automatically, and so preventing too much oil being applied, with consequent production of smell, has been tested; and a more exact regulation of the gas admission will no doubt be secured, abolishing the vibration caused by careless manipulation of the lever.

Technical men who experienced two years ago the strong vibration of the cars in Dresden, can be convinced of the improvement by the absolute smoothness of the Dessau cars. The great defects and the many sources of interruption with other systems have yet to be overcome; and it may be assumed that improvements in detail of the gas cars will go on as rapidly in the future as in the past two years. It is not claimed that the new system is the best under all conditions—the special circumstances must in every case be considered. Nevertheless, the future may be trustfully looked forward to, as no disadvantages will ensue to vested interests through the advent of the gas motor system.

The *rôle* that compressed coal gas may play in the future, is indicated by the formation last year of a company at Havre for the running of small cargo boats between Havre, Rouen, and Paris; the boats being furnished with a motor and coal gas, compressed to 100 atmospheres in iron cylinders. The first boat of the kind was 100 feet long and 19 feet in the beam, and was provided with a 40-horse-power (effective) motor. It has carried a load of 145 tons a distance of 45 miles without refilling of the gas reservoirs. The work expended in compressing the gas does not increase proportionally with the pressure, but is relatively much less with high pressures. Thus only two-and-a-half times the power is needed to increase a pressure of 10 atmospheres tenfold—*i.e.*, to raise it to 100 atmospheres.

There is a prospect that the distances traversed by gas cars with one charge of gas may be greatly extended, and that gas motors may be used on small local railways. There is no immediate chance of acetylene being employed for motors, as, though it has approximately fifteen times the lighting value of common gas, it has only two-and-a-half times the heating value; and if it cannot be economically used for lighting, except under very exceptional conditions, there is no likelihood of using it yet for the development of power. Furthermore, rich gas is burnt with difficulty in an engine without deposit and clogging. Ordinary gas, of moderate heating value, is, as far as can be seen at present, the best.

Having disposed of the technical objections to the gas-motor tramcars, we next come to the consideration of the lessons and results of the gas tramway up to the present time. As already pointed out, the working continued with regularity through the hard winter. In the event of a car failing, it can readily be propelled also by the succeeding car, as each has an ample excess of power available; and thus no block is caused through the failure. The system has so far worked splendidly, and no considerable alterations have had to be made to the cars.

When we come to the financial aspect of the system, it is evident that a little more than a half-year's working, in the least favourable season of the year, cannot give figures of any great value. With a plant of this description, there are a number of extraordinary expenses in the first half year of its working, which do not subsequently occur; and no reliable factor for the general cost of repairs can be arrived at in so short a time. The wages of the driver and conductor are the same as with other methods; and the item which is peculiar to this system—viz., consumption of gas—is the most important among the remaining expenses. This charge has been determined, not only for a half year, but even for any given day; and the ease of checking this main factor of the expenditure is a special and unique advantage of the new system. Two meters in the compressing station give the amount of gas used in the work of compressing, and the quantity of gas compressed. The cubic content of the car reservoirs is known; and each being furnished with a pressure-gauge, the volume of gas within can be ascertained at any time, and the consumption on each journey found. If this is high on any day without readily assignable cause, the car is carefully examined for faults; and the same, when located, are remedied. During the first five months of this year, the average consumption of gas, including that consumed in the compressing engines, was 31·2 cubic feet per mile run, which is even less than had been estimated, notwithstanding the severe weather with which the cars had to cope. Compressing required 16·8 per cent. of the gas compressed, which is too large a proportion, and has since that time been reduced to 10·5 per cent. The total consumption of gas is therefore less than had been anticipated; and with more frequent trips, it will fall even lower in the future.

The plan and execution of the line influence the results of working to at least the same extent as the system of traction used, and must suit the particular system finally adopted. This is of great importance in respect to the power consumed. The Dessau line is of "Phœnix No 7" rails; and, except where there is wood pavement, it is laid directly on the gravel, and easily bears the weight of the cars.

If from the above it is concluded that the Lührig gas tramway is a success, the question occurs to the managers of gas and electrical works, as to which of them can most naturally provide the power for working tramways. In Dessau, the pioneers of the tramway had electrical traction in mind—especially as there was already in the town an electric central station. But on consideration, it was found that the dynamos only afforded the usual lighting current of 110 volts; and the cost of transforming it to one of 500 volts, which would be needed for the tramway, would be prohibitive. There was nothing for it but to put down new engines and dynamos; and those already installed would then be no better utilized than formerly. It was, however, impossible to raise the capital in Dessau; and as alternating currents have not been satisfactorily used for tramways, attention was turned to gas. The lines are in large towns always in the main streets, where the mains are large enough to meet the increased consumption; and thus no fresh expenditure is required for the distribution of the power. There is also great latitude in the choice of the position on the line of the compressing and filling stations, which need not necessarily be at the termini.

All the advantages which have been claimed for the consumption of gas for cooking and heating purposes, are present in its use for tramways. Two-thirds of it is day consumption; and it is greater in summer than in winter, as 25 per cent. more people travel in the former season. Thus, the tramway tends to equalize the day and night, and summer and winter consumption of gas. The more uniform demand would secure a better duty from the settings and apparatus; and moreover gas coal can be bought more cheaply in summer than in winter. The tramway consumption is equal to that of a large number of ordinary consumers; and therefore the expenses of registering such a quantity of gas, and collecting a number of accounts for it, are saved, and a greater profit is made on this quantity. The consumption of a tramway would, on the heaviest winter's day, be only about 1-400th of its consumption per year, which is half that of the ratio of the consumption for lighting purposes on the same day to the lighting consumption for the year. Therefore the extra capital for the supply of gas for tramways need be only half that required for supplying the same quantity of gas for lighting puposes.

If we take the actual, instead of the selling, price of the gas, the prospects for the gas tramway are even more hopeful. To give some idea of the consumption of a tramway, it may be pointed out that one car, according to its size and the traffic, requires from 800,000 to 1,000,000 cubic feet of gas (including that used for compressing); and that the adoption of gas as the sole motive power on the Cologne tramways, for instance, would cause an additional consumption of 70 million cubic feet of gas per annum. The transport of gas for power purposes has opened up an extensive new field for the gas industry.

The South Metropolitan Workman-Director Proposal.—When referring to this subject in last Friday's number, *Engineering* said: "Mr. George Livesey has again tabled his proposal to elect a workman as a Director in the South Metropolitan Gas Company; and . . . power is to be sought in the Bill to be re-introduced into Parliament. But the clause is to be permissive, 'to enable the Directors to allow the men to select a representative.' But whether permissive or obligatory, the point is valuable as showing that the system of profit-sharing is making real progress. Mr. Livesey has dealt with the gas-workers in such a way as to allay discontent; and the men co-operate well with the management, to the advantage of all concerned."

Protection of Underground Pipes from Electrolysis.—An article of some length which appeared in a recent number of the *Street Railway Review* describes a method of permanently protecting underground pipes from the effect of electrolytic corrosion. It is stated therein that nearly half of the energy generated by dynamos at full load is wasted in the conductors to and from the motors. Even with perfect feeder wires and rail joints, the currents in the pipes are only reduced; and they will still carry a considerable portion, suffering corrosion at the joints where the current leaves them. After discussing the various wiring systems in their bearing on electrolytic corrosion, the writer sums up the three essential problems in a successful method as follows: The pipes must be kept at least one volt negative to the rail at all points and at all times; the flow of current on the pipes should be diminished as much as possible; and permanent low contact resistance between the pipes and the feeder wires should be secured.

Manchester District Institution of Gas Engineers.—We learn from the Honorary Secretary of this Institution (Mr. S. S. Mellor, of Northwich) that the 103rd quarterly meeting will be held next Saturday, at Buxton, under the presidency of Mr. G. Smedley, the Engineer and Manager of the gas-works there. The members will leave the Central Station, Manchester, so as to reach Buxton just before eleven. Upon their arrival, they will be conveyed to the gas-works, where they will be received by Mr. E. C. Milligan, the Chairman of the Gas Committee of the Urban District Council. Luncheon will be partaken of at the Royal Hotel; and the business subsequently transacted. One new member will be proposed for election; and Mr. R. G. Shadbolt, of Low Moor, will read a paper entitled "Some Experiences in Gas Purification." After the business, the members and their friends will be taken by coach to the "Cat and Fiddle" Inn, which, we believe, claims the distinction of being the highest licensed house in the kingdom, and return *via* Axe Edge. Tea will then be served at the Royal Hotel; and Manchester reached about nine o'clock.

ILLUMINATING GAS FOR HEATING PURPOSES.

At the International Congress of Hygiene and Demography held last year at Buda-Pesth, Mr. Frederick Siemens read a paper on the above subject, in the course of which he described the stove, constructed by him on the regenerative principle, of which Professor Lewes spoke so highly in the course of his paper "On the Combustion of Coal Gas for Fuel Purposes," at the last meeting of The Gas Institute. The following translation of Mr. Siemens's paper appears in the August number of the *Engineering Magazine*.

There is hardly any more important and more difficult question to be solved than the rational heating of dwellings. This is evident from the fact that, though many systems and constructions have been applied, not one exists which meets all the requirements. A heating appliance must be cheap, not only as to first installation, but especially as to operating expense; it must be easy to attend to, and must not require any intelligent attendance; and above all, it must be agreeable, and not detrimental to the health. Furthermore, it must be easily regulated (preferably by an automatic device) and must not cause any nuisance outside. For instance, it must not evolve any smoke —that being very often the cause of complaints in otherwise good heating installations.

How are these requirements met in practice? The first installation is too expensive in most of the central heating systems, which show lesser or greater deficiences according to the system employed. The hot-air heating system has a very disagreeable effect on the organs of respiration, for the reason that the air is hot and dry. From a hygienic standpoint, therefore, it is to be condemned, because the air which we breathe should be cool, and nearly saturated with moisture. On the other hand, the existing systems are too expensive in operation, as, for instance, the English grate, which probably best meets the hygienic requirements in a dwelling, but which vitiates the air of the neighbourhood—at least in large cities—with the escaping smoke and other products of combustion. The English grate heating system is very expensive on account of the large waste of fuel, and because it makes necessary continuous care of the grate. In other respects, it is agreeable and comfortable, mainly because only radiating heat is employed, similar to the heat from the sun, which is certainly the most agreeable and hygienic heat. Heating by large porcelain tile stoves is cheap; but from a hygienic point of view it is bad, as almost no radiating heat is obtained. The convection of heat by means of these large, moderately-heated porcelain stoves is effected in the main by the circulation of the air, as the air in the room rises against the heated surfaces of the stove, and falls against the cooler walls of the room.

The advantage of the porcelain stoves consists in the moderate degree to which the surfaces of the stove are heated; but, from a hygienic point of view, this mode of heating must be condemned, because the effect is about the same as that of the hot-air system. The circulation of the air, as described, heats the air of the room, while in the English grate system the radiating heat leaves the air of the room cool, but, on the other hand, heats the walls and all the objects in the room in exactly the same manner as the sun heats everything in Nature. Another very uncomfortable, but simple, method of heating is by means of the so-called "Cannon" stoves. These stoves are usually made of iron. They get very hot on the outside, and therefore radiate much heat. They act less by heating the air than by radiation; but they vitiate the air in the room in other respects to a very high degree. The heated iron permits the poisonous gases of combustion (for instance, carbonic acid gas) to pass through it. Besides, the air in the room rises against the hot surfaces of the iron stove, as in the case of the porcelain stoves; only the air gets heated to such a degree that it burns and carbonizes many particles of dust composed of organic substances always prevalent in air. This causes a highly disagreeable odour, which will always be found where stove surfaces heated to a high degree are exposed to the air of the room. I classify under the heading "Cannon" or iron stoves all stoves of which the external surface is heated to more than 212° Fahr. These iron stoves exist in innumerable types, and are made under many systems, but are usually employed only as makeshifts; it being unbearable to any human being to breathe for any length of time the half burned and singed organic matter contained in the air.

It can be easily seen that the temperature of the surface of a stove should be kept below 212° Fahr. This is the reason that in all countries with cold and long winters, where the necessity for heating apparatus is the greatest, the large, moderately-heated porcelain stoves are generally used; while in countries with moderate winters the iron stoves prevail, because heating apparatus is used rather exceptionally. In all central heating systems, the low-pressure steam heat is preferred, though the first cost and the operating expenses are comparatively high, on account of the large heating surfaces needed. The "air under" system is more agreeable and healthful than in cheaper installations, which operate with smaller heating surfaces and higher temperatures.

I might go into still more detail in these comparisons; but I assume that I shall be readily understood when I say that, for heating dwellings, the ideal apparatus is one which generates a large amount of radiating heat, but exposes only very moderately heated surfaces. This leads me to the consideration of the regenerative gas-stove, which was constructed to meet these ideal conditions. As a common gas-flame does not radiate more than 30 per cent. of its heat, I increase this percentage by using an intensely white regenerative gas-flame, similar to that used for lighting purposes. Such a flame radiates, on account of its much higher temperature, at least twice as much heat as does the common gas-flame. However, the escaping products of combustion of the very hot flame convey less heat to the stove, because the regenerator absorbs most of the heat of combustion for the purpose of heating the necessary amount of air previous to combustion.

In order to make myself clear on the subject, I want to state that I commenced about twelve years ago to manufacture heating-stoves for illuminating-gas and with regeneration of heat, which were also called "accumulators." In 1885, I obtained my German and other patents; and I then commenced to offer such stoves to the public. The result was that a good many competitors appeared, offering stoves to be used with illuminating gas, partly with and partly without radiating heat, but all without a heat-accumulator. In the beginning, these gas heating-stoves did not find favour, partly on account of the erroneous supposition that the use of illuminating gas would be too costly, and partly because the intensely illuminating regenerative gas-flame had a blinding effect on the eye. When, finally, a few years ago, during the Brussels Exhibition, such a stove, without a regenerator or accumulator, made its appearance, in which the heating radiating gas-flame was invisible, but gave its effect indirectly by means of a copper reflector, it found more favour with the public.

Since the appearance of the indirectly operating reflector, which I employ also, the demand for regenerative gas-stoves has increased considerably, in spite of the many competitors who do not employ regenerative apparatus, but succeeded nevertheless in selling a good many stoves on account of their cheapness, and because they called them "regenerative" or "double regenerative." I would not care about this competition if the public were not deceived by cheap stoves, falsely called regenerative—thereby injuring the reputation of the system. As it would take too much space to relate the whole business development of my heating system, I confine myself to its description as it stands to-day.

The drawings figs. 1 and 2 [next page] show, in two cross sections, that the heating apparatus consists of two main parts—viz., the simple radiating grate arrangement A, and the stove B, which is built over the grate for the complete utilization of the remaining heat. The gas heating-flame is formed by leading illuminating gas through the horizontal pipe V, which is located above the reflector R. The pipe contains in the forward direction one or more fine holes, through which the gas can escape in horizontal flames.

The air necessary for combustion flows at the beginning—that is, when the apparatus is cold—out of the space in front of the reflector to the burners. The flames are pointed horizontally and forward, as shown, and radiate a great deal of their heat on the reflector R. Then they are led through the downward channel M of the regenerator C, and then again forward through the channel N in the upper part of the stove B, and finally escape through the stove-pipe E. In leading the products of combustion downward, the regenerative apparatus is heated as contemplated. The necessary air of combustion, which is, of course, cold, enters now through the vertical regenerator channel E from below. The air then moves in a direction opposite to that of the products of combustion, which are moving downward in the shaft N; and in this manner the air absorbs the greater part of the heat of the products of combustion. Then, highly heated, the air mixes from above and below with the gas escaping out of the pipe V. The air channel E, on account of its heating by the products of combustion, and of its almost vertical position, becomes a small chimney, and conducts the hot air to the gas-flames automatically—*i.e.*, independently of the main chimney E.

This automatic conveyance of the hot air is a highly important requirement, because the whole heating apparatus becomes independent of the unreliable draught of the chimney, and may be employed even where there is no chimney at all. In the latter case, however, the products of combustion would escape into the room, which must be obviated for hygienic reasons. The products of combustion, already considerably cooled in the regenerator C, now heat, in the moderate manner desired, the upper part of the apparatus, the real stove B, which consists of a number of boxes K, so arranged that they leave spaces, and constitute a large extended heating surface, in order to utilize in the best possible manner the remaining heat. Provision is also made for the evaporation of water in the upper part of the stove, in order to saturate to a certain extent the dry air generated by the stove B.

An important part of the whole heating apparatus is the reflector, which, as can be seen from the drawing, is so arranged that the rays of light and heat falling on it from above are reflected forward and sideways, while the intense white flame itself cannot be seen from the room. By means of the reflector—the material, colour, and surface of which are so selected that

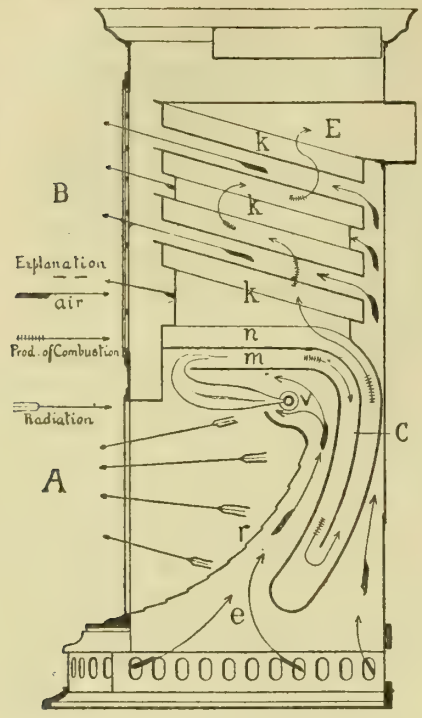


FIG. 1.

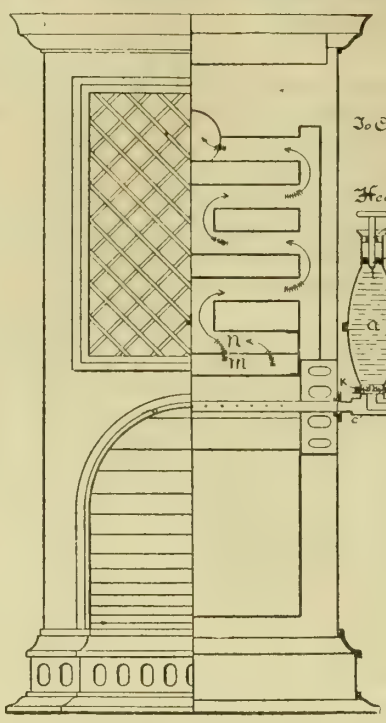


FIG. 2.

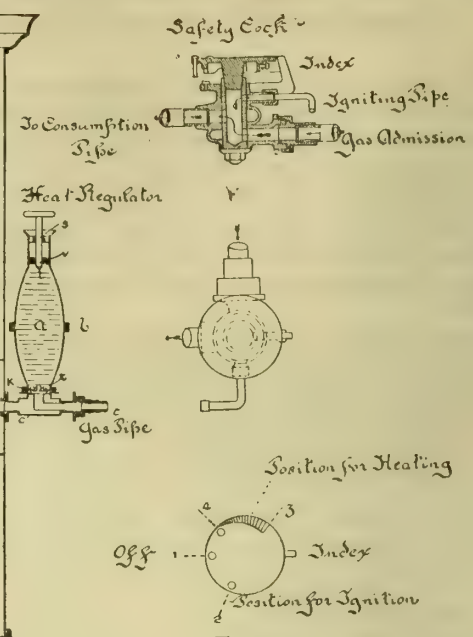


FIG. 3.

the rays of heat are thrown completely into the room without disturbing the eye by the rays of light or the images of the burners—the room is mainly heated in the lower part, so that at the height of (say) 5 feet the temperature is considerably lower than at the floor. By such an arrangement, the comfort is greatly increased, and waste of heat is prevented—a waste which must exist when, as in the other heating systems, the ceiling of a room is heated while the floor remains cold. I describe the upper part of the heating apparatus (the real stove B) only superficially, because this part does not show any novelty, and might even be omitted under certain conditions. Where considerations of the greatest economy do not exist, it might be well to use only the lower part of the heating apparatus—the real grate A, with its excessive radiation of heat. With the small surfaces of the stove B, and with its low degree of heat, the effects of the stove must be the same, though in a small degree, as in the large porcelain stove already described. As, by means of the regenerative system, a much greater part of the heat generated by combustion is converted into radiating heat, and led to the room in the most advantageous manner, it is the more advisable to do away with the stove B. Lately this arrangement has met with much favour, especially in the more luxurious dwellings.

Another highly important advantage, which is made possible only by the application of illuminating gas for the generation of heat, consists in the possibility of the application of an automatic regulator. This heat regulator, which may be adjusted for any desired temperature, raises or lowers the temperature by permitting more or less gas to flow to the burners. This arrangement not only adds to the comfort, but prevents the waste of gas. It is fair to assume that the consumption of fuel in all other heating systems is increased by the lack of an automatic heat-regulator, because the heating is effected without regard to the existing temperature. The consumption of fuel, of course, could be diminished if an economical mode of heating were adopted. But this is not alone sufficient; it is necessary also to adjust the heating in accordance with the continually changing demand for heat. As the automatic heat-regulator permits the use of fuel in exact proportion to the momentary demand, and as the generated heat is directed by means of the reflector to the place where it is needed, the gas heating-stove shows an actual saving in fuel in comparison with all other systems, in spite of the comparatively high price of illuminating gas.

The heat-regulator constructed by me is shown in fig. 2. It consists of an oval metal vessel A, to which is attached below a telescoping arrangement *Z*, made out of thin tin. To the lower end of the telescoping arrangement is attached a small cone K, which serves to regulate the flow of gas through the pipes C and C^1—C being inside of C^1. The pipe C is connected with the gas service-pipe; and C^1, with the stove. The flow of the gas is indicated by the arrows. The vessel A is provided in its upper end with a small pipe, which terminates in a little funnel T; the latter containing a small needle-valve V, which may be opened or closed by means of a thumb-screw S. The whole apparatus is filled with water in such a manner that the water becomes visible in the funnel and does away with air bubbles. Hoop B may be compressed by means of a screw; thus compressing A more or less, so that the water in the funnel will visibly rise or fall. As soon as the whole apparatus is regulated so that the cone, at a certain temperature—say, 54° Fahr.—with the needle valve closed, permits a sufficient quantity of gas to pass, the water in the metal vessel will expand with any rise of temperature. This will cause the telescoping arrangement to move the cone in a downward direction, and consequently the flow of gas will be partially or entirely shut off. If the water in the vessel cools, the telescoping arrangement will contract, and the cone will again permit the passage of the gas in proportion to the degree of temperature. The advantage of such a temperature-regulator over other well-known devices lies in the fact that, in case of any escape of the liquid, the needle valve may be opened, and water may be added through the funnel until the apparatus is again properly adjusted.

Another important device is the safety-cock S with self-igniter (fig. 3). This cock is so constructed that it can be turned only in one direction, and only step by step. If the index points to step 1, the cock closes. If the index turns to step 2, the igniting flame touches the gas service-pipe. The next step connects that pipe with the main flame. This is ignited by the igniting flame, and the latter is again shut off, so that when the index points to step 3 only the main flame is burning, and the igniting flame is shut off. Between steps 3 and 4, the hand may be moved to and fro for the admission of more or less gas, as indicated by the scale. If it becomes necessary to extinguish the flame, the index is set to 1. Such a safety device is very important, because (without it) negligence and ignorance may cause many bad results. Even malicious intent could cause an irregularity only when assisted by technical knowledge.

In closing this paper, I beg to draw your attention to the fact that probably illuminating gas will be superseded to a very large extent by the electric light. It is, however, a rather curious coincidence that electricity for heating can find only a limited application, while, on the other hand, illuminating gas is particularly adapted for it. Illuminating gas as fuel is not only applicable for heating-stoves, but for all feasible domestic and technical purposes. It is well suited for cooking, melting, annealing, and other operations. It has become more and more evident that illuminating gas is particularly adapted for heating purposes, on account of its great radiation of heat—this being the best for heating purposes. Where heating by contact is required, we may apply Bunsen or similar burners; so that even for these purposes the illuminating gas can be well employed. I beg to remind you of the Auer incandescent light, and various cooking and heating appliances. In most of the heating and melting operations, especially in all cases where the regenerative system can be used with advantage, it is the radiating heat that we want, as I pointed out some years ago in my several papers read in Germany and England. I refer to these papers, and to the success I have achieved with my regenerative gas-stoves in many technical industries, especially in those connected with glass and steel.

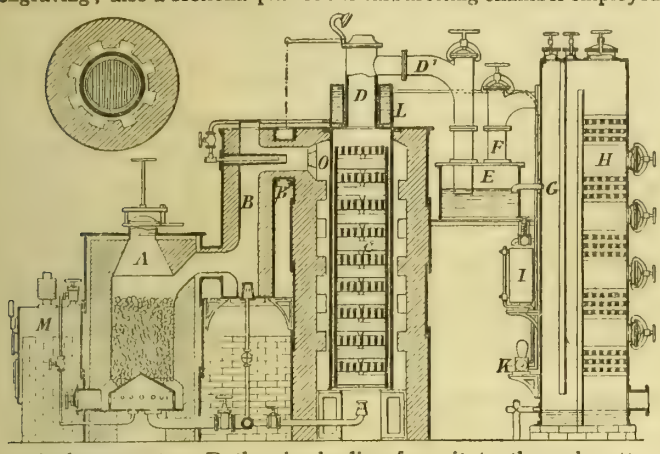
I think I may predict that the present illuminating gas will gradually change its *rôle*, and will be used in future mainly as fuel. Especially in large cities would this change be advantageous; but, in order to obtain this result, the illuminating gas, or rather the heating gas, must be considerably reduced in cost. Prospects for such reduction are good, because gas prices have been continually on the decline, and larger competition and the great progress made in the methods of manufacturing gas will contribute their share, especially if the gas is used to a larger extent for heating purposes.

The Oil-Gas Experiments at Bradford.—The Gas Committee of the Bradford Corporation have instructed Mr. L. T. Wright to prepare a supplementary report on the Dvorkovitz process, dealing with various points not previously touched upon in the report briefly noticed in the last number of the JOURNAL.

REGISTER OF PATENTS.

Generating and Carburetting Water Gas.—Fourness, W. A., of Manchester, No. 14,885; Aug. 3, 1894.

The general arrangement of this water-gas plant is shown in the engraving; also a sectional plan of the carburetting chamber employed.



A is the generator; B, the pipe leading from it to the carburettor; C, the carburettor; D, the outlet-pipe leading to the hydraulic seal E; F, the pipe leading to the condenser G, with the scrubber H; I, the oil cistern; K, a small oil-pump; L, an oil-heating cistern; and M, a steam-boiler—these parts being (with few exceptions) constructed in any ordinary manner.

The improvement in the generator A consists in placing at the bottom of the chamber containing the coke or fuel, a cast-iron plate, raised in the centre and sloping downwards towards the periphery, and supported preferably by a cast-iron cylinder; also in forming an annular space or flue round the cylinder and plate into which the ashes can drop off the cover—doors being provided for cleaning out the ashes.

The steam for producing water gas is conducted from the boiler M to a cylindrical box—entering preferably from the bottom, so as to strike the plate or roof, and become superheated by contact therewith, after which it issues through lateral openings into the annular flue, and passes to the fuel.

The carburetting apparatus C consists of a fire-brick jacket in a shell, and a cast-iron cylinder or pipe fitted with a number of cast-iron grids or perforated trays. The cylinder, which is open at the bottom, is supported so as to be raised off the floor. It is surrounded by a jacket of fire-brick of such diameter that an annular space is left round it, communicating at the top end with the top of the generator A through the pipe B, so that the gas from the generator enters the annular space at the top, passes down outside the cylinder, and up through the inside. The top of the cylinder is fitted with a cover, having an outlet-pipe D provided at the top, with a valve or damper that can be opened or closed by means of a lever and chain. A branch on the pipe D leads through the elbow-pipe D^1 to the hydraulic seal E. Below the open end of the central pipe an air-supply pipe or blower connects with a blast-pipe. The nozzle of the blower is preferably arranged as shown, with a closed end and lateral outlets, and the end-plate projecting over the sides, so that the air issues from the blower and enters the cylinder in a diffused state.

The oil for carburetting is contained in a cistern I, from which it is drawn by a pump K, and forced up into a cistern L, placed upon the top of the carburetting apparatus and surrounding the outlet-pipe D, so that the oil becomes heated therein. It then passes through the pipe S shown, and issues (in a more or less vaporized state) into the space surrounding the cylinder C.

The plant may be operated in the following way: After the fire has been lit in the generator A, and the apparatus generally heated (the damper being open), coke is charged into the generator, the lid of which is then closed and the air-valve opened. The coke is thus blown into incandescence; the air being heated and distributed all round the generator, as described. The hot gases pass through the pipe B into the jacket at the top, and descend in the same (the current being broken up by projecting baffle bricks), and enter the cylinder C at the bottom end. The current of air thus mixes with the gas, which usually contains a considerable quantity of carbon monoxide, so that the latter is burnt, whereby an intense and rapid heating of the cylinder C and the cast-iron grids or plates in it is effected. The gas then passes out through the pipe D into the atmosphere. Air may also be supplied to the gas in the pipe B, so as to burn part of the combustible components, and obtain an intenser heat at the top of the carburettor. After the coke has become sufficiently incandescent, the air-blasts are shut off, and the damper closed. The steam-valve is then opened, and steam blown in until it issues into the annular space round the generator, after having become superheated by contact with the roof of the chamber. The water gas formed by the steam and coke passes up the pipe B, and enters the surrounding jacket. The pump, on being started, draws oil from the cistern I, and forces it through the heater L and the pipes connected therewith, where it becomes more or less vaporized, and mixes in that state with the water gas. The combined water gas and oil vapour then pass down the jacket and up the cylinder C, in which, by contact with the heated walls and grids or chequer work, the oil vapour becomes decomposed and incorporated in the water gas. The carburetted water gas passes through the pipe D^1 into the hydraulic seal E; thence through the pipe F into the condenser G and scrubber H, in the direction indicated by arrows; and finally out of the outlet to the gasholder.

Electric Apparatus for Lighting Gas-Burners.—Eliasson, L., of Paris. No. 16,710; Sept. 1, 1894.

This invention refers to an electric lighter specially applicable for gas-burners of the Welsbach and analogous types. It is so arranged that when it is wished to light the gas, a button placed anywhere in the electric circuit is pressed; and the current passing a platinum wire becomes incandescent, and an armature is attracted to a bobbin. The ratchet on the armature causes the plug to turn through an arc of 45°. Gas thereupon passes into the auxiliary burner, by the hole in the plug, and by the channel in the conical opening into which the plug is fitted; and it is ignited on contact with the incandescent wire. By pressing the button a second time, the armature, which has been again lifted by its spring, again descends, and causes the plug to complete the quarter turn. The gas then passes to the burner, and ignites by contact with the flame of the auxiliary burner, into which the gas then ceases to enter. If it be wished to decrease the intensity of the flame, the button is again pressed; the armature is again attracted; the plug is again moved; and the gas is turned down. Another pressure on the button will cause the gas to be turned off; and the apparatus is then in position to recommence its cycle of operations.

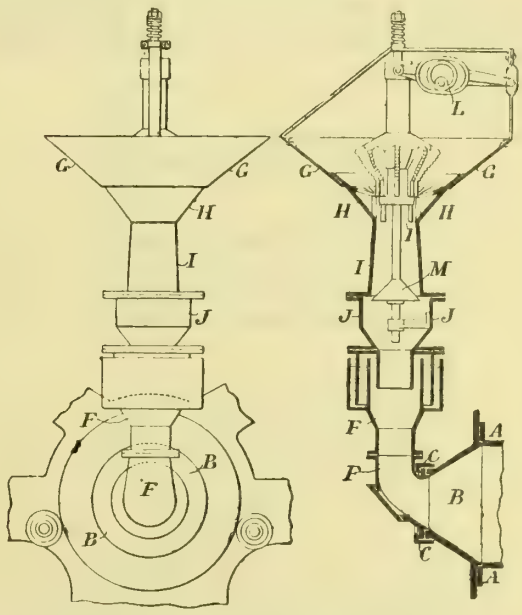
Carburetting Air.—Coutts, J. F., of Woolwich. No. 16,923; Sept. 5, 1894.

This invention (in the words of the patentee) "relates to an improved apparatus for overcoming the difficulty experienced in carbonizing air (commonly called 'air gas') in winter, when, owing to low temperature of the atmosphere, it does not readily carbonize, and is therefore all but useless for ordinary purposes."

The *modus operandi* is as follows: The generating chamber is filled with animal or vegetable fibre, which acts as an absorbent; and it is then charged with spirits, and certain regenerative burners fixed in contact with this chamber are turned on and lighted. The air that has entered the apparatus comes in contact with the spirits; and, becoming saturated, gets heavier than when pure, and falls to the bottom of the chamber. It here furnishes an air gas to supply the three regenerative burners, the flames from which heat the blast, which forces air (under pressure) through and out of the generating chamber, and "assists the same to become carbonized."

Manufacturing Gas from Coal.—Dinsmore, J. H. R., of Liverpool. No. 17,555; Sept. 15, 1894.

According to this invention, there is combined with a coal-distilling retort, a feeding device, by which the coal is automatically fed to the retort without opening it, and by which the feed is practically continuous. It is "more particularly designed to be used in connection with retorts in, or by, which coal is moved or worked and discharged mechanically, as, for instance, rotary retorts, by which the discharge of coke is automatically effected."



The accompanying illustration shows the application of the invention to the feeding of coal continuously and automatically to a rotary gas-making retort; as, for instance, a retort of the type described in patent No. 23,950 of 1893.

A represents the inlet-end of the rotary retort, of which B is the mouth, and C the joint between the rotating mouth and the stationary part. With regard to the feeding mechanism (the subject of this invention), above the elbow F, which conveys the material supplied to it to the mouth B, there is a feed-device, comprising a hopper G, a mouth H having a floor with longitudinal slots therein, and a tapered cylindrical shoot or chamber I with vertical slots in the upper part of it. The floor, the upper part of the cylinder I, and the outer part of the mouth H, form an annular chamber at this part. On the lower part of the chamber I is a box J, which has on its lower end a cylindrical tubular projection that fits in the annular vessel, making a lute joint therewith. There is also a discharge-shoot, through which the fuel is shot into the mouthpiece elbow F.

The mechanical feeding device consists of a plunger nearly filling the tapered cylindrical chamber I. On this part, there are formed substantially parallel projecting parts, which work in connection with the vertical slots; and above these again are gradually extended projecting ribs, notched at their outer edges, and adapted to work in connection with the slots in the floor of the hopper mouth. The plunger is moved up and down by a cam L on the shaft, working in connection with a lever, the outer end of which is fixed on a bar, and the inner end on the upper part of the feeding device. The action of this part is that, when the plunger is in the lower-most position, the top of the projecting part or ribs will lie within the slots, and the lower end of the

plunger will have passed the lower ends of the slots. In this position communication between the chamber I and the hopper G is practically cut off; and the material below the plunger will be in a closely pressed condition. Then, in the return action, the material that lies within the annular chamber round the top of the chamber I and that above, can fall through the slots in the floor H, and into the chamber I. In the downstroke, the material under the projections will be forced into the chamber H by the projections; while that lying below the plunger will be forced downwards into the chamber I. This latter chamber is always full of coal; it being held up therein by the valve M, mounted on a shaft (which serves as a vertical support and slide for the plunger-device to work on), and held on its seat by a spring. Thus, when the material is forced downwards by the descent of the plunger, it opens the valve, and falls past it into the box J, and so down into the conduit leading to the retort. As soon as the descent of the feed-plunger ceases, or it begins to rise, the valve M is closed by the spring.

By this action and construction, crushed coal is fed practically continuously to the retort, and without admission of air—that is, the air is excluded from the chamber I by being constantly filled with practically closely packed coal, from which the air has been expelled by the feeding action and compression of it by the means described.

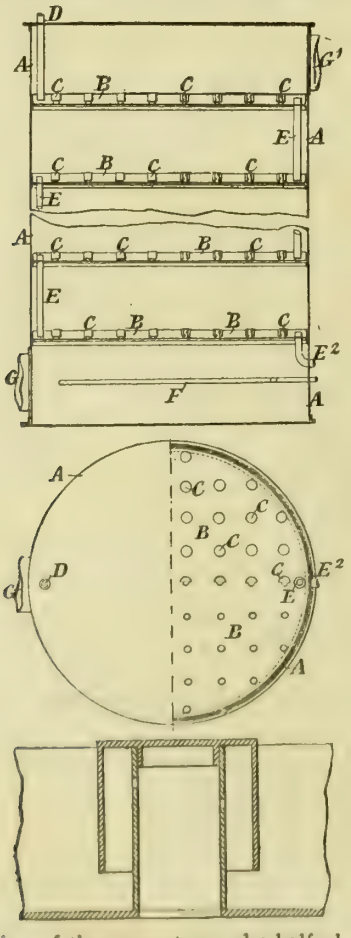
The upper part of this feeding apparatus—namely, the box J, the chamber I, and the hopper G—is supported and fixed in any convenient way, and made independent of the retort and parts connected with it by the loose joint connecting the box J with the elbow part F, which is supported from the mouthpiece B of the retort by a joint, such as described in the 1893 patent.

Carburetting Gas.—Blake, H. T., of Ross. No. 17,873; Sept. 20, 1894.

This invention relates to apparatus for converting "Dowson gas" into a gas which may be used for illuminating purposes." The process of conversion (in the words of the patentee) consists in passing the Dowson gas through a series of chambers, in a closed vessel, packed with cotton wool, or cotton waste, and charged with benzoline, thereby enriching the Dowson gas, and rendering it suitable for illuminating, by means of the ordinary gas fittings and burners.

Enriching Gases by Liquid Hydrocarbons.—Dvorkovitz, P., of Bishopsgate Street, E.C. No. 18,078; Sept. 22, 1894.

This invention refers to means "whereby gases, such as coal gas, more especially, or other gases used for lighting and heating purposes, can be very efficiently enriched by liquid hydrocarbons." The liquid hydrocarbon is caused to pass down through a vessel, in which it forms successive layers; and the gas to be enriched is caused to pass through these layers in succession—the gas being, if necessary, previously heated to a temperature requisite to allow it to efficiently take up the enriching constituents from the liquid hydrocarbon as it passes therethrough. The gas, when enriched, passes off from the enriching vessel "at a temperature low enough to prevent its subsequent deterioration."



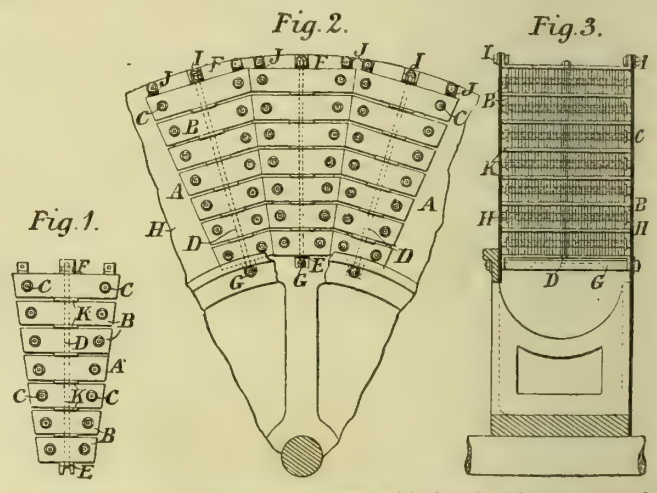
A vertical section of the apparatus, and a half plan and half horizontal section are shown in the illustrations; also an enlarged view of one of the "covering caps" referred to later on.

A is the casing or shell of a tower, containing trays B, arranged at suitable distances apart one above another. In the bottom of each tray are a number of openings, each surmounted by a tubular projection closed at its upper end by a cap C, provided with two downwardly projecting concentric rims—the inner one fitting the interior of the tubular projection, while the outer rim is of sufficient diameter to form an annular space between the interior of it and the outer surface of the tubular projection. The rim is of sufficient length to extend to within a short distance from the bottom of the tray. Near the upper end of the tubular projection are perforations, opening into the annular space. Liquid hydrocarbon is admitted by a pipe D on to the uppermost tray of the series. It overflows on to the next tray below by a pipe E, the upper end of which stands up above the bottom of the tray to a height equal to the depth of hydrocarbon liquid required to be retained on the tray. In like manner, the hydrocarbon flows in succession from one tray to another, any excess of liquid flowing from the bottom tray through a pipe E^2. The depth of liquid retained on each tray should be such, says the inventor, as to reach to nearly the top of the caps on the tubular projections on the trays.

The gas to be enriched enters the chamber beneath the lowermost tray, by the passage G, in which there may be a steam-coil, as shown at F, to heat the gas as it enters. The gas passes from this chamber into the tubular projections, and through the perforations therein into the annular spaces; thence beneath the lower edge of the rims into the space or chamber between the lowermost tray and the next tray above—the gas having been caused to pass through the liquid hydrocarbon contained on the lowermost tray. In like manner, the gas passes upwards through each tray and the liquid contained therein, in succession; and finally it passes from the apparatus through an outlet G^1, "enriched by the hydrocarbon liquid, and at a temperature sufficiently low to ensure its enrichment being retained."

Washing or Scrubbing Gas.—Hersey, S., and Kirkham, Hulett, and Chandler, Limited, of Palace Chambers, Westminster. No. 18,440; Sept. 28, 1894.

This invention of "improvements in apparatus for washing or scrubbing gas," has for its object "to obtain a large amount of wetted surface by means of a simple and economical construction." For this purpose, the patentees propose to construct discs of segmental bundles, each made up of laths placed one above another edgewise; the laths, as they approach the lower end or centre, becoming gradually shorter. The laths are threaded on horizontal bolts in rows or sections, with distance-pieces between them; and the several rows or sections are connected into a bundle endwise, by means of end-plates and a central bolt.



As shown in figs. 1, 2, and 3, the several laths of each row or section are connected together by horizontal bolts C (distance-pieces being arranged upon the bolts between the laths); and the several sections are connected together by the longitudinal bolt D, which passes through the two clamping plates E F. The plate E has recessed lugs, by means of which the segment may be engaged with a transverse bolt G in the drum, the side-plates of which are indicated by the letter H, and the clamping-bar F being provided with lugs having holes for receiving fixing bolts I, which pass through the plates H and clamping-bar F.

In order to further ensure the retention of the segments in the drum, retaining bars are arranged for, such as J, which are bolted to the two side-plates H of the drum, and are in contact with the uppermost section of each segment. K are the distance-pieces arranged between the several sections; the longitudinal bolt D passing through the distance-pieces, in order to retain them in their proper positions relatively with the section.

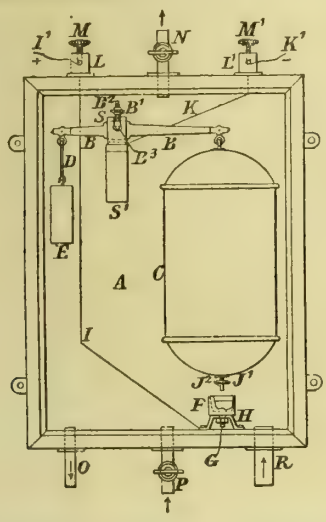
Various modifications of the arrangement here described are detailed in the specification.

Apparatus for Giving Warning of the Presence of Escaped Gas in Rooms or the like.—Haddan, R.; a communication from José Serra and Co., of Barcelona, Spain. No. 11,703; June 15, 1895.

This apparatus—intended to serve for automatically giving warning when a dangerous quantity of a gas (such as ordinary illuminating gas) has been mingled with the air of any room—essentially consists of a balance-beam, one arm of which carries suspended "a hollow, voluminous, unalterable, light, and hermetically closed vessel or body; while the other arm is balanced by a weight of less volume." The balance is provided with a metallic pin, which, on going downward, dips in a basin containing mercury; and both balance and basin are inserted in the circuit of an electric bell.

As shown in the engraving, the beam B has two arms of unequal length, resting with knife-edges B^8 on a support S^1. From one of the arms is suspended a hollow body C; while the other arm is balanced by a weight E, attached thereto in a similar manner. In order to give the body C a larger play of movement, the arm carrying it is made considerably longer than the other; but even if the two arms were of equal length, the principle of working of the apparatus would in no way be altered. Underneath the hollow body C, there is a metallic basin F, fastened by a screw G to a loop-like socket H, secured to the bottom of the box; the spindle of the basin passing through the socket,

is adjusted so as to assume any desired level. At its lower extremity, the body C is provided with a platinum needle, to be immersed in the mercury of the basin or vessel according to the relative position of the arms B. Over the surface of the mercury is a layer of glycerine, the object of which is to prevent oxydation of the needle point and keep it covered, lest in the case where the surrounding atmosphere is composed of an explosive mixture, it should communicate a spark from the electric circuit, and so cause an explosion. The basin F is connected to the positive pole of a battery by means of the conductors I and I^1, fastened by a set-screw M; while the support S^1 for the beam B or the knife-edge B^3 respectively, has connection with the negative pole by means of the conductors K and K^1, fastened by the set-screw M^1. A bell apparatus is inserted in the electric circuit, in combination, when desired, with registering apparatus.



The apparatus is encased in a box A. R is the tube for communication with the space or room to be controlled as to the variations of the density of its atmosphere; and O is the air outlet-tube of the box A. Cocks P and N serve to air the box A after an observation has been made, so as to accelerate the exit of the mixed atmosphere which it should happen to contain, and thereby restore the equilibrium of the beam B.

In the position of equilibrium, the point J is not immersed in the mercury; consequently, the circuit is interrupted. But should the atmosphere of the room to be controlled become lighter, for instance, through an escape of lighting gas, it will fill the box A through the tube R; and the body C will then sink. The point J will thus be immersed in the mercury of the basin F, and close the circuit and set the electric bell in operation.

APPLICATIONS FOR LETTERS PATENT.

14,819.—Bennett, H., and Wooler, E., "Automatically lighting and shutting off the gas of the burners connected with gas-stoves." Aug. 6.

14,826.—Fulleylove, W. K., "Petroleum gas-lamp specially adapted for incandescent lighting." Aug. 6.

14,834.—Golby, F. W., "Lighting incandescent gas-lamps." A communication from E. Dispot. Aug. 6.

14,838.—Burin, H. B., "Gas forge and furnace." Aug. 6.

14,855.—Huntington, A. K., "Manufacture of cyanogen." Aug. 6.

14,973.—Webber, W., "Prepayment apparatus for attachment to gas, electricity, or other fluid meters." Aug. 8.

15,045.—Lanchester, F. W., "Gas and oil motor engines." Aug. 9.

15,048.—Foulis, W., "Manufacture of gas." Aug. 9.

15,066.—Frank, A., and Caro, N., "Production of cyanogen compounds." Aug. 10.

15,125.—Gregory, R., "Coupling lead and other soft metal pipes together." Aug. 12.

15,166.—Peletan, J. H., and Christophe, E., "Electrophores applicable as electric lighters." Aug. 12.

15,168.—Foulis, W., and Holmes, P. F., "Obtaining cyanides from gases." Aug. 12.

15,216.—Webb, F. A., "Electric lighting attachments for gas-burners." Aug. 13.

15,228.—Newton, A. V., "Raising the temperature and illuminating power of flames." A communication from A. Nobel. Aug. 13.

15,246.—Crocker, S. A., "Incandescent mantles for lamps." Aug. 13.

15,254.—Middleton, R. E., "Production of gases from hydrocarbon oils. Aug. 14.

15,268.—Hempel, F. W. H., and Gumpel, M., "Incandescent gas-lamps." Aug. 14.

15,310.—Shuttleworth, A. and F., and Deed, P., "Igniting the combustible charges in gas, oil, and like engines." Aug. 14.

15,315.—Le Page, J. F., "Gas-cocks." Aug. 15.

15,359.—Duke, J. F., "Combined tap, bye-pass, and automatic igniter for incandescent gas-lamps." Aug. 15.

15,360.—Willson, T. L., "Production of calcium carbide." Aug. 15.

15,366.—M'Ewen, T. G., "Manufacture of gas." Aug. 15.

15,402.—Exley, J. H., "Generating acetylene gas." Aug. 16.

15,423.—Hancock, D., Craig, J. B., and Hancock, A. H., "Atmospheric gas-burners for incandescent lighting." Aug. 16.

15,430.—Thomas, W. J., "Gas-lamp." Aug. 16.

15,456.—Bueb, J., "Preventing gas conduits from being stopped by deposits caused by frost." Aug. 16.

15,469.—Glover, R. T. and J. G., "Increasing the heating power of atmospheric burners (gas), and increasing the luminosity of incandescent mantles, canopies, or like bodies." Aug. 16.

15,512.—Robinson, S. H., "Gas-burners." Aug. 17.

15,521.—Horton, G. A., "Supplying steam, water, or other fluid to the cups of telescopic gasholders." Aug. 17.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Thursday, Aug. 22.

THE SUPPLY OF WATER IN LONDON.

Mr. J. Stuart had upon the paper three questions to the "President of the Board of Trade" on the supply of water in London. He asked, first, with reference to the fact that the reports of the Official Water Examiner for the Metropolis show that since the great frost of last winter the quantity of water sent out by the East London Company has been largely in excess of that supplied by them before the frost, and that the average quantity delivered daily during last June was upwards of 51 million gallons, whereas that supplied during June in each of the two preceding years was only 43 million gallons, whether any facts have been furnished by the Water Examiner or by the Company to account for this great increase. He next desired to know the number of days' supply represented by the capacity of the storage reservoirs for unfiltered water belonging to the East London Water Company and to each of the other London Water Companies. The third question on the paper was whether the "President of the Board of Trade" would lay upon the table of the House a return showing the average quantity of water supplied daily by the East London Company from various sources in each month during the past two years; and whether he would, in future, present to the House the monthly reports of the Water Examiner as to the quantity and quality of the water supplied by each of the London Water Companies.

Mr. Chaplin: I am informed by the East London Water Company that the increase in the quantity of water supplied during the month of June last, as compared with the supply during the corresponding month in the two preceding years, is due (1) to an increase of 36,000 in the population since 1893; (2) to the fact that a large number of pipes belonging to the consumers were burst—50,000 of such fractured pipes having been found between April 20 and June 29—and that in many instances the necessary repairs have not yet been carried out; and (3) to the abnormally dry weather of May and June, when garden watering was a source of great waste. The Engineer of the Company states that all pipes belonging to the Company within the County of London which were damaged by frost or otherwise were replaced or made good by April 8. I have communicated with Major-General Scott, the Water Examiner under the Metropolis Water Act; and he informs me that he has no information which would lead him to doubt the accuracy of the statements of the Company in this matter. In answer to the second question, I have made careful inquiries of the several Water Companies as to the number of days' supply represented by the capacity of their storage reservoirs for unfiltered water. The effect of the replies is as follows: East London Water Company, an average of about 17 days' supply of Lea water; West Middlesex Company, 6⅓ days' supply; Grand Junction Company, 3½ days' supply; New River Company, 4 or 5 days' average supply; Southwark and Vauxhall Company, 4 days' supply; Chelsea Company, 13½ days' supply. With regard to the third question, I am quite willing to lay upon the table of the House a return showing the average quantity of water supplied daily by the East London Water Company from various sources in each month during the past two years, if the hon. member will move for it. As to the monthly reports of the Water Examiner, they are furnished by the Local Government Board to the London County Council and to all the sanitary authorities in the Metropolis; and they are also placed on sale. It is hardly necessary to lay these reports upon the table of the House; but if any member would desire to be furnished with copies, and will inform me of his wish, I will arrange that they shall be regularly supplied to him.

Friday, Aug. 23.

LONDON WATER COMPANIES' SUPPLY.

On the motion of Mr. J. Stuart, a return was ordered, "showing the average amount of water supplied daily by each of the London Water Companies, from various sources, in each month during the past two years; specifying the amount from each source separately."

The Gas Orders Confirmation Bill and the Gas and Water Orders Confirmation Bill, having been considered by the Committee on Unopposed Provisional Order Bills, in accordance with a resolution of the House, were last Wednesday reported without amendment, read the third time, passed, and returned to the Lords.

LEGAL INTELLIGENCE.

DOVER QUARTER SESSIONS.—Monday, Aug. 12.

(*Before Mr.* H. B. Poland, *Q.C., the Recorder.*)

The Assessment of the Broadstairs Gas-Works.

This was an appeal by the Broadstairs Gas Company against the assessment of their works, mains, &c., by the Assessment Committee of the Isle of Thanet Union and the Overseers for the parish of St. Peter's, Isle of Thanet.

Mr. Littler, Q.C., Mr. Ryde, and Mr. Weigall appeared for the appellants; Mr. Balfour Browne, Q.C., Mr. Page, and Mr Hohler, for the respondents. The professional witnesses present for the Company were Mr. W. Marshall and Mr. H. E. Jones; and for the Guardians, Mr. C. F. Jones, F.S.I. (the Union rating valuer), Mr. W. Eve, F.S.I., Mr. W. A. Mason, F.S.I., and Mr. W. R. Chester.

The appeal was against a rate which was originally fixed on the property of the Company at £1567 gross and £1027 rateable, and which was reduced by the Assessment Committee to £1490 gross and £900 rateable. The old assessment was £580 gross and £460 rateable, which had been standing since 1880.

Mr. LITTLER, in opening the case, admitted that there had been undoubtedly a considerable increase in the sale of gas; but notwithstanding that, he felt sure he could establish that there had been very little increase in the rateable value. This argument he founded on the fact that the Company in their present buildings were completely crowded out, and that their plant and appliances were being worked to their utmost. Although they had been unsuccessful in an application for a Provisional Order to extend the works, it would be essential in the immediate future; and in considering the balance-sheet of the Company, it was necessary to look at the amount that would have to be spent in a very short time. Counsel then handed the Recorder a balance-sheet, pointing out all the considerations which he urged should be taken into account in making an assessment.

After the mid-day adjournment,

The RECORDER suggested that an attempt might be made to come to an amicable settlement, so as to save expenses, as it was understood that otherwise the case would occupy at least two days.

Considerable discussion ensued, which ended in an arrangement being arrived at to the effect that the rateable value should be lowered from £900 to £775; that the appellants were to contribute £210 towards the respondents' costs; and that, as far as the latter can promise, they will not disturb this arrangement for five years from this hearing.

The RECORDER remarked that he considered the matter had been settled very fairly.

The Welsbach Patents before the Brussels Courts.

The Welsbach patents have lately been before the Brussels Courts in an action brought by the Société Belge d'Incandescence Auer against the Société Nouvelle d'Eclairage and two other defendants. It appears that a burner made by the latter, and exhibited in a shop-window in the city, had been seized, as being an alleged infringement of the plaintiffs' patents. The defendants denied that there had been any infringement, inasmuch as the Welsbach system had been anticipated: (1) By the publication of an article relating to the "lunar" and "solar" lamps of Frankenstein, published in 1848 by the *Leipziger Tageblatt;* (2) by an invention of Werner relating to the same appliances, which was the subject of a communication to the Polytechnic Society of Leipzig on the 3rd of March, 1848; (3) by a Belgian patent taken out by M. Clamond on May 23, 1880, and by his subsequent patents of June 20, 1882, and June 20 and Dec. 7, 1883; and (4) by the French and English patents of Williams, of Jan. 16, 1882. The comparison of these documents with the Welsbach patents involved technical questions which the Court could not settle without the assistance of experts. The defendants contended that it is impossible, following the specifications, to produce the Welsbach burner as it is now offered to the public as an article of commerce; and that the solution of the oxides of rare earths in which the mantles are steeped is really a trade secret. They maintained that this solution is the essential element of the invention, inasmuch as it is eventually to become the incandescent body; that its composition enters directly into the process of manufacture claimed by Dr. Auer von Welsbach; and that there would be obscurity in the description of the method of manufacture if, by the aid of the directions contained in the specification, competent people could not succeed in composing the impregnating liquid so as to obtain a light, if not equal, at least nearly similar, to that afforded by the Welsbach burner as sold—the intensity and quality of the light being dependent upon the skill of the maker and upon the purity of the metals or rare earths employed. In order to clear up all these matters, which, as stated above, involved technical questions necessitating experiments, it was thought that assistance should be sought from experts, who would be able to determine whether or not the burners produced by the defendants were, in fact, infringements of the Welsbach patents. The Court considered that the impregnating solution was not a subject of patent, and that anybody is at liberty to make the liquid by means of the materials indicated in the specifications, which are already articles of commerce, and by the processes described therein. But before pronouncing upon the principal demand of the plaintiffs, the Court submitted to three experts—viz., MM. Bruylants, Rousseau, and Wauters—the following points: (1) Are the productions of Frankenstein, Werner, Clamond, and Williams, taken in their entirety, anticipations of the Welsbach patents? (2) Is it possible to obtain, in a satisfactory manner, the commercial result claimed in the Welsbach patents, by making an impregnating liquid by a mixture of the substances therein indicated, in whatever proportions, or by a combination of these substances in the proportions determined in those specifications? (3) Is the seized article constituted of the same materials and made according to the same processes as those mentioned in the Welsbach patents? The result of the litigation was that the plaintiffs were ordered to restore the burner, and to pay the defendants 500 frs. damages and costs.

The Suggested Extensions at the Hinckley Gas-Works.—With reference to the article on the above subject which appeared in the JOURNAL on the 13th inst. (p. 351), in which some extracts were given from a report by Mr. G. Helps, the Gas Engineer and Manager of the Hinckley District Council, showing the urgent need for improvement; we learn that the Chairman and members of the Gas Committee are quite agreed as to the necessity for the extensions proposed, and some 16 months ago application was made to the Local Government Board for further borrowing powers; but they were not granted.

Blackburn Gas and Water Supply.—The Borough Treasurer of Blackburn has issued his statement of accounts for the year ending the 25th of March last. They show an expenditure of £59,870 on the gas account; the receipts exceeding this sum by £37,057. Interest and the payment into the sinking fund, &c., amounted to £26,394; leaving a balance of £10,663 to be carried to the reserve fund. The water-works account shows a loss on the year's working of £4145. The gross liabilities of the Corporation on the 25th of March were £2,229,198, of which sum only £637,778 is unproductive. The rateable value of the borough increased from £330,782 in 1885-6 to £441,590 in 1895.

MISCELLANEOUS NEWS.

LIVERPOOL UNITED GAS COMPANY.

Reduction in Price.

The Annual General Meeting of this Company was held last Tuesday—Mr. E. LAWRENCE, J.P., in the chair.

The SECRETARY (Mr. P. F. Garnett) having read the notice convening the meeting, the report of the Directors, with the accounts for the year ending June 30, was presented. It stated that the total revenue amounted during that period to £581,982, and the expenditure to £445,916; leaving a surplus of £136,066, which had been transferred to the profit and loss account. After deducting the amount taken for the payment of the dividend declared last February, and the interest on the bond and debenture debt, there remained a balance of £72,362, out of which the Directors recommended a dividend for the past half year of 5 per cent. on the ordinary consolidated stock, and 3½ per cent. on the 7 per cent. stock. The Directors expressed their pleasure in being able to announce that the prospects of the Company for the current year justified a further reduction in price to 2s. 10d. per 1000 cubic feet, to take effect from the end of last quarter.

The CHAIRMAN, in moving the adoption of the report, said he ventured to hope the accounts would be deemed satisfactory. The capital expenditure, so far as new works were concerned, was now coming to an end; and he trusted it would be a long time before any further outlay of the kind would be required. As to the revenue account, the main point on the expenditure side was the great saving in the cost of coal carbonized, which amounted to nearly £60,000. This, of course, was largely due to the fact that during the previous year the Company were compelled, by the coal strike, to pay a very heavy price for coals. Otherwise the expenditure was much the same as in previous years; the total being £445,916, as against £509,140. On the other side of the account, there was the same disturbance of calculation arising from the additional price of coal in the former year. In spite of an increased consumption, the total amount received for gas from all sources was £475,185, as compared with £503,287. During the past year, the gas sold to private consumers showed an increase of about 1¼ per cent.; that consumed by automatic meters, an advance of 27 per cent.; while on the gas sold to the Corporation there was a decrease of 11 per cent., which, of course, was owing to the action of the Corporation in reducing the light given to the city. The total result was that the sales of gas came to 1 per cent. in excess of what they were in the previous year; and when the shareholders considered that the electric light went on making steady progress in the town, he thought they would come to the conclusion that the result as regarded the Company was very satisfactory. The estimates for the coming year, which were based on a lower scale of prices for coal, warranted the Directors in proposing a reduction of 2d. per 1000 cubic feet in the price of gas. At one time, he hoped there would be a larger amount available; but, unfortunately, the prices of the residual products had fallen off as regarded coke and ammoniacal liquor. He hoped, however, that, with the reduction of 2d. per 1000 cubic feet, they would be able to pay their way satisfactorily, and that the public would feel the Directors were doing all in their power to supply gas at the lowest possible figure. There had been complaints about the gas made at Garston; but, in reality, it was of very fine quality. No doubt its specific gravity differed materially from that of the ordinary gas; and the ordinary burners were not quite adapted to it. The Directors were doing everything they could to remedy any defects, by putting in fresh burners; and as far as his knowledge went, in the great majority of cases where this had been done, people had expressed themselves as perfectly satisfied. The public and the shareholders might rest perfectly assured that the gas was good, and that the working of the new concern at Garston had been singularly satisfactory. When they last met, he was able to tell them that their troubles with the Corporation had practically been brought to a close; and that one point—the question of price in the future—had been left open for amicable consideration. He was glad to say that this matter had been settled without any trouble. They felt it was not wise that two public bodies should be brought into conflict by wrangling over the small amount involved in the allowance the Corporation wanted; and therefore they agreed to make an abatement to them, from which the Company in no way suffered. There were one or two other questions the Corporation had opened; and he hoped the Directors would be able to settle them as pleasantly as they had done in the other case. He, however, would just like to say that he did not think it was calculated to facilitate the settlement of questions in dispute for the Chairman of the Lighting Committee to say, as he did at the last meeting of the Council, when they were striving to work amicably together, and to do the best they could for the welfare of the town and its inhabitants, that the Company were paralyzing the industry of Liverpool. Such remarks did not tend to promote the friendly spirit they were all trying to foster. The Corporation had asked for certain information as to the price at which an inferior quality of gas could be supplied. Without in any way passing an opinion on the question of the reduction of the quality, they were endeavouring to prepare the information required. The question was a serious one, and deserved attention; but what the outcome of it might be it was impossible to forecast. At all events, the Corporation would be approached by the Company, and he hoped the Corporation would approach them, in a fair and reasonable spirit. The Corporation had lately made a new start. They had purchased the electric lighting undertaking; and therefore one might expect in due course that, so far as the Corporation were concerned, gas would be superseded by electric light. But he was very doubtful whether the Corporation would be able to persuade the public to take the more expensive illuminant, any better than the Electric Lighting Company had done. At all events, he could see nothing to make the shareholders feel that the property of the Company was not as good as it had always been. They might depend upon it that everything would be done by their officials to keep down the expenditure, and manufacture gas at the lowest possible price; and

he believed that, on these conditions, they would be able to hold their own in the future as they had done for so long in the past.

Mr. H. B. GILMOUR seconded the motion, and it was adopted.

The dividends recommended having been declared,

Sir T. Earle, Bart., Mr. D. Owen Bateson, Mr. Malcolm Guthrie, and Mr. G. Holt were re-elected Directors of the Company; and Mr. J. R. Darsie was again appointed Auditor.

The proceedings concluded with a hearty vote of thanks to the Chairman for presiding.

CRYSTAL PALACE DISTRICT GAS COMPANY.

The Ordinary Half-Yearly General Meeting of this Company was held at the Albion Tavern, Aldersgate Street, E.C., on Friday last—Mr. GEORGE LIVESEY in the chair.

The SECRETARY (Mr. Charles M. Ohren) having read the notice convening the meeting, the report and accounts, the principal features of which were given in the JOURNAL last week, were presented.

The CHAIRMAN moved—"That the report of the Directors and the accounts be received, adopted, and the report entered upon the minutes." He said the Company were in the happy state at that moment of having no history, excepting one of uniform and satisfactory progress. There was an unusual increase in the demand for gas in the past half year; but this was due to a large extent to the severe frost during the first two or three months. Beyond that, he was happy to say the increase had still been maintained. During the first quarter, it was a very excessive rate of increase—something like 17 or 18 per cent. But during the second quarter, when there was no frost, and nothing unusual to cause an augmentation of consumption, it was at the rate of about 9 per cent.; and in the past month (July) it had been at the rate of 10 per cent. So that it indicated, at any rate, that there was vitality in the Company's business, and that they might still look forward to a considerable increase. Speaking of increase, he was reminded that during the last ten years the business of the Company had grown to the extent of more than 60 per cent. Comparing the June half year of 1885 with the past half year, the increase was at the rate of 63½ per cent., which might be taken at something like 6 per cent. per annum. This was so far satisfactory; but there was another side which was not so satisfactory as one could wish. The increase in the consumption of gas had enabled the Company to meet the very considerable fall in the value of coke and ammonia. Coke, which in the June half of 1894 brought them in 7s. 4d. per ton of coal used, in the half year just terminated only returned 5s. 6d. per ton of coal; showing on this item a very serious loss indeed—viz., as much as 1s. 10d. per ton, which was equal to 2d. per 1000 cubic feet of gas sold. This, of course, they could not help. They sold the coke as it was made, and according to the market demand. When the market called for it, they reduced the price; and probably the fall in the price of coke was due to the fall in the price of coal. Last year, coal was somewhat dearer; and, as far as gas coal was concerned, the price was artificially maintained or increased by a combination of coalowners. This, as the report stated, collapsed this year; and the result had been that gas coal had returned to about its normal figure, which was a little over 6s. per ton, free on board. But there was another matter which was quite as serious, and more unaccountable—viz., the question of ammonia. The accounts for the past half year did not show the drop in ammonia to its full extent. Last year they sold sulphate in the middle of the year at £13 15s. per ton, or (say) £13 10s.; and now one could not get £9 10s. for it—showing a drop of about 30 per cent. Of course, one tried to ascertain what was the cause of these fluctuations, which were very serious to gas-makers and consumers; for the fall in ammonia, coupled with the fall in coke, amounted to something approaching 3d. per 1000 cubic feet on the price of gas. Sulphate of ammonia was used exclusively for agricultural purposes; and it was mainly exported—being in great demand for growing sugar beet. If the sulphate made in any given year was not sold, it remained in stock, only to glut the market for the succeeding year; and thus all the sulphate that was sold year by year was used and got rid of. Unfortunately, last year, when the price was so good, there were some people who wanted to make it better, and refused £13 15s. a ton—saying they would only sell at £14. The result was there were no buyers at £14, and large stocks accumulated, which ultimately had to be sold at £13. They then stood out for that price; and though it was sold for £13 in October, in December again large stocks accumulated, and had to be disposed of for £11 per ton. Now the figure had gone down to £9 10s. These low prices were due to the fact that buyers knew there were large accumulated stocks; and as they knew they must be put on the market sooner or later, they were refusing to give anything but this absurdly low price—the lowest he had ever known—and he did not think that there was much probability of improvement until these stocks had been got rid of for what they would fetch. The fall in the price of coke and sulphate made it difficult to reduce the price of gas; but the Directors were in a position, as was stated in the report, owing to the lower cost of coal, and some savings they hoped to make in manufacture, to announce a reduction of 1d. in the price of gas from the June quarter. This Company, acting under the enlightened guidance of the gentleman who for many years was its Deputy-Chairman (the late Mr. H. P. Stephenson), had adopted the principle in 1863 of making reductions of 1d. a time; and he had the curiosity the other day to add up the reductions which had taken place since 1859. He found that in 36 years, they had reduced the price 33 times. In 1859, the price was 5s. 6d., while it was now 2s. 7d.; and in all those years the price had only been raised once—in 1892, when it was increased from 2s. 6d. to 2s. 9d. per 1000 cubic feet. They had now got back to 2s. 7d., and were very anxious indeed to reach 2s. 6d. again, at which figure the price stood before the last increase. It was satisfactory also to report that the demand for gas still continued on the automatic supply system. As most of the proprietors were aware, working-people and weekly tenants were unable or unwilling to pay the cost of fitting up their houses with gas, and found it a difficult matter to pay a quarter's gas bill; but if the gas could be put into their houses without their being called upon to pay the cost in a lump sum, and if they were able to pay for the gas consumed in small amounts, they were very willing and anxious to obtain it. The system they had adopted was to put fittings into the houses and fix meters without charge to the weekly tenant or the consumer (rent of meter and fittings being charged in the price of gas); and then when he wanted a supply of gas, he had only to put a penny into the meter, and that would allow the meter to pass about 25 cubic feet of gas. Or 5d. or 6d. might be put in at once; and then five or six pennyworth of gas was supplied. When notice was given by the gradual dropping of the light, the consumer put in a few more pennies, and the meter went on again. A year ago, they had 1100 of these automatic meters; at Christmas, they had 1700 odd; and on the 30th of June, they had 2316 meters. In the last fortnight, the Engineer reported that 72 additional meters had been laid on. This method was beneficial in two ways. The Company got the profit on the increased sale of gas, which helped them to sell gas cheaper; and they were also conferring a benefit on the working classes of the district. He might mention that they were progressing in another way. Whereas ten years ago it took rather over 10d. per 1000 cubic feet to pay interest on capital, it now required 8½d. to pay a little higher interest. They were paying a rather higher dividend—5¼ per cent., as against 5 per cent.—and it now took 8½d. per 1000 cubic feet, as against 10d. They were looking forward to the time when, by an increase in business, the relative amount of capital should be further increased, and when they would be able to pay a full dividend at a smaller charge than 8½d. per 1000 cubic feet, though this was considerably less than was often required by gas companies. He did not know that there was anything further he need remark upon. He thought it would be very interesting to the shareholders to know that the officers and workmen had now the opportunity of depositing their savings and annual bonus with the Company at 4 per cent. interest; and that they had availed themselves of the privilege in the course of the year to the extent of £4100. This was evidence of thrift on the part of the employees, and also evidence of their confidence in their employers. He had much pleasure in moving the resolution, as he considered the report would be satisfactory to the shareholders.

The DEPUTY-CHAIRMAN (Mr. F. Lane Linging) seconded the motion, which was carried unanimously.

The CHAIRMAN then moved—"That a dividend for the half year ended June 30 last, be now declared at the following rates per annum—viz., 5 per cent. on the preference stock, and 5¼ per cent. on the ordinary stock, less income-tax; and that the warrants for the net amounts be forwarded on the 30th inst., to the registered addresses of the proprietors, by post."

Dr. FREDERICK HETLEY seconded the resolution, which was carried unanimously.

The CHAIRMAN then moved—"That the salary of the Secretary be increased by £50 per annum, from Jan. 1 last." He explained that the Directors always considered the question of salaries in the early part of the year, though they did not increase them every year; and as it was determined to recommend an increase in the Secretary's salary, they thought it would be rather hard upon him, seeing that they had to get the consent of the shareholders, to put him in a worse position than he would otherwise have been in. It was, therefore, recommended that whatever was done should date from January 1. Mr. Ohren had now been Secretary for two years. He was an officer who was thoroughly devoted to the Company's interests, and most anxious to promote its prosperity, as his father had been before him. He had, therefore, great pleasure in proposing this resolution.

The DEPUTY-CHAIRMAN, in seconding the motion, endorsed what the Chairman had said. When the question came up some two or three years ago of a successor to the late Secretary, the Directors very properly took great care before filling up the vacancy. He had seen Mr. Ohren during a number of years—having been a Director of the Company for now 33 years—and he saw how well he worked, and how he devoted himself to the business; and he felt sure that if the Directors placed their confidence in him, they would be doing the right thing. He had only to say that he had realized everything that was expected of him, and thoroughly deserved the recognition proposed to be given him.

The resolution was carried unanimously.

Mr. C. M. OHREN thanked the Board and the shareholders for the practical manner in which they had shown their appreciation of the way he had carried out his duties. It was most encouraging to anyone who endeavoured to do his duty in a satisfactory manner to receive such recognition; and he could assure them that all the officers, both under their most able Engineer and himself, did their utmost to gain the esteem of those in authority.

Mr. H. J. ROBUS proposed a vote of thanks to the Chairman and the Directors for their services during the past half year. He was quite sure the business of the Company could not possibly be carried out in a better manner.

Mr. A. EAMES had great pleasure in seconding the resolution, and especially congratulated the Directors on the way in which they had recognized the services of the Secretary.

The resolution having been carried,

The CHAIRMAN said the Board were all deeply interested in the Company; and they were very proud to belong to it. The shareholders might rest assured that they would do their utmost to ensure its prosperity. He could not sit down without proposing a vote of thanks to the officers; for unless they had efficient, honest, and thoroughly reliable officers, the Company would not succeed. He therefore proposed a vote of thanks to Mr. Gandon and those associated with him, and to Mr. Ohren as representing the clerical staff, for their services.

The DEPUTY-CHAIRMAN seconded the motion, which was adopted.

Mr. GANDON, in acknowledging the vote of thanks, said he believed the Company had as devoted a set of officers as any company could boast of. For his own part, he took a thorough interest in the work, and hoped to see the Company succeed; and he believed that all those under him took the same interest in it.

Mr. OHREN also briefly responded on behalf of the clerical staff.

The proceedings then terminated.

BRISTOL GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Friday—Mr. J. W. S. Dix in the chair.

The Secretary (Mr. John Phillips) read the notice calling the meeting; and the report, which was noticed last week in the Journal, was taken as read.

The Chairman said it was a matter for congratulation that the Directors could place before the meeting such satisfactory accounts. The increase in their output was 7½ per cent., which showed that they were not much affected by their electric friends, nor had they any fear but that their prosperity would continue. They had not only earned their dividend (which placed them in a better position than some gas companies), but they had £11,300 besides. He referred to the increased earnings from stoves, and said that this department had a very satisfactory future before it. The demand for stoves went on gradually increasing; and he had no doubt that it would continue to do so. There was also another departure which it would be desirable to cultivate; and that was "slot" meters. Though the Company had been in existence for so many years, no more than 20,000 houses in their district were provided with gas. Speaking generally, the houses of the working classes were not supplied with gas; and if the Company could induce mechanics to have gas by slot meters, the advantages of gaslight would be brought home to them, and they would rapidly learn to appreciate it. In addition to what he had told them, they had carried £1000 to the reserve fund; and last, though not least, it would be pleasant to them, and to the citizens generally, to learn that the Directors had reduced the price of gas 2d. per 1000 feet, and at some future time, not very far distant, he hoped they would make a still further reduction. He moved the adoption of the report and accounts.

Mr. R. D. Robjent seconded the proposition. He congratulated the shareholders on the present condition of affairs.

Mr. Medway, while also congratulating the Directors and the shareholders on the present condition of affairs, reminded the Board that the business, after all, was speculative. He must confess that he would rather see a further building up of the reserve fund before making too liberal concessions to the consumers. Some day they might lose their dividends.

The Chairman claimed that the Board had the best interests of the shareholders in mind when they took the present line. The policy of the Board was, of course, to guard the shareholders by a judicious increase of reserve: and, at the same time, to act liberally towards their customers. He did not think it would be well to rush up their reserve fund before doing anything for the public. The shareholders might depend upon it that the Directors would endeavour to do the right thing between the Company and the public without jeopardizing their interests.

The motion was carried unanimously.

A resolution authorizing the payment of the usual 5 per cent. dividend was then passed; and votes of thanks to the Chairman, Directors, Auditors, and other officials, terminated the proceedings.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Report and Accounts.

The Directors of the Tottenham and Edmonton Gas Company have issued their report for the half year ending June 30; and it will be submitted to the proprietors at the ordinary general meeting next Saturday. We learn therefrom that the quantity of gas sold was 16,755,300 cubic feet, or 10·57 per cent., more than in the corresponding period of 1894. The number of consumers who were using ordinary meters on June 30 was 5489; and of those using automatic meters, 1825. The demand for the supply of gas by the latter meters continues steadily to increase. The number of gas-cooking stoves fixed on rental since Dec. 31 last is 67; making the total number on rent 868. Having made favourable contracts for the supply of coal during the next two years, the Directors have been enabled to reduce the price charged to the local authorities for public lighting. This took effect from the 1st ult. They have also determined to further reduce the price of gas supplied by ordinary meter, from and after the Michaelmas quarter, by 1d. per 1000 cubic feet; making the selling price 3s. With regard to residuals, as in the case of many gas companies, the Directors have to report that the market price continues very low; that of sulphate of ammonia being exceptionally so. It is gratifying to find that the carburetting plant which has been put up at the Company's works continues to act satisfactorily; and during the severe frost in the early part of the year it proved to be of great service in meeting the increased demand for gas. The high appreciation in which the stock of the Company is held was exemplified during the past half year by the sale of the third portion of "C" stock (£20,000), which realized a net premium of £15,308, equal to £76 10s. 9d. per cent. The Company's Engineer (Mr. W. H. H. Broadberry) reports that the whole of the works, machinery, and distributing plant are in efficient condition. The balance available for division is £9069, which includes £1682 brought forward; and the Directors recommend the payment of the following dividends, less income-tax: On the "A" stock, at the rate of 11½ per cent. per annum; and on the "B" and "C" stocks, at the rate of 8½ per cent. per annum. This will absorb £7236, and leave a balance of £1833 to be carried forward.

The accounts accompanying the report show that £5044 was spent for capital purposes in the first half of this year; £1991 being for new buildings and manufacturing plant, £1612 for new mains and services, £1264 for new meters (including fixing), and £177 for new gas-stoves. This brings the total expenditure to June 30 up to £222,912, and leaves £14,198 in hand. The revenue account shows that the sale of 175,077,700 cubic feet of gas for public and private lighting, produced £27,026; rental of meters and stoves, £962; and the sale of residuals, £4046—the total receipts being £32,046. On the other side of the revenue account, the manufacture of gas is shown to have cost £16,360 (£10,399 being for coals); distribution, £2808; rents, rates, and taxes, £1609; and management, £1698—the total expenditure being £23,632, leaving a balance of £8414 to be carried to the profit and loss account. With regard to working, 9909 tons of coal and 7 tons of cannel were carbonized, and 241,122 gallons of petroleum were used for enrichment. In the manufacture of carburetted gas, 1543 tons 18 cwt. of coke were employed. Of this residual, 6393 tons 16 cwt. were made; 100 tons 18 cwt. were bought; 1092 tons 13 cwt. were in store; 2043 tons 4 cwt. were used as fuel; 5483 tons 16 cwt. were sold; and 60 tons 7 cwt. remained in store at the end of the half year. Of the other residuals, there were 1179 chaldrons of breeze, 89,367 gallons of tar, and 2754 butts (108 gallons) of ammoniacal liquor; and the production of sulphate of ammonia was 99 tons 8 cwt.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

According to the accounts to be submitted at the half-yearly general meeting of the Bath Gas Company on the 30th inst., the gas-rental for the six months ending in June amounted to £26,362. This is an advance on the corresponding period of 1894, notwithstanding a reduction of 2d. per 1000 cubic feet in the price of gas which took place in July of that year. The total receipts were £33,002; while the expenditure was £26,497—leaving £6505 to go to the net revenue account. The balance available for division is £12,788; and the Directors will recommend maximum dividends. Under the supervision of Mr. C. Stafford Ellery, there were 21,237 tons of coal carbonized in the past half year; the residuals produced being 13,787 tons of coke, 1411 tons of breeze, 1043 tons of tar, and 614,000 gallons of ammoniacal liquor—the quantity of sulphate made being 183 tons.

In the report which the Directors of the Brighton and Hove Gas Company will submit to the proprietors on the 13th prox., they state that the abnormally low temperatures which prevailed during the early part of the year had a marked effect on the rate of increase in the quantity of gas sold by the Company in the six months ending in June, which reached the high figure of 9¾ per cent. The accounts accompanying the report show a corresponding rise in revenue from this source. The sale of residuals was satisfactory, though resulting in a decrease in the amount realized as compared with the June half of 1894, which was an exceptionally good time. The sale of gas for public and private lighting—in all, 481,473,600 cubic feet—produced, at prices ranging from 2s. 11d. to 4s. 11d. per 1000 cubic feet, £71,990; rental of meters and fittings brought in £1995; residual products, £17,772; and other items made up the receipts to £91,860. The expenditure in connection with the manufacture of gas amounted to £49,546 (£32,956 being for coals); distribution expenses came to £6753; those connected with management, to £4268; and the total expenditure was £64,726—leaving a balance of £27,134. The sum available for division is £31,887; and the Directors recommend dividends at the rate of 11, 8, and 6 per cent. per annum on the three classes of the Company's stock. With regard to the works (which are under the supervision of Mr. J. Cash, M.Inst.C.E.), the Directors state that progress was made in the past half year in the construction of carburetted water-gas plant. The amount of coal carbonized was 46,218 tons. The estimated quantities of residuals produced were: Coke, 59,241 chaldrons; breeze, 2016 tons; tar, 549,391 gallons; and ammoniacal liquor, 1,002,375 gallons.

At the half-yearly meeting of the Colchester Gas Company on the 16th inst., the Directors reported that the revenue in the six months ending June 30 had been £11,982; and the expenditure, £9912—leaving a balance of £2070. The Chairman (Mr. C. Coleman), in moving the adoption of the report, said there had been a great demand for gas, both for cooking and lighting purposes; but the market for sulphate of ammonia had been the lowest anyone remembered. Tar had improved in value, and had in a measure counterbalanced the loss on ammonia; and the demand for coke was well maintained. On the whole, therefore, the financial position of the concern was much the same as in the corresponding half of 1894. The motion was carried; and resolutions authorizing the payment of a dividend at the rate of 10 per cent. per annum on the original shares, and of 7 per cent. per annum on the new shares, were passed. The meeting was then made special for the purpose of authorizing the raising of additional capital. The Chairman explained that, when the works were last enlarged, they were told that they would suffice for about twenty years. The time had now come when they must do something; for in the winter, when the retorts were all in full work, they could hardly keep up the supply. They did not want to raise the needful capital all at once, but to issue the shares as required. He concluded by proposing the necessary resolution. In answer to a question, he added that the additional capital was mainly for improving the works. They did not propose to extend the present retort-house, as this would entail great expense; but they proposed to erect plant for making water gas. The motion was carried unanimously.

The consumption of gas at Dover in the six months ending June considerably exceeded the supply in any similar period. The advance existed throughout the entire half year; and the Directors of the Dover Gas Company express, in the report they will submit to the proprietors on the 2nd prox., the belief that it arose from the extending use of gas for heating and cooking purposes—a form of increase which they say is most beneficial at the present time. They regard the results of the half-year's working as eminently satisfactory, on the whole. There is a balance of £2696; and they recommend the usual dividend at the rate of 7½ per cent. per annum—leaving a small balance to be carried forward.

The Faversham Gas Company had an increase of £149 in their receipts from the sale of gas, and of £57 in the returns for residual products, in the year ending June 30; but against this there was an additional expenditure of £286, due in a large measure to the severe weather of the past winter, which retarded the delivery of coal to the works, and necessitated the purchase of supplies wherever they could be obtained. The Directors, in their report, nevertheless consider the net result satisfactory, under the circumstances, as the gross profit for the year is only £15 less than for the previous year. The net profit,

after allowing for income-tax, is £2733 (as against £2775 13s. 7d. for 1893-4). This, with £1026 brought forward, and a small amount for interest, makes a total of £3763 available for distribution. Out of this the Directors recommended the declaration of a dividend of 9 per cent., free of income-tax, which will absorb £2419 and leave a balance of £1344 to be carried forward. During the year a reduction of 5s. per lamp was made in the charge for public lighting; and the Directors proposed to reduce the price of gas to private consumers 3d. per 1000 cubic feet, as from the 30th prox. In moving the adoption of the report at the recent annual meeting of the Company, Mr. J. A. Anderson, the Vice-Chairman (who presided in the absence of Mr. W. E. Rigden, the Chairman), said it was to be regretted that the income from gas-stoves did not increase so much at Faversham as it did in other places. This was disappointing from the shareholders' point of view; because if a larger number of stoves were used, gas would be consumed in the daytime, when they had it to spare. Alluding to the proposed reduction of 3d. per 1000 cubic feet in the price to private consumers, Mr. Anderson said the net profit this year was no more than it was in 1894. But coals were down to something like their normal price; and the Directors were glad to be able to make the reduction, which was in a measure promised a year ago. It was a liberal one; and he hoped the consumers would appreciate it. The motion was carried, and the dividend recommended declared.

The accounts presented at the annual general meeting of the Maidstone Gas Company on the 15th inst. showed a balance of £13,077; and the Directors recommended the payment of a dividend, less income-tax, at the rate of 11 per cent. per annum for the six months ending June 30. They reported an increase in the Company's business; and stated that the works and plant (under the able management of Mr. H. Smythe) had been kept in good condition. In moving the adoption of the report, the Chairman (Mr. Ambrose Warde) remarked that there had been an increase to the extent of 11 per cent. in the consumption of gas, which was considerable. With regard to figures, the balance of the profit and loss account in favour of the Company was £13,077; and out of this the Directors recommended a dividend of 6 per cent. for the past half year—making 11 per cent. for the year. This would absorb something like £4400—leaving £8600 to be carried forward; so that they had another year's dividend of 11 per cent. at present in hand. The reduction of 1d. per 1000 cubic feet in the price of gas had cost £1000 a year, of which the consumers received more than 80 per cent., and the shareholders the rest. The cost of coal for the coming year would be about £1000 less than last year; and this was a very good thing in their favour. The residuals were not quite so good as usual; they had repaid about 76 per cent. of the cost of coal, as against 85 per cent. last year. The difference was to be attributed chiefly to the falling off in the price of sulphate of ammonia, which was at present very low. But the capital of the Company was also low, the amount per ton of coal being £5 1s. 10d. Altogether the concern was in a very favourable position. The works were in a good state; and they looked like living, he thought, for many years to come. The report was adopted; and the dividend recommended was subsequently declared. The remuneration of the Directors was increased by £100 per annum.

The revenue of the Ryde Gas Company from the sale of gas in the year ending June 30, as shown by the accounts presented at the annual general meeting on the 15th inst., was £9510; meter-rental produced £271; and the sale of residuals, £2529—rents to the amount of £42 making up a total of £12,352. The outlay in connection with the manufacture of gas was £6052; with distribution, £366; and with management, £703—the total expenditure being £7980. The balance carried to the profit and loss account was £4372. The balance applicable for division was £2387, out of which the Directors recommended a dividend (including the half-year's dividend already paid) of the full statutory amount of £1 2s. 6d. per share on the original shares, and 7 per cent. per annum on the ordinary shares, less income-tax. With regard to the works (which, as mentioned in the JOURNAL last week, have been placed under the management of Mr. F. F. Farrand, in succession to the late Mr. G. Garnett), the new gasholder, completed towards the close of last year, has considerably increased the distributing power of the works; and larger mains have been put down in several streets. Improvements are now being made in the retort-house. In the past financial year, the quantity of coal carbonized was 6399 tons. The production of gas is not given; but the residuals are estimated as follows: Coke, 3838 tons; breeze, 593 chaldrons; tar, 70,911 gallons; and ammoniacal liquor, 146,690 gallons.

The annual meeting of the Salisbury Gas Company was held last Wednesday—Mr. G. Fullford in the chair. In their report, the Directors stated that the net profit for the year ending June 30 was £2813. The interim dividend paid in February absorbed £1260; and the remainder, added to £65 brought forward, made a sum of £1618 available for distribution. The payment of the usual dividends was recommended. Regret was expressed at the decease of Mr. T. Hardick, who had been associated with the management of the Company for about 33 years; and the appointment of Mr. Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S., as his successor was announced. The Chairman, in moving the adoption of the report, said there had been an increased sale of gas to the amount of £681; but the returns from residuals were less by £430, partly due to coke following the reduced price of coal, and partly to the very unsatisfactory condition of the sulphate of ammonia market. He regarded the progress in the demand for gas as a satisfactory feature, and said that the Directors welcomed the introduction of incandescent burners or anything else that would improve the value obtainable from the gas consumed. They had decided to reduce the price of gas, as from the 1st ult., by 1d. per 1000 cubic feet, to the private consumers; bringing it down to 3s. 3d. With regard to the public lighting, this was fixed at a special low rate some time ago; and in some years it had really been an actual loss to the Company. As it was now practically at cost price, they could not reduce it further. He next referred to the death of Mr. Hardick, who, he said, was largely concerned in bringing about the present prosperous condition of the Company. After alluding at some length to Mr. Hardick's connection with the Company, he said that they had appointed to the vacant office Mr. N. H. Humphrys, who had been Sub-Manager for twelve years, and the Directors were thoroughly satisfied with their choice. Mr. S. Griffin, in seconding the motion, said he wished to join in deploring the loss of their late Manager, and to add his tribute to the skill and ability of the present one. It was no small thing to take on the management of the undertaking at short notice, just at the end of the financial year, and yet show everything in perfect order. The motion was carried unanimously. Mr. H. B. Wells proposed a vote of thanks to the Chairman and Directors; also to the Secretary (Mr. A. Whitehead), Manager, and other officers of the Company, for their attention to the business during the past year. Mr. Fisher seconded the motion, and it was carried. The Chairman having briefly replied, Mr. Humphrys, in acknowledging the vote, said he could not forget the good old friend who had discharged the duties of Manager for so many years. In his decease, the whole of the staff felt they had lost, not an employer, but a kind and sympathetic friend. With regard to himself, he highly appreciated the kindly remarks that had been made; and they would encourage him to do his best, in the more onerous position in which he was now placed. He added that the whole of the staff were united, and working in harmony to do all they could for the Company.

The Sheffield United Gas Company will hold their 81st half-yearly meeting on the 10th prox., on which occasion the Directors will present a satisfactory report on the working of the undertaking in the six months ending June 30. The receipts for gas amounted to £99,327; and though this is a falling off of £2826, there was really an increased sale to the extent of 8¾ per cent. as compared with the half year ending June 30, 1894—the reduced income being due to the price of gas being 3d. per 1000 cubic feet lower than it was during that period. The total receipts were £141,953; the expenditure being £100,966—leaving a balance of £40,987. The amount available for division is £40,653; and the Directors recommend the payment of the maximum dividends on the various stocks and shares. These will amount to £38,263; leaving a balance of £2390 to be carried forward. In the works, under the supervision of Mr. Fletcher W. Stevenson, M.Inst.C.E., 79,237 tons of coal and 17,727 tons of cannel were carbonized in the past half year. The estimated quantities of products are given as follows: Coke and breeze, 58,386 tons; tar, 6248 tons; and ammoniacal liquor, 3,060,000 gallons.

The 53rd half-yearly general meeting of the shareholders of the Waltham Abbey and Cheshunt Gas Company was held last Friday at Waltham Cross, under the presidency of Mr. Alfred Kitt (a Director), in the absence of the Chairman, Mr. Corbet Woodall. The Directors, in their report, stated that after writing off £300 from the suspense account, there was a balance of undivided profits amounting to £1884, from which they recommended the payment of a dividend at the rate of 7 per cent. on the "A" shares, and 5 per cent. on the "B" and "C" shares (less income-tax). In moving the adoption of the report, the Chairman said he considered it to be very satisfactory. The improvement in the half-year's revenue was due partly to increased sales of gas, and partly to better manufacturing results, and reduction of waste consequent on the recent works of reconstruction. The improvements at the works were completed. The penny-in-the-slot meters had been favourably received; and the number supplied was on the increase. The report was adopted without comment. The Directors, the Manager, (Mr. W. B. Randall), and the Secretary (Mr. H. Gough) were thanked for their services.

In moving, at the recent half-yearly meeting of the Weymouth Consumers' Gas Company, the adoption of the report of the Directors, the principal features in which, and in the accounts accompanying it, were noticed in the JOURNAL on the 13th inst., the Chairman (Mr. R. Thomas) referred to the approaching completion of the Company's new holder, which, he said, would enable them to supply all anticipated demands. It had cost £3000, part of which would have to be paid out of capital. To meet this payment, they had made liberal terms with their bankers for the accommodation required prior to raising additional capital. If they had to apply to Parliament, they would seek for powers, perhaps to include the lighting of Broadwey, Upwey, and Preston, so that if the borough extended in these districts the Company would have the right to go there, and prevent any other company from trespassing upon them. It was now 27 years since they were authorized to raise additional capital; and during this time fresh mains had to be laid. He thought their Manager (Mr. J. Lowe) had been most careful in watching these matters. The report was adopted; and maximum dividends were declared.

Water Companies.

The Engineer and Manager of the Cambridge Water Company (Mr. W. W. Gray) reported, at the last half-yearly meeting, that in the six months ending June 30 water had been laid on to 100 houses, the increased rental derivable from which was £187 per annum. The total number of premises now supplied is 13,803. The Directors recommended dividends at the rates of 10 and 7 per cent. per annum, less income-tax; but, to pay them, the sum of £253 would be taken from the balance brought forward. Both reports were adopted.

The annual meeting of the Sevenoaks Water Company was held on the 19th inst., when the Directors reported an improvement in the water revenue during the six months ending June 30, compared with the corresponding period of last year. But, of course, the severe and protracted frost in February and March last caused much injury to the Company's plant; and this has greatly increased the expenditure under the heading of repairs and renewals. It is estimated that a further outlay of about £100 will be required during the current six months, before the whole of the damage caused by the frost has been repaired. The balance available for distribution was £965 12s. 2d., *plus* £100 transferred from the reserve fund. This enabled the Board to recommend the usual dividend at the rate of 8 per cent. per annum on the consolidated stock, and £5 12s. per cent. per annum on the share capital, free of income-tax. This would absorb £1025, and leave a balance of £40 12s. 2d. to be carried forward.

The 35th ordinary general meeting of the Wrexham Water Company was held on the 13th inst.—Mr. W. Overton in the chair. In their report, the Directors stated that £4238 had been spent on capital account during the year ending in June; this outlay having been incurred in laying a 12-inch main from the Packsaddle reservoir to Wrexham. The receipts on water and fittings account amounted to

£147 more than in the preceding year; and water had been laid on to 167 additional houses—bringing up the number to 4588. The balance on the net revenue account was £2550; and the Directors recommended a dividend at the rate of 5½ per cent. per annum upon the consolidated stock, free of income-tax. In moving the adoption of the report, the Chairman referred to the increase which had taken place in the revenue. He said that from 1875 to 1880 it was £1250; from 1880 to 1885, £1200; from 1885 to 1890, £1200; and from 1890 to 1895, £1200. Taking the accounts altogether, and excluding the heavy charges due to the frost, the result of the past year's operations had been fairly satisfactory. The dividend proposed had been more than earned; and seeing that sufficient balances remained, the Directors recommended that the whole of the extraordinary charges should be written off, and the dividend recommended paid. The report was adopted; and the Directors were empowered to call up the remainder of the unissued capital.

GAS PROPELLED ROAD-CARRIAGES.

Our contemporary, the *Engineer*, in last week's number, published the following: "We have offered for competition prizes to the value of One Thousand Guineas for self-propelled road-carriages, believing, as we do, that the construction of such carriages may very well constitute a new branch of manufacture at least as important as that of cycles, which in a very few years has attained to enormous proportions. But it is obvious that unless the use of vehicles propelled by steam, oil, gas, or electricity is sanctioned by the Legislature, no progress can be made in this direction. It will be remembered that an alteration in the existing Highways (Locomotives) Act was prepared and met with favour in the late Parliament, and would probably have become law but for the dissolution. It is most desirable that the existence of a demand for such a change should be brought to the notice of the new Government; and to that end we have prepared the subjoined memorial, a copy of which lies at our office for signatures. . . . . Energetic action at the present moment will be of far more value than at a subsequent period, when Parliament becomes engrossed with matters which, however important for the nation in general, have scant interest by comparison for engineers."

To the Right Honourable HENRY CHAPLIN, M.P.,
President of the Local Government Board.
The Memorial of the undersigned Engineers, Manufacturers, and Employers of Labour in Great Britain,
Showeth as follows—

Towards the close of the last Parliament the late Government introduced a Bill for the repeal of existing statutes, so far as they operate to prevent the use of light vehicles propelled by steam, or other motive power, not employed in traction. The Bill was read a first time; but, by reason of the dissolution, did not proceed further.

Your memorialists believe that the time has now come when such a measure should be passed into law. They point to France for an example of the use that is made of motive power upon roads; and they respectfully urge that this country should not be in a less favourable position.

The fact that there is no opening for the use of light road carriages in this country by reason of restrictive statutes, operates to prevent the development of a trade in such articles in competition with other countries where such restrictions do not exist.

The passing of such a measure as that introduced during the last session of Parliament would lead to a large development of trade and to the benefit of a large section of the operative classes of the country.

Your memorialists therefore pray that you will take the question into consideration, and that the Bill introduced by the President of the Local Government Board under the late Government, or some other Bill to the like effect, may be presented to Parliament with the least possible delay.

THE SELECT COMMITTEE ON WEIGHTS AND MEASURES.

As Affecting the Gas Industry.

A few weeks since (see *ante*, pp. 73, 86), it was intimated in the JOURNAL that the Select Committee appointed to inquire into the subject of British weights and measures had agreed on their report—recommending immediate legislation so as to provide for the introduction of the decimal system in this country compulsorily after the lapse of a certain number of years. The evidence taken by the Committee has now been issued as a blue-book; and it forms a mass of very interesting reading. As affecting the gas industry, very little specific evidence was given; though all of it bears more or less on the possibility of usefully altering the unit of value by which gas, coal, &c., are now sold in most English-speaking countries.

The most direct evidence was given on May 14 by Mr. W. T. Rowlett, a member of the Gas Committee of the Leicester Corporation, in reply to questions addressed to him by Mr. James Stevenson. The questions and answers are given thus in the Minutes of Proceedings:

How would you deal with the gas-works, who have by Act of Parliament their price fixed at so much per 1000 cubic feet?—I should figure it out by the cubic metre.

Then you would have to alter the price in all the Acts of Parliament?—Any Act of Parliament which would make the use of the metric system compulsory would contain all the necessary stipulations for things of that kind.

Would the gas companies have to alter their gas-meters?—That is a question which has never come before me, and which I have never thought of; it is very likely they would.

Then gas-supply pipes are all made by inches and fractions of an inch—half-an-inch, three-eighths, and so on. Would this be illegal after the introduction of the metric system; would it be illegal to order so many feet of half-inch gas-pipes at so much a foot?—There is no doubt there would be some friction there; but as other countries have been able to overcome it, I do not see that we should not be able. Every country in Europe, with the exception of Turkey and Russia, has had to go through this experience, and has done it without much friction. We have all their experience to go upon. With respect to meters, I would say that, at the commencement, we might have a transformation table, giving the number of cubic feet, marking the cubic metre, until we should gradually have the meters replaced.

I think you put the necessity of foreign trade as the most prominent argument for a change. Why should the people whose business is all at home (for instance, gas companies) be obliged to change their language for the convenience of foreign firms with whom they have nothing to do?—For the sake of simplicity of work. There would be some difficulty in the transformation at first, but the simplification of work would be immense.

Going back to the gas-works, how would the introduction of the metric system simplify the business of the gas companies?—It would simplify their calculations.

In what way?—Take a cubic foot and divide it into cubic inches, and see what a difficulty it is.

But gas companies do not talk of cubic inches?—The question of bookkeeping would be very much simplified if you have metric weights and measures.

I do not see what difference it makes to the gas consumer if his bill is sent in in cubic metres instead of cubic feet?—I was not referring to the consumer. I was speaking of the gas company. I understood your question applied to the gas company.

In their dealings with the consumer?—I think for the gas company it would be a considerable improvement; and inasmuch as many of the gas companies now are also chemical manufacturers, and the chemical units are very much worked upon the metric system, there would be another very great simplification for them there.

Is there a single kilogramme weight or a single metre measure inside any gas-works in this country?—They use them in their chemical works.

In the laboratory?—In the laboratory, where the calculations are made—the testings. For instance, in our own gas-works, we have a large laboratory, where we test all the coals that come in, to see what their product is. Then we test all the bye-products. All these things have to be done metrically.

You select very small samples, and you analyze them, and you use the metric tables in the analysis. But I am speaking of the trade outside the laboratory, the manufacture of sulphate of ammonia in gas-works, for instance; where does the metric system come in there?—The metric system will come in there the same as it does in any other trade. We have to sell our things by the hundredweight and ton; and if we sell them by the 1000 kilos and 100 kilos, we shall have the same simplification as in other trades.

We now have the 1 lb. weight as the foundation of our weights, and the old English yard is the foundation of all our measures. What simplification can you get by substituting a weight which is two and one-tenth times the weight of a pound weight?—The simplification we shall get is in the decimal division instead of the Imperial division which we now have.

Do you mean that 16 oz. is an inconvenient division of a pound?—Certainly.

After a few questions on other matters, Mr. Stevenson asked: Are you not aware that, in actual measures, the inch is divided into 100ths and 1000ths. I read a specification last night of pipes for a water company, where the thickness of the metal was given in three places of decimals of an inch, according to the diameter of the pipe?—Witness replied: That is an attempt to get away from our present system. If you take our tables, you do not find that the inches are given in decimals at all; and what you say is an attempt to get away from a bad system. It is at attempt to solve the very thing that we are inquiring about now.

METROPOLIS WATER SUPPLY.

The Quality of the Water in July.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the month of July, show that the average daily supply amounted to 232,572,139 gallons, as compared with 216,653,007 gallons in the corresponding month of 1894. The number of services being 818,023, the rate was 284 gallons to each service. Of the entire bulk of water sent out, 124,727,621 gallons were drawn from the Thames, and 107,844,518 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·6; New River and East London (deep well), 1·1; Tottenham, 1·2; Colne Valley, 1·4; East London (river supply), 1·6; Southwark, 1·8; Chelsea, West Middlesex and Lambeth, 1·9; and Grand Junction, 2. The unfiltered river waters contained the following proportions: Thames at Hampton, 4; New River Cut, 2·1; and the Lea at Angel Road, 3·2. The Thames at Hampton was, on July 1, turbid and pale yellow in colour. It was of excellent chemical and good bacterial quality. As delivered by the five Companies drawing from this river, it was in every case efficiently filtered, and of excellent chemical and (with one exception) bacterial quality for dietetic purposes. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 93·94; West Middlesex, 97·88; Southwark (No. 4 well), 99·7; Grand Junction, (general filter well at Hampton) 76·37, (general filter well at Kew Bridge and south filter well) 96·67; and Lambeth, 97·88. The New River Cut, before entering the subsidence and storage reservoirs, was, on July 3, turbid and very pale yellow in colour. It was of excellent chemical and good bacterial quality. By passing through the storage reservoirs, it was greatly improved bacterially; and, after efficient filtration, was of excellent chemical and bacterial quality for dietetic purposes. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well and No. 1 filter well, 99·35; No. 7 filter well, 95·16. The water taken from the Lea by the East London Company at Angel Road on July 3 was turbid and pale yellow in colour. It was of excellent chemical but inferior bacterial quality, and did not exhibit

much improvement bacterially after storage for fifteen days. After efficient filtration, it was of excellent chemical and bacterial quality for dietetic purposes; the total bacterial improvement being represented by the following percentage numbers: No. 1 Essex well and No. 11 filter bed, 99·24; No. 2 Essex well, 99·43; and No. 12 filter bed, 99·62. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes; and the Colne Valley Company's water, being softened before delivery, was thus rendered suitable for washing. Seen through a stratum 2 feet deep, the Kent, Colne Valley, Tottenham, and East London (deep-well) waters were clear and colourless; the New River and East London (river supply), clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters before and after storage, the Thames water after preliminary filtration used by the Grand Junction Company, and the supplies of the various Companies collected on the 1st, 3rd, and 4th of July, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw and Stored River Waters.		
Thames at Hampton, July 1	1320	18·7
Thames at Hampton, after storage for 14·7 days (Chelsea Company), July 1	300	19·4
West Middlesex Company's water (supplying filters Nos. 1–5), July 2	880	18·7
Grand Junction Company's water arriving at Kew from Hampton, July 2	140	19·5
Grand Junction Company's Water passing on to No. 3 filter at Kew Bridge, July 2	340	19·8
New River Cut before passing reservoirs, July 3	1240	16·7
New River Cut after passing reservoirs, but before filtration, July 3	460	17·1
Lea at Angel Road, July 3	2100	17·4
Lea at Angel Road, after storage for 15 days (East London Company), July 3	1720	17·9
Filtered River Water as Supplied.		
Thames—		
Chelsea Company's general well, July 1	80	19·4
West Middlesex Company's general well, July 2	28	19·2
Southwark Company's No. 4 well, July 1	4	18·9
Grand Junction Company's general filter well at Hampton, July 1	312	19·3
Grand Junction Company's general filter well at Kew Bridge, July 2	44	19·5
Grand Junction Company's south filter well at Kew Bridge, July 2	44	19·7
Lambeth Company's general well, July 1	28	19·3
Lea—		
New River Company's general filter well, July 3	8	16·9
New River Company's No. 1 filter well, July 3	8	16·9
New River Company's No. 7 filter well, July 3	60	18·9
East London Company's No. 1 Essex well, July 3	16	17·7
East London Company's No. 2 Essex well, July 3	12	16·3
East London Company's No. 11 bed, July 3	16	17·7
East London Company's No. 12 bed, July 3	8	18·3
Deep Wells—		
Kent Company's new well at Deptford, July 4	44	11·3
East London at Lea Bridge, July 3	4	11·3

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied to London during July, as ascertained by tests of samples taken daily on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 189 samples examined, one was recorded as "slightly turbid," and one as "clear, but dull." The remainder were clear, bright, and well filtered. July was the wettest month since November last, when an excess of 2·49 inches of rain fell in the Thames Valley. The actual amount of rain during the month just passed was 3·41 inches; and as the mean of 25 years is 2·58 inches, there has fallen an excess of 0·83 inch. With the exception of a heavy storm on the 1st, the first half of July was dry; after the 1st, scarcely any rain fell till the 18th—the greater part falling between the 18th and 25th. The high level of purity of the Thames-derived waters, to which we drew attention in the report for June, was sustained in July, notwithstanding the fact that turbidity and peaty colouring matters are always washed from the land into a river by heavy rain following a drought. A comparison of the chemical composition of the waters in July and in June shows that the constituents are almost identical in quantity. We have continued to examine the samples drawn from the clear-water wells of the Water Companies at their works, and from the unfiltered river water. The unfiltered Thames water contained an average of 3425, and the filtered water at the works contained 30 microbes per cubic centimetre.

Reductions in Price.—The Ashford Gas Company have reduced the price of gas 1d. per 1000 cubic feet; the Tottenham and Edmonton Gas Company will make a similar concession to the consumers at Michaelmas; and the Faversham and Kidsgrove Gas Companies have decided to bring their prices down 3d. The Directors of the Salisbury Gas Company have taken off 1d. per 1000 cubic feet to private consumers as from the 1st ult.; making the price 3s. 3d. The price of gas at Hanley has been reduced by the British Gaslight Company from 2s. 6d. to 2s. 3d. per 1000 cubic feet. A reduction from 2s. 9d. to 2s. 6d. was effected a year ago, with the result that the consumption increased in twelve months by 17½ million feet—mainly owing to the rapid extension in the use of gas as fuel. At Hull, the same Company have announced a reduction of 2d. per 1000 feet as from the 1st ult.; making the price 1s. 10d.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Chief Engineer's Report on Available Sources of Water Supply.

(*Continued from p.* 407.)

II.—*General Description of Sources of Supply.*

The sources of supply to which I propose to direct attention are situated at altitudes above 600 feet, extending to 2800 feet, above the sea-level at the head waters of the Rivers Usk, Wye, and Towy, in the counties of Cardigan, Brecon, Radnor, and Montgomery. The areas from which the water would be derived are composed of the impermeable beds of the primary rocks of the old red sandstone and Silurian systems, which are noted for the purity of the water which flows from their slopes.

Owing to the general altitude of these districts, on the steep slopes of the surrounding hills, arable cultivation is almost impossible; the lower portions being chiefly composed of mountain pastures running up into bare unculturable wastes, with but a sparse population in any part. On these high lands, situated as they are near the western seaboard, the rainfall, as compared with that of the Thames Valley (27 inches), is very heavy—varying from 45 up to 75 inches or more per annum. Consequently, from a total area of 312,400 acres, or 488 square miles, 415 million gallons a day can be obtained, after making full allowance for dry years and evaporation, and due compensation in water to the streams and rivers from which the supply is derived, compared with 300 million gallons a day without compensation from the 3542 square miles in the Thames Valley above Molesey.

The altitude and contour of the valleys also is such as to permit of the water being stored in economical reservoirs, and flowing by gravitation into service reservoirs situated at an altitude of about 300 feet above the sea in the neighbourhood of London; so that pumping at the source or for the general supply of the Metropolis is unnecessary.

The scheme of works which I propose to lay before you may, for the purposes of description, be divided into five main sources—

(1) The valley of the Usk.
(2) The Yrfon, a tributary of the River Wye, combined with the upper sources of the River Towy.
(3) The Edw, another tributary of the Wye.
(4) The River Ithon, which ultimately flows into the Wye.
(5) The upper portions of the Wye itself.

III.—*Description of the Proposed Sources of Supply, with the Necessary Reservoirs, &c.*

(1) *Usk.*—The River Usk, which falls into the Bristol Channel at Newport, takes its rise among the Brecon Beacons and the hills called Mynydd Epynt, which lie to the north-westwards and south-west of the town of Brecon, above which town the main river has a general easterly and westerly direction. The geological character of the district is almost entirely composed of beds of the old red sandstone formation.

Briefly speaking, the supply will be derived mainly from the upper part of the Usk Valley by conduits which will skirt the hills at an altitude above the 600 feet contour line, so as to leave the lower and more cultivated and populous portions of the valley entirely untouched. The water from these upland drainage areas, 136,000 acres in extent, including the district of the Black Mountains which lie eastwards of the town of Brecon, would be led by conduits into a large reservoir, which would be formed most economically on the site of an existing shallow lake called Llangorse. The top water-level of the present lake, after being raised 93 feet, would be 595 feet above the sea; and its area would be 2800 acres—being 5 miles in length, and more than 1½ miles broad at its widest part. Its contents would be about 38,000 million gallons; and the dam to retain this enormous quantity of water would be only 130 feet in height as an extreme, and of comparatively short length. For economy of construction, no reservoir with which I am acquainted excels this.

The only source of contamination which has been noticed by the Chemist in his report is occasioned by the small village and farmhouses on the banks of the existing lake, which would be submerged were the proposed reservoir constructed, and so remove the only possible source of pollution in the district. For it must be remembered that the water in the present lake is no criterion of the purity of the water which will be derived from this district, as in future the water stored in the proposed reservoir will be derived from other sources, the chemical analysis of which, as instanced by that of the River Usk, given in the Chemist's report, is of exceptional purity. But even the water now stored in the existing lake compares favourably in many respects with the filtered water at present supplied to the Metropolis.

The construction of this reservoir would involve the diversion of a portion of the Mid-Wales and Brecon and Merthyr Railways near their junction at Talyllyn. This, however, is a matter which can easily be effected; and, if my remembrance of the Mid-Wales Railway is not incorrect, with some advantage to the railways themselves.

After making full deductions for dry years, evaporation and compensation, a supply of 182 million gallons a day can be obtained from this source. A portion of the compensation would be given from a reservoir to be constructed near the village of Trecastle in the upper portion of the valley; while another portion would be given out of the proposed Llangorse reservoir, the bulk of which would be discharged into the River Usk, and the remainder down a small stream which flows into the Wye. From the reservoir at Llangorse, the main aqueduct, hereafter described, would commence and carry water to London; being joined at a distance of about 7 miles from Llangorse by the tributaries which would flow in from the northwards.

I may state that in all cases, whether for compensation or supply, the reservoirs are so designed as to contain 180 days' storage—that is, they would last, when once filled, for a period of 180 days, without taking into account the natural inflow of water which undoubtedly would take place during so long a period in a climate so humid as that

which we are considering. Consequently, I am sure that ample provision has been made against fluctuating rainfall or droughts in excessively dry years.

(2) *Yrfon.*—At a short distance above the town of Builth, the Wye is joined by a large tributary named the Yrfon, which takes its rise to the westwards among the hills which form the boundary between the Wye and the Towy. Passing up the River Yrfon to about a mile above the village of Llanynis, a fine site for the storage of water is to be found; and it is at this point that the second great branch of the scheme would be located. Above this point there is an available drainage area of some 67,000 acres running up to altitudes of from 1700 to 2000 feet above the sea. The whole of this drainage area is composed of beds of the Silurian age of the Wenlock, Bala, and lower Llandovery series.

At the place indicated above Llanynis, a dam across the river, about 166 feet in extreme height, would form a lake 2850 acres in area, the top water of which would be 606 feet above the sea-level, and would contain 31,000 million gallons. This lake would form, with the island which it would contain, a most picturesque object in the landscape; it having a serpentine course of over six miles in length, with three branches to the northwards from ¾ mile to 1½ miles in length. In this case also, a diversion of the Central Wales Railway would be required, which, from the sections of that line I have examined, can be easily carried out, with almost as much advantage to the line itself as in the case of the Mid-Wales Railway at the Llangorse reservoir above referred to.

In addition to the natural drainage area of the Yrfon above spoken of, the drainage from 19,800 acres of the Upper Towy can be poured into the above reservoir by diverting the flow of the River Towy through a tunnel about 4¼ miles in length. This district of the Upper Towy is remarkably barren and uncultivated, running up to altitudes of from 1700 to 1800 feet; the geographical structure of the district being composed entirely of the rocks of the lower Llandovery series.

From these two areas on the Towy and the Yrfon, by the large reservoir before described, a supply of 135 million gallons a day is available for London, after making liberal allowances for dry years, compensation to the River Yrfon, and the proper proportion of evaporation. The compensation to the River Towy would be afforded by the construction of a reservoir on one of its tributaries a little below Capel Ystradffin, from which the compensation water would be passed down the main stream—the compensation to the Yrfon being given from the Yrfon reservoir itself.

(3) *Edw.*—A little below Builth, the Wye is joined on its eastern bank by a tributary stream called the Edw. Upon this stream there is an available drainage area of 17,000 acres, situated above an admirable site for a reservoir of 570 acres in extent, the top water of which would be 700 feet above sea-level. The drainage area is composed of rocks of the upper and lower Silurian series, with certain interpolated volcanic beds, and will give a supply, after dry years, evaporation, and compensation have been allowed for, of 18 million gallons a day.

(4) *Ithon.*—At a point about a mile above the village of Ystradenny upon this river, there is an available drainage area of 25,000 acres, running up to altitudes of from 1200 to 1500 feet above the sea. It is composed of upper Silurian rocks of the Wenlock series. On this river can be constructed a reservoir about 900 acres in extent, the top water of which would be 900 feet above the sea-level. This again would form a picturesque object, as it would consist of two main branches—one 4 and the other 2¼ miles in length. From this reservoir, which would contain about 9000 million gallons, a supply of 37 million gallons daily could be obtained for London.

The compensation for the water so abstracted from the Ithon would be given from a reservoir situated on its tributary stream, the Clywedog, just below Abbey-Cwmhir. To this reservoir there would be a drainage area of 9800 acres. The top water-level of the reservoir would be 800 feet above the sea, and would afford ample compensation to the stream below.

(5) *The Upper Wye.*—The fifth source of supply to which I would direct attention is that of the Upper Wye. At a point about 4 miles above the town of Rhayader, there is a remarkably good site for a reservoir with a top-water altitude of 900 feet above the sea. Draining into this is an area of about 22,000 acres, the whole of which is composed of the lower Silurian beds of the Llandovery series. It runs up to great altitudes of more than 2300 feet on the slopes of Plynlimmon. At the place indicated, a reservoir having an area of 900 acres could be constructed. Its extreme length would be 4½ miles, with an extreme breadth of about half a mile. The dam would be about 130 feet in height; and the capacity of the reservoir, 10,500 million gallons. From this reservoir, after providing for dry years, evaporation, and compensation, a supply of about 43 million gallons a day could be obtained for London.

These five branches, into which the scheme naturally divides itself, afford an opportunity of so designing the works as to permit of their gradual construction as the necessities of the case demand; so that if, in future, a portion was at first found sufficient, it could be added to as necessity arose, by taking in any of the five sources as occasion might dictate.

To summarize, therefore, the quantities that can be obtained from these sources, we may throw them into the following table:—

	Million Gallons per Day.
(1) The Usk and Llangorse areas	182
(2) The Yrfon and Towy sources	135
(3) The Edw	18
(4) The Ithon	37
(5) The Upper Wye	43
Total	415

To give some idea of what this quantity of 415 million gallons a day represents, I append a table showing the average natural flow of the Thames at Teddington Weir, inclusive of the quantity pumped from the river and supplied to London during certain months of the years 1884-5-7, 1891-3. Taking the average flow of these five selected months at 333·6 million gallons a day in the Thames, the quantity of water obtainable in Wales as a certainty at all periods of the year may be said to exceed the dry-weather flow of the Thames by nearly 81·4 million gallons a day.

Date.	Total Monthly Quantity. Million Gallons.	Daily Average for the Month. Million Gallons.
1884—August	11,706·7	377·6
1885—August	9,547·8	307·9
1887—August	10,573·2	341·1
1891—July	10,642·9	343·3
1893—September	8,949·3	298·3

But this may be said to be merely an exceptional case of circumstances arising in individual months of particular years. We can, however, view the Thames from another standpoint. In the following table, I give the average natural flow of the Thames at Teddington Weir for five consecutive months in 1884, three months in 1885, four months in 1887, and six months in 1893. The average flow of these periods amounts, as will be seen, to 404 million gallons a day; so that we may say that the quantity of water obtainable from the five sources above enumerated exceeds the average total flow of the Thames over periods of from three to six months' duration. It is only by such comparisons as these that we are able to understand what the available yield of the Welsh district is, or the capabilities of the Thames to afford a supply to the Metropolis. It is useless to talk of the average flow of the Thames, including the winter floods, as a source of supply; for the Royal Commissioners have recently, after careful inquiry, reported that the Thames floods should not be used, on account of the contaminated nature of the drainage area from which they would flow.

Date.	Daily Average Natural Flow. Million Gallons.
1884—Five months, July to November	417
1885—Three months, July to September	393
1887—Four months, July to October	393
1893—Six months, June to November	413
Average	404

Assuming that the Thames and Lea were entirely abandoned as sources of supply for London, we should have left as available uncontaminated sources the chalk wells in the Lea Valley and those of the Kent Company. The Royal Commissioners have given it as their opinion that from the Lea Valley 40 million gallons per day can be obtained; and if pumping from the river were to be abandoned, this, in all probability, would be the case. From the chalk wells of the Kent Company, they estimate a yield of 27 million gallons a day. If we now add these 67 millions from the chalk wells to the 415 million gallons available in Wales, we obtain a total possible volume of 482 million gallons a day, which, at the rate of 35 gallons per head per day, would afford a supply to a population of nearly 13,800,000 persons, which would probably be the population of the districts now supplied by the various Water Companies in the year 1945.

Among the works above proposed, the construction of the large reservoirs suggested is the most characteristic feature. Undoubtedly two of them—that at Llangorse and that on the River Yrfon—would be the largest ever constructed in this country. The height of the dams, excepting in the case of the Yrfon reservoir, which is 166 feet, is in no way remarkable, as I have myself constructed an earthen reservoir embankment 125 feet in height; but in all probability, in all the cases mentioned, masonry dams will be found most suitable to the circumstances of the case.

Although the Yrfon dam would be 166 feet in height, and the highest in this country, such a dam is perfectly feasible, as we have instances in France of dams of greater height, which have been constructed with perfect security; and one instance in this country—the Vyrnwy—of a dam of greater height than any of the others now proposed. In fact, masonry dams, properly constructed, are among the most stable and secure of engineering works.

It is somewhat difficult to form an idea of what these reservoirs would be like when brought to completion. I have therefore added below a short table giving the altitudes and areas of some of the best-known lakes in this country. It will consequently be seen that the Llangorse reservoir, 2800 acres in area, would be somewhat larger than the Ullswater lake in Cumberland; and its top water-level would exceed that of Ullswater by 115 feet. In the case of the reservoir on the Yrfon, 2850 acres in area, it would exceed Ullswater by 550 acres, and falls short of Loch Katrine—the source of supply for Glasgow—by about 150 acres, and Windermere by 450 acres. The altitude of its water surface, however, would be 126 feet above that of Ullswater, and 246 feet above that of Loch Katrine. It will have been noticed that all the reservoirs for the supply of London are situated at greater altitudes than the lakes, with the exception of Haweswater, in the table below. This, I need not point out, is of paramount importance to the scheme in question, for it enables the Metropolis to be supplied by gravitation without the aid of pumps.

Lakes.

	Top Water-Level.	Area in Acres.
Bala	530	1000
Windermere	137	3300
Thirlmere	533	875
Ullswater	480	2300
Derwentwater	238	—
Haweswater	694	683
Loch Katrine	300	3000

Artificial Reservoirs.

	Top Water-Level.	Area in Acres.	Capacity, Million Gallons.
Vyrnwy reservoir	825	1180	13,000
Thirlmere, as raised	584	793	8,130

(*To be continued.*)

The Gravesend Town Council and the Water-Works.—The Gravesend Town Council have instructed their Clerk to prepare a report with a view to an application being made to Parliament for power to construct water-works and supply water, or, alternatively, to purchase the undertaking of the Gravesend Water Company.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Perth Gas Commissioners are into the thick of the question of the removal of the Corporation Gas-Works from the present site in the centre of the city to one upon which there will be room for the extensions which, according to all appearances, it will soon be necessary to make upon the manufacturing plant. They met on Monday night to discuss, not the question of removal—for all, except perhaps one member of the Commission, are agreed upon the necessity for removal—but the question of whether the proposed new site, known as the Sand Island, is suitable. I have not had the opportunity of visiting the site; but from what I learn, it does not conform to its name, in respect that it is not an island. It is only a stretch of sandy ground on the banks of the River Tay; and, unless in times of flood, it is not surrounded by water. It is situated at the lower end of the city, in one of the upper navigable reaches of the Tay, which gives it the great advantage of water communication with the rest of the world. It is also near the railway, from which a siding could easily be obtained, which is also in its favour. It possesses the further advantage that it is near to the last large gasholder which the Commissioners erected, and which could be superintended from the works without extra cost. Its low-lying situation also makes it suitable for the erection of gas-works; and the promoters of it find a further reason for adopting it in that, being within the city bounds, it would retain for burgh purposes the whole of the assessments which would be leviable upon the works. These are all reasons of great importance in the selection of a site for a gas-works; and others were mentioned in the discussion. It would appear as if the site had been selected by the Commissioners, or some of them, and that then Mr. Whimster, the Engineer and Manager to the Commission, was asked to report upon it. This he did, giving his estimate of the cost; and he was then asked to report again. His second report was also favourable; but the Commissioners resolved to have an independent opinion on the subject, and called in Mr. W. Foulis, the Engineer and Manager to the Glasgow Corporation Gas Department. Mr. Foulis, in his report, a summary of which I gave a fortnight ago, while not stating disapproval of the scheme, was careful to point out the extra cost which would be involved in it, by reason of the fact that the foundations for the buildings would require to be made to a depth of 15 feet from the surface of the ground. Even with this, however, he seemed to think that the scheme was feasible; and he did not discourage the Commissioners from adopting it.

In the discussion on Monday night, Mr. Wright, the Convener of the Works Committee of the Gas Commission, urged the adoption of the scheme, on the grounds that the site was already the property of the town; that another site which had been mentioned, on Lower Friarton Farm, being two miles away, would interfere with the sale of coke in the town—the loss to the Commission in that matter alone being, according to his estimate, about £100 a year; and that to place the gas-works outside the burgh would mean an annual loss to the rates of nearly £400, which, capitalized at thirty years, meant a loss to the citizens of about £12,000. Replying to anticipated objections, he said one of these was that the works might get flooded; but that £1000 had been allowed for foundations, "and all that was necessary, in so far as the gas-works were concerned, was retort-benches." It having been pointed out that the ash-pans would be some 3 or 4 feet below flood-level, Mr. Whimster explained that he proposed to put the whole of the retort-benches into a concrete basin, the bottom of which would be about 8 feet below the present level, which would prevent the water getting in. The purifiers would be in an iron chest, about 5 feet deep. A member said that that, again, would be 2 feet below the flood-level, and that he knew the force of the current would send water into them. The objection was then raised that the works might be cut off from communication with the town in times of flood, unless they were prepared to raise the level of the shore all the way down to them.

Motions were made that a report be obtained as to the suitability of the Friarton Farm site, and that a Special Committee be appointed to confer with the Prison Commissioners with regard to their objection to the planting of gas-works in the vicinity of the prison. There seemed to be a general desire for delay in coming to a decision in the matter; and it was ultimately agreed to ask Mr. Whimster to report on the comparative cost of the two schemes of the Sand Island and Friarton Farm. I should think this was the most sensible resolution to come to. The Sand Island may be a most excellent site in many ways; but it seems to me to be a risky one. It would be most undesirable to have the gas-works planted where they would be liable to be surrounded by raging floods. Running water is a most erratic element; and it is not beyond the bounds of possibility that, unless most costly works were undertaken to raise the level of the shore "right down," as a Commissioner expressed it, the river might cut a new channel between the works and the mainland, and sweep away the supply-pipes. The works must be made safe, whatever the cost; and it will not do to push forward a scheme which has elements of risk in it, without looking at other sites, and counting the cost both of certain and of probable outlays.

The Greenock Police Board, out of the good working of the past year in the Corporation gas-works, have been able to reduce the price of gas from 3s. 2½d. to 3s. per 1000 cubic feet.

The accounts of the Aberdeen Corporation Gas Department for the past year have not been published yet; but it is announced that it is expected that the Gas Committee will be able to reduce the price of gas from 3s. 5d. to 3s. 3d. per 1000 cubic feet. Last year a reduction of 3d. per 1000 cubic feet was made, which makes 5d. in two years. Mr. Alex. Smith the Engineer and Manager, with his right hand, is thus able to beat his left hand in the form of the Electric Lighting Department, which is also under his charge. The Corporation have just completed the laying of a long stretch of new mains to the west end of the city, which should assist greatly in the distribution.

The Forfar Gas Corporation have this week reduced the price of gas to 3s. 9d. per 1000 cubic feet, which is 6d. less than at this time last year. The reduction is due to the new plant which the Manager (Mr. Forbes Waddell) has introduced. The accounts for the past year, which I have already given, were approved, after some criticism by one of the members of the Corporation, which was not of any value. Notice has been given of a motion that a photometer be provided at the gas-works, which should be of great assistance to Mr. Waddell in keeping up the illuminating power of the gas he sends out.

A new smoke-consuming apparatus, which has been patented by Mr. W. M'Glashan, consulting engineer and surveyor, of Leith, was tested at the Royal Infirmary, Edinburgh, on Wednesday, and gave satisfactory results. In Mr. M'Glashan's process, crude oil is used as the means of increasing the flame of the waste gases, by which the smoke is consumed before it enters the chimney. The oil supply is arranged to work automatically.

An aged man, who has been in charge of the small gas-works at Macduff for many years, is now obliged to retire on account of advancing infirmity. This is always more or less of a melancholy incident in the life of a man; but in this instance, the Company have the additional element to disturb their minds that, along with the wearing out of their Manager, they have learned that their works are quite done. Mr. Smith, of Aberdeen, has been called in to report upon their condition, and what will be necessary to make them fit to meet the demands upon them.

One of those unpleasantnesses which often arise between local gas companies and municipalities, regarding the supply of gas for public lamps, has just been amicably settled at Turriff. I understand that a former Secretary and Manager to the Gas Company was in the habit, although a number of the lamps were under meter, of disregarding the readings of the meters—being satisfied that there was an amount of waste, on account of defective fittings, boys turning on unmetered lamps during the day, and the like, to justify him doing so; and that when this fact was discovered, after the present Secretary came into office, the Police Commissioners claimed a rebate on the past four years. Though the practice was undoubtedly a wrong one, the Secretary would appear to have justified it to himself on the ground that the amount received from the Commissioners was under the average which is paid by the Police Commissioners in neighbouring towns. The sum paid for gas is only about 9s. 6d. per lamp per annum; the lamps being only lighted on moonless nights. The former Secretary, therefore, seemed to have endeavoured to overcome the effect of a hard bargain. Most unqualifiedly I say it is mistaken policy on the part of a gas company to do anything, which savours of taking advantage of anyone. It is far better for a company rather to be generous to local authorities, even to the suffering of a slight loss, than to attempt anything smart, not to say questionable. There is sufficient feeling antagonistic to gas companies, particularly in small communities, without the company doing anything to create more. In this case, it must not be forgotten that it was not the Company, but their late Secretary, who did the wrong. In settling the matter, the Police Commissioners have exhibited a great degree of magnanimity. Instead of pressing their claim, they have agreed to accept, as a settlement, that they are to pay for the past two years according to the average of the test meters for the ensuing lighting season; and the number of meters is to be increased.

The Aberdeen Town Council have, as part of a scheme for the improvement of the water supply for the city, agreed to lay a concrete floor in the large reservoir at Invercannie, where the water is taken from the River Dee, at a cost of £4430. The work was very much needed, as hitherto the flooring of the reservoir has been very muddy, and leeches and other objectionable forms of a quatic life have been apt to engender in it and to get, occasionally, into the distribution pipes to the dismay of the consumers.

The Dundee Town Council have resolved to proceed with works for the filtration of the water in Monikie reservoir, before sending it into the city. The estimated cost of the works is £8000, which, it is calculated, will entail an annual charge of £450, or about ⅓d. per pound on the rateable rental; but it is expected that no increase will require to be made on the rates, to provide this sum.

The Glasgow Water Commissioners recently opened the Loch Chon section of the new aqueduct from Loch Katrine to the city. At the opening ceremony, Bailie Osborne, the Convener of the Water Committee, said the new section would enable them to add 6 million gallons of water per day to the supply. Mr. J. M. Gale, the Engineer to the Commissioners, said that the section was 3½ miles long. It had cost £95,000, or about 6 per cent. more than the parliamentary estimate of 1885; and it had occupied four years in construction. The distinguishing feature of the contract was the hardness of the rock through which the tunnels were driven, and the consequent large number of air-compressors and other appliances which the work required. Mr. George Waddell, on behalf of the Contractors, Messrs. Waddell and Sons, of Edinburgh, presented ex-Bailie Osborne with a silver key, with which he opened the gate leading to the sluices, which were then opened, allowing the water to flow from the old aqueduct alongside into the new channel. In the course of their tour, the Water Commissioners practically inspected the whole line of the new aqueduct between the reservoir at Mugdock and Loch Katrine. Its total length is about 23½ miles. Of this, 16¾ miles are completed, 5½ miles are under construction, and 1¼ miles (being the length of the Loch Katrine Tunnel) are not yet commenced. The new aqueduct will be 1¾ miles shorter than the old one, with which it runs nearly parallel. It is 12 feet wide and 9 feet high where it is not lined with concrete, but only 10 feet wide where it is lined. The bottom is laid with concrete throughout the whole length; and it has a fall towards Glasgow of 1 in 5500. It consists of a succession of tunnels, which, for the greater part, were driven from the two ends without shafts; the drills being worked by compressed air at a pressure of about 60 lbs. on the square inch. It will discharge 70 million gallons of water per day, which, added to the 40 million gallons per day derived from the old aqueduct, will bring up the total supply to the service reservoirs to 110 million gallons. Allowing for stoppages in the flow for examination and repairs, however, only 100 million gallons per day can be calculated upon as available for the city. The syphon pipes which cross the valleys of the Endrick and Blane consist of four lines of 48-inch cast-iron pipes, two of which are being laid at present.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 24.

Sulphate of Ammonia.—Prices during the week have been somewhat irregular. There has been some covering of "bear" sales for August delivery. This has been done principally in Scotland—resulting in an advance there of about 3s. 9d. per ton. Prices at other points have not, however, been affected; but, owing to the business referred to, the market closes with a rather steadier tone—the quotation being £9 5s. to £9 7s. 6d. per ton f.o.b. at the ports. There is more inquiry for delivery ahead; but, so far, buyers will not pay a premium acceptable to sellers.

Nitrate of Soda is quiet; and 8s. 1½d. per cwt. is now the nearest value of fine quality on spot. The forward position is unchanged.

LONDON, *Aug.* 24.

Tar Products.—The only feature of interest in this market is a better demand for naphthalene, both refined, crude, pressed, or drained salts. There appears now to be a permanent market for this very objectionable product. It is true the price offered is very low; but, seeing that the great bulk of naphthalene salts produced in the country are employed for fuel purposes, it is a relief to find there is a more useful outlet for them. Pitch is still well inquired for; and some lots have changed hands, for forward delivery, at 34s. west-coast ports, and 37s. 6d., less discount, for east-coast ports. The increased output of Scotch creosote is seriously impairing the market prospects of oils from coal tar. Trade in common tar-oils was never worse than it is at the present moment. There are several reported sales of anthracene outside the Committee, at 9½d. for "B" quality, which is ½d. to 1d. below what the Committee quote for "B" anthracene. Most of the "A" anthracene appears to be well taken up; and there is none offering. The better value of pitch is slightly firming the price of tar; but the only nominal value of tar oils (which form a very large proportion of the tar itself) unfortunately more than counterbalances the improved prices obtaining for pitch. Transactions during the week are noted as follows: Tar, 18s. to 21s. 6d. Pitch, west-coast, 34s.; east-coast, 37s. to 38s. Benzols, 90's and 50's, 11½d. for London; 11d., country. Solvent naphtha, 1s. Toluol, 1s. Crude, 30 per cent., naphtha, 4½d. Liquid creosote, 1¼d. Naphthalene salts, 24s. Cresylic acid, refined, 1s. 1½d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d. Anthracene, "A," 1s.; "B," 9½d. to 10½d.

Sulphate of Ammonia is undoubtedly firmer. Buyers appear to have come to the conclusion that prices have touched bottom. Considerable business is being done, and largish contracts have been made during the week at £9 2s. 6d. to £9 6s. 3d., less 3½ per cent., all ports; while gas liquor is offered at 6s. 6d. to 7s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—At the last meeting of the Manchester Coal Exchange, it was reported that the Salford Corporation had at length settled at any rate a portion of their gas-coal contracts. With regard to these contracts there has been a good deal of very strong criticism amongst the principal representatives of the coal trade; one or two of the largest Lancashire firms having declined to tender on the forms sent out by the Corporation, as they would not bind themselves in any way to the conditions it was sought to impose. In these cases, tenders were sent in on their own forms; and, so far as I can gather, none of them have been entertained by the Corporation. There would seem to have been a good deal of finessing with regard to prices, in connection with the tenders that were considered, which perhaps accounts for the extraordinary delay in coming to a settlement; and the figure at which, I was informed, one large quantity, amounting to 40,000 tons of Arley gas nuts, had been secured, was so low that I should not care to take the responsibility of repeating it. The settlement of the Salford Corporation contracts may be said to practically close the present gas-coal season, which all through must have been anything but a satisfactory one to colliery proprietors, who, to secure anything like quantities, have had to cut down their prices to excessively low figures. As regards the round coal trade generally, business still drags on in a very depressed fashion, with pits not working more than half time, and supplies excessive. So far as house-fire coals are concerned, there has perhaps never before been so quiet a season; and this is largely accounted for by the fact that during the coal strike gas and oil cookers and heaters were largely introduced, and have since obtained a permanent footing, with the result that to a very considerable extent the use of coal as fuel for domestic purposes has been altogether abandoned during the summer season. The economy and cleanliness of gas-fires and gas-cookers is every summer receiving still wider recognition; and there seems to be the probability that, except in the winter months, house-fire coals will gradually go more and more out of use. Prices remain without quotable change, as colliery proprietors, in anticipation that September may bring forward an increased demand for winter requirements, are holding back from pushing sales, preferring to run short time or stock. Common round coals, for iron-making, steam, and general manufacturing purposes, continue a drug; and with the usual holiday stoppages in various districts, requirements are still further interfered with. For these, prices are very irregular, owing to the competition for business; but they may be quoted at about 6s. to 6s. 6d. per ton for good steam and forge coals, and 4s. 6d. to 5s. for best engine fuel, with ordinary sorts at 3s. to 3s. 6d.

Northern Coal Trade.—The demand continues strong for best steam coals; and in some instances a higher price is obtainable. For best Northumbrian steam, 9s. 3d. per ton f.o.b. is freely paid for early delivery. There is, however, an abundant supply of second-class coals; and the price for these shows no general advance—being still 8s. to 8s. 6d. per ton. Small steam coals are plentiful also; and are quoted at 3s. to 3s. 6d. per ton. Gas coals are steady; and some local contracts in the market may test whether there is any improvement in price. Generally speaking, the quotation for best Durham gas coals varies from 6s. 3d. to 6s. 9d. per ton f.o.b. The shipments are increasing satisfactorily, as consumers wish to take advantage of the quick despatch and low freights still current. Coke retains its firmness at about 13s. 6d. per ton f.o.b. Gas coke is a little more largely produced; but the market readily takes up the limited output. Prices of gas coke are unaltered.

Scotch Coal Trade.—The improved demand for all classes of coal which set in a week or two ago still continues; but prices can scarcely be said to be altered. Small varieties are in great demand for export. The better sorts do not seem to be in so much request for foreign orders. With the shortening days, larger quantities are being required for gas-works; but these are nearly all under contract, and the market prices are not affected. The prices now quoted are: Main, 5s. 10d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. (full); splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 173,516 tons—an increase on the quantity in the previous week of 3936 tons, and upon the corresponding week of last year of 166,030 tons. For the year to date, the total shipments have amounted to 4,446,094 tons—an increase over the same period of last year of 704,163 tons.

Failure of the Electric Light at a Newport (Mon.) Concert-Room.—During a smoking concert at the Falcon Inn, Newport (Mon.), on Monday last week, when several hundred persons were present, and many more were expected—a large number of tickets having been sold—the electric light failed. The premises have just been rebuilt; and the concert may have been partaking somewhat of the character of an opening of the new establishment. Fortunately the landlord had some gas on at the time; but had it not been for this resource, the audience would have been obliged to leave, as the electric light remained extinguished all the evening. It is understood that the defect was in the transformer.

Artesian Well-Boring at Birmingham.—To provide for the necessary water supply at the Grand Hotel, Birmingham, Messrs. Isler and Co. have just completed an artesian well 600 feet deep—the supply of water from it being copious and of extreme purity and softness. An accident occurred to the first bore-hole started; as when it had reached a depth of about 450 feet, the diamond boring crown got fixed, through the feed-pipe which lubricates the drill bursting. It was found, on reconnecting it, that the crown had become set; and though powerful machinery was put to work to withdraw it, it was impossible to shift the crown in any way. It was then suggested that the supply should be tested, which was done; and an ample one was obtained. But unfortunately the hardness of the water prevented it being of any use for boiler purposes, &c.; and, as a soft and pure water was a desideratum, Messrs. Isler proposed starting a fresh hole, which (as stated) has now proved successful in every respect.

Harrow and Stanmore Gas Company.—The report of the Directors, to be submitted at next Monday's meeting of the shareholders, states that, in pursuance of the powers of the Harrow and Stanmore Gas Act of 1894, since the 25th of March the Harrow District Gas Company and the Great Stanmore Gas Company have become one undertaking, under the title of the Harrow and Stanmore Gas Company; and since that date a reduction in the price of gas of 3d. per 1000 cubic feet has been made throughout the Stanmore district, as intimated in the last report. The balance of the profit and loss account is £2019. The Directors recommend that a dividend be declared for the half year to June last, at the rate of 7½ per cent. per annum on the original "A" capital, of 7 per cent. on the additional "B" capital, and of 5¼ per cent. on the additional "C" capital; and for the three months to June at the rate of 6 per cent. per annum on the guaranteed shares—all less income-tax. The dividend on the guaranteed shares for the three months ending March was paid by the Great Stanmore Company.

The Kent Water Company and their Supply during Last Winter's Frost.—The Chairman of the Kent Water Company (Mr. G. Smith), at their recent half-yearly meeting, referring to the difficulties arising out of the frost of last winter, remarked that it was unprecedented; and he cited the following extracts from the report of Mr. J. Glaisher, the veteran meteorologist, to the Registrar-General for the quarter ending in March: "The mean temperature of the month of February, at Greenwich, was 28·9°; being the coldest February back to 1771. . . . . So far as I know, such a series of 23 consecutive low night temperatures is unprecedented." He also quoted the following from Professor Symons, in the March number of the *Meteorological Magazine*: "There is no case equal to 1895 with four consecutive days on each of which the mean temperature was below 20°." He added that these were very important facts from the highest authorities, and should find acceptance with those who were naturally annoyed by the partial and temporary inconvenience they suffered from the interruption of the abundant supply to which they were accustomed. Even a municipal water authority could not foresee or control the weather; and the provincial newspapers had abundantly proved by their records that water consumers supplied by local authorities suffered in common with, and in some towns much more than, consumers in London. The Directors, on learning early in March that some of the Company's smaller mains in exposed positions had been frozen, at once gave orders that every section of the mains so obstructed should be relaid and lowered, to afford complete protection against any recurrence of the kind. In doing their best to meet these exceptional extreme difficulties, in remedying the damages to their pipes, and providing for any recurrence in the future, the Company had voluntarily and ungrudgingly spent £15,000 out of their profits, and so taken their full share of the burden of trouble and expense the disaster had brought with it to so many. No water authority, whether municipal or corporate, could possibly have done more. In conclusion, he observed that the interval since the previous meeting had been perhaps the most remarkable period in the history of the Company. Bills had been presented to Parliament to acquire the whole undertaking by compulsion; an altogether unprecedented frost had befallen both the water consumers and the Company; and a prolonged extreme drought had involved the greatest demand ever made upon their resources. These combined events had caused the past half year to be one of considerable anxiety and strain; but, having surmounted every difficulty, the Directors could congratulate the shareholders upon the position the undertaking held after so severe a test of its soundness and efficiency.

Gas Explosion at Mile End.—In the afternoon of Saturday, the 17th inst., an escape of gas, owing to the fracture of a large main, caused a fire at the Mile End Infirmary. The arrival of the Fire Brigade soon put an end to it; and, though there was a great deal of excitement, no serious personal injury was sustained.

Sales of Shares.—On Monday last week, Messrs. Killingworth and Son sold by auction at Boston 13 fully-paid £25 shares in the *Boston Water Company* for £51 12s. 6d. each; 22 original (£10) shares in the *Boston Gas Company* for £18 15s. each; and 20 new (£10) shares at £15 10s., £15 11s., and £15 12s. 6d. each.——At the Royal Hotel, West Hartlepool, last Thursday, Mr. J. Hunter sold 500 £10 shares in the *Hartlepools Gas and Water Company* at £17 10s. and £17 11s. each; a total of upwards of £8750 being realized.

The Water Supply of East London.—At a conference of representatives of the London Vestries and District Boards within the East London Water Company's district, held last Thursday night at the Hackney Town Hall, a resolution was passed requesting the London County Council, being the Metropolitan authority, to take action against the Company to compel them to carry out their obligations, and appointing a deputation to wait upon the Water Committee of the Council to-day. A deputation is also to wait upon the President of the Local Government Board.

Ottoman Gas Company, Limited.—The Directors of this Company will report to the shareholders, at their half-yearly meeting next Tuesday, that the gas-rental in the six months ending June 30 amounted to £8738, compared with £8429 in the corresponding period of 1894; and that the net profit is £3465. The sum standing at the credit of the profit and loss account is £4177, which the Directors recommend should be dealt with as follows: Addition to the reserve fund, £1000; dividend at the rate of 7 per cent. per annum on both classes of shares, £2625; and carried forward, £552.

Rejection of the Lighting and Watch Act at Norton, near Sheffield.—A well-attended meeting of the ratepayers of the parish of Norton was held last Thursday, in order that the electors might consider the desirability or otherwise of lighting, at the expense of the whole parish, portions of two main roads in the parish—Derbyshire Lane, to the extent of the Sheffield Gas Company's mains, and Chesterfield Road, from Heeley to Woodseats. After a lengthy discussion of the subject, the proposal to adopt the above-named Act was rejected by 65 votes to 31; and so the matter will have to rest for at least twelve months.

New Joint-Stock Companies.—The Self-Lighting Gas Company, Limited, has been formed with a capital of £200,000, in £10 shares, to acquire any inventions for self-lighting gas, and all or any of the patents, patent rights, &c., in connection therewith, in any part of the world; and, generally, to carry on business as manufacturers of, and dealers in, any articles under such or other patents as may from time to time be acquired by the Company. The Menzies Water-Works, Limited, with a capital of £50,000, in £1 shares, has been formed to adopt and carry into effect an agreement, made between the Gold Estates of Australia, Limited, and J. G. Broad, on behalf of the Company, and to supply the district of Menzies Find, Western Australia, or any other districts, with water, and to carry on the general business of a water company.

The Profits of the Carlisle Gas and Water Works.—The annual accounts of the gas and water undertakings of the Carlisle Corporation for the year ending June 30 have been completed and audited; but, as they have not yet been before the Committee, the publication of an official abstract has been deferred. We learn, however, from a local paper, that while the water-works have realized a gross profit of £4900, or about the same as last year, the gross profits of the gas-works for the year were £8000, or about £1000 more than in 1893-4. The two undertakings have therefore brought into the coffers of the Corporation for the year the round sum of about £13,000. The gross profits of the gas-works in 1893-4 were £7124, while in 1892-3 they were £3763. The gross profits of the water-works in the same years were £4906 and £4502 respectively. From the gross profits of £8000 of the gas-works will have to be deducted repayment of loans, interest on stock, &c., which last year amounted to about £3300; and any payment to the reserve fund which the Committee may order (last year the amount was £700). Presuming, however, that these outgoings do not exceed those of last year, there will be about £1000 more applicable to the purposes of the city fund; while the balance from the water-works available for the general district fund will be substantially the same as before, after deductions for the repayment of loans, interest, &c., have been made.

The Proposed Water Trust for West Kent.—Mr. C. E. Baker, the Parliamentary Agent to the West Kent Local Authorities, has informed the Bromley District Council that there appears to be some misunderstanding in connection with the position of the London County Council and their Transfer Bills. The Bills are only suspended, and will be taken up in February at the Committee stage, and be proceeded with as if there had been no dissolution, with this exception—that, if the Committee choose to do so, they can insist upon having the speeches and evidence repeated before them. The position is therefore very much the same as it was; and the promotion of a Bill by the Kent authorities is a tactical piece of work, for while it would seek powers for acquiring the whole of the Kent Water Company's undertaking, the main object was, of course, the acquisition of the undertakings outside the County of London. The writer pointed out that though a Bill could be modified, and proposed provisions excluded, no additions could be made in respect of which notice had not been given. Our local correspondent says: "Mr. Baker's statement that the London County Council's Bills are only suspended, appears to have put the various local bodies at sixes and sevens; for somehow it had become generally accepted that the Transfer Bills were dead, and several of the West Kent Councils have not favoured the proposal to promote a Bill for the transfer of the Kent and Lambeth undertakings to a Joint Board formed of representatives of West Kent. The Bromley Council have resolved to ask the London County Council to inform them exactly how the matter stands, so that they may know what to do.

The Proposed Purchase of Ossett Gas-Works.—At a largely-attended town's meeting held last Wednesday, a resolution was passed calling upon the Ossett Town Council, at the earliest convenient moment, to take into consideration the purchase of the Ossett Company's gas-works; and if necessary to promote a Bill in Parliament for the purpose.

Opening of New Water-Works at Lostwithiel.—Last Thursday was a memorable day in the history of the ancient and interesting little borough of Lostwithiel, from the fact that the completion of the works for furnishing an ample supply of pure water to the town was celebrated with the customary festivities. The question of the water supply of Lostwithiel has for some years troubled the municipal authorities. Like many other towns and villages in Cornwall, the community has hitherto depended solely upon the natural resources by which it has been favoured; but the inconvenience of having to fetch from a distant stream whatever water was required, and the danger of its pollution, aroused the inhabitants to the need for a more satisfactory and commodious method of supplying the town. At first the difficulties to be surmounted were great; and it was not until Lord Robartes came to the relief of the Corporation that a solution of the problem seemed practicable. His Lordship offered free access to springs which exist on his estate at Ford—a distance of about three miles from Lostwithiel; and Messrs. S. W. Jenkin and Son, of Liskeard, devised a scheme which would involve a total outlay of about £2100. This provides for the collection of the water from three springs into a reservoir, the capacity of which is 40,000 gallons. The water is conveyed by gravitation through a 4-inch main. The reservoir is 200 feet above the highest part of the town, 300 feet higher than the point at which the water enters, and 350 feet above the lowest part. The work has been carried out by Messrs. Oliver and Minnear, of St. Blazey. The main takes a lengthy course through Lord Robartes's property; but his Lordship has met the Corporation in the most liberal manner, and has granted the authorities a 99 years' lease of the springs, with the right to renew for a similar period, at the nominal rental of 10s. a year. A large proportion of the houses in Lostwithiel have already been connected with the main. The opening ceremony was performed by Lady Robartes.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 434.)

Issue.	Share	Whe ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall on Wk.	Yield upon Invest-ment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c. .	10	23—24	..	4 7 6
100,000	10	,,	7½	Do. 7 p. c. .	10	15½—16½	..	4 10 11
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 7
200,000	5	10 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5¼	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated . .	100	253-258*	..	4 13 0
180,000	,,	,,	9	Do. New	100	200-210*	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
888,500	Stck.	28 Feb.	5	Bristol	100	125—130	..	3 16 11
320,000	20	28 Mar.	11¼	British	20	54—56	..	4 0 4
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c. .	10	22—23	..	5 0 0
51,510	10	,,	8½	Do. 7 p. c. .	10	17—18	..	4 14 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾—8¼	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb. .	100	101—104	..	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	29—31	+1	5 6 5
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock . .	100	300—305	+1	4 8 6
165,000	,,	,,	10½	Do. New o. . . .	100	225--230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	265—275	..	4 14 6
200,000	,,	,,	10	Do. 7 p. c. Pref. .	100	203—208	..	4 16 2
535,000	Stck.	28 Feb.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited . .	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100 2	291-296*	−1	4 6 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107-112*	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280-285*	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf. .	100	130-135*	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do. .	100	197-202*	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max. .	100	187-192*	..	3 12 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf. .	100	277-282*	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.. .	100	163-168*	..	3 11 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	131—134	..	2 19 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	200—205	..	2 18 6
3,800,000	Stck.	10 May	12	Imperial Continental . . .	100	249—254	..	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met.of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited . .	20	17½—18½	+1	5 8 1
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds. . . .	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited . . .	10	10—11	..	6 7 3
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	365—375	+10	4 2 8
1,350,000	,,	,,	12	Do. B do. .	100	307—312	+ 2	3 16 11
308,685	,,	,,	13	Do. C do. .	100	317—322	+ 2	4 0 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	172—176	..	2 16 10
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary . . .	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	[illegible]	East London, Ordinary . .	100	228—233	..	3 8 7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk. .	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117—122	+2	2 17 5
708,000	Stck.	14 Feb.	12	Kent	100	309—314	..	3 16 5
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max. . .	100	260—264	..	2 16 9
406,200	100	,,	7½	Do. 7½ p. c. max. . .	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk. .	100	145—150	..	2 13 4
500,000	100	14 Aug.	12½	New River, New Shares . .	100	385-395*	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk. .	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	157—163	..	2 9 1
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	292—297	..	3 7 4

*Ex div.

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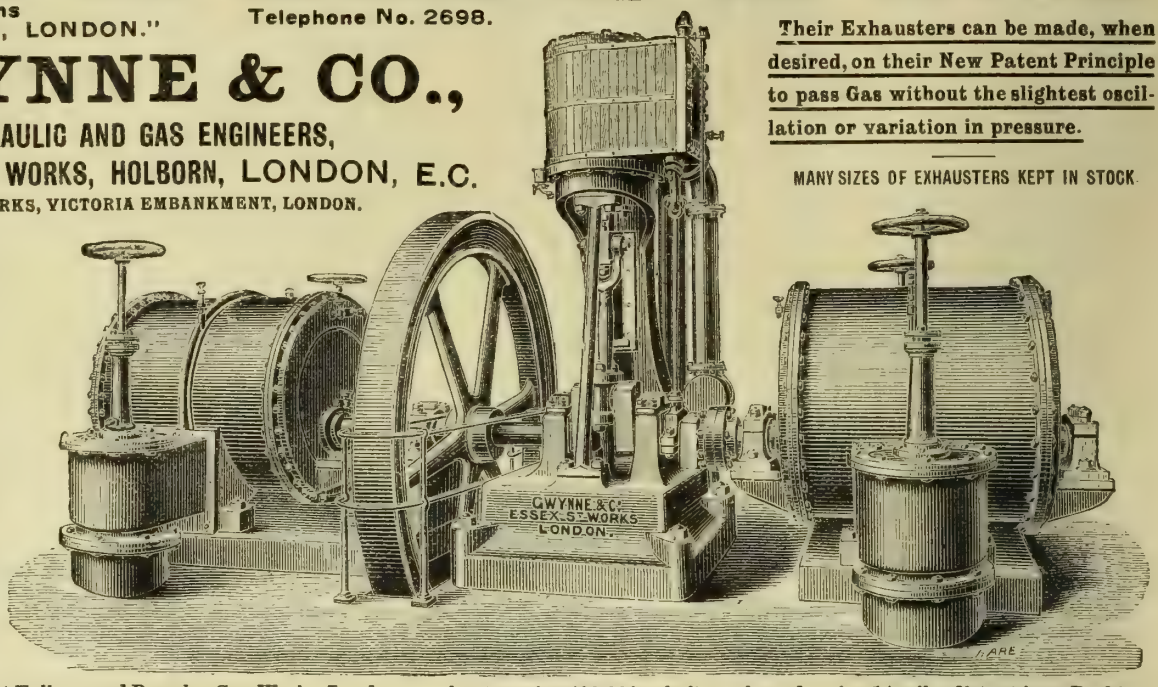

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EDITORIAL NOTES.

Coal Gas as a Locomotive Power.

IT has been already noticed in these columns that, just before the fall of the late Administration, Mr. Shaw Lefevre took steps to obtain an alteration of the law at present hampering the development of mechanical power vehicles for common roads. In connection with this movement, our contemporary the *Engineer* offered the munificent prize of 1000 guineas for self-propelled road carriages; believing, with reason, that the amendment of the existing law on this subject may very well result in the creation of an important new home industry. The change of Government threatened at one time to throw the legislative question into the background; and accordingly our contemporary prepared a memorial, for signature by engineers and others, praying that the cause might be taken up by the new President of the Local Government Board. Happily, however, by the more expeditious means of a question addressed to the Minister in the House of Commons, an assurance has meanwhile been obtained that the matter will not be lost sight of. It is therefore open to the ingenious to apply themselves, with all the ardour that the opportunity demands, to the production of such self-propelled vehicles as may appear likely to obtain first of all a share of the premium offered by the *Engineer*, and afterwards an even more remunerative meed of public patronage. In this connection, there should be hope for those who turn their attention to the capabilities of compressed gas as a motive power for use on common roads. The experience gained from the employment of gas power in working tramcars at Dessau and elsewhere should constitute a valuable datum from which to make the new departure. Herr von Oechelhaeuser's paper on the subject, published in last week's JOURNAL, is a timely contribution to the by no means plentiful literature of this interesting branch of technics. It proves that, at any rate, gas power is well to the front as a means of driving tramcars; and there is no apparent reason why it should not answer as well off as on the rails. The electricians appear to be flattering themselves that the solution of the problem is in their hands; but the evidence in support of this supposition is extremely slight. Even for working tramcars, electricians can do nothing without the objectionable trolley wire, which is, of course, impossible for free road traffic. Their only aid to free carriage driving is the accumulator, which has never yet succeeded in justifying itself for this application, notwithstanding the tens of thousands of pounds that have been spent in experiments with this ponderous and inefficient means of propulsion. The most successful self-propelled road carriages yet made have been driven by steam or petroleum-spirit engines, especially the latter; and it is with the best of these that the adaptors of gas motors to the new application will have to compete. We have had in this country the utmost liberty in regard to the construction of mechanically propelled small and light river launches, which from one point of view may be regarded as analogous to light road carriages; and plenty of experience has been gained from the use in these craft of electricity, steam, oil, or naphtha as the source of power. So far as we are aware, gas power has not hitherto been tried for vessels of this class, with the exception of a French gas-driven barge, which proves the rule. It is not likely, however, that launch experience will help much the designers of self-propelled road carriages; the differences of the conditions being so radical and irreconcilable.

Some French experiments with mechanically-driven road carriages appear to favour the use of the naphtha-engine, which is practically a gas-engine. It remains to be seen whether naphtha or compressed gas is preferable on all counts as a portable source of energy. For compactness, there is probably nothing to surpass petroleum spirit; and if Mr. Maxim's judgment in the matter of driving his flying-machine is worth anything in this connection, it may be better to burn the spirit as a fuel for raising steam than to gasify it for use in an internal-combustion engine. Naphtha and spirit, on the other hand, are dirty, and are not devoid of risk in handling or using. A cylinder of gas, on the contrary, is incapable of making a mess; and the risk of carrying and handling it is certainly less than that attaching to volatile mineral spirit. It must not be forgotten, moreover, that the noble animal, the horse, whose place

between the shafts is to be taken by the engine carried in the body of the conveyance, is not free from little tricks of his own. The subject of risk, indeed, hardly enters into the discussion of the suitability of compressed gas for driving vehicles. A certain, or rather uncertain, amount of danger attaches to the use of every appanage of material civilization; and unless this amount can be proved to be materially increased by any particular appliance—which is not the case with compressed gas motor engines—there is no need to regard it as affecting the issue.

We were recently "hauled over the coals" by an electrical contemporary for drawing attention to the enormous waste of power that appears in the equipment of an electric tramway. We ventured to remark, with reference to a Brussels undertaking of the kind, that stationary steam-engines indicating 900-horse power seemed to be an extravagant allowance for working twenty-two cars; and we were told that we knew nothing about the matter. The conditions of using horse and electrical power were stated to be so different, that it is impossible to judge of the requirements of the latter by the capabilities of the former. It was admitted, however, that it is the starting that uses up the motive power of the electrical machinery so wastefully. This is reasonable enough, for everybody knows that starting an engine of any kind with the load on is a different thing from running away with it afterwards. How much nominal power would need to be provided for an electrically-driven vehicle capable of carrying four or six people, for use on common roads, to ensure its starting in all circumstances, we do not know. But Herr von Oechelhaeuser reports that the Dessau tramcars do their travelling with a gas consumption of only 31·2 cubic feet per mile run, including the loss in compression, which is remarkably little. Not much more than one-half of this quantity ought to be needed to do an amount of work on common roads equivalent to that of one carriage-horse trotting at a fair rate of speed for this gait—a rate that should never be exceeded by anything on wheels, off a special track.

The subject, however, might be discussed at greater length than we can find room for here, without being exhausted. We can only express the hope that mechanicians will rise equal to the occasion, and that the best system, whatever it may happen to be, will win. It is not to be supposed that the gas industry will reap much profit from the supply of compressed gas to users of mechanically-driven road vehicles, even if the gas-engine were to surpass all its rivals for this application. But the great thing to be desired is that coal gas, like every other product of Nature and Art, shall be made, by the ingenuity and industry of man, to yield up, for the benefit of the community, whatsoever capabilities of subserving the common good may be inherent in it.

The Manchester Institution Meeting.

The Manchester District Institution of Gas Engineers met at Buxton on Saturday last, under the presidency of Mr. George Smedley; and the meeting was pleasant and successful in every way, as indeed could hardly have failed to be the case under such genial auspices and in such favouring circumstances. The paper read was by Mr. R. G. Shadbolt; and it described, in an acceptable manner, some instructive experiences in gas purification—more especially in connection with the attempt to approximate the ordinary to a continuous process in closed vessels by the help of air and steam. As usual, Mr. Shadbolt's instruction in this fascinating pursuit was led up to by the common difficulty of gas purification—a growing "tightness" of accommodation. His paper narrates how he began to use air with a view to obtaining continuous revivification, and what were the immediate and deferred consequences thereof. It is significant of much that, whereas the immediate results of several of the author's experiments were satisfactory, no sooner did most of them appear to be settling down to produce a regular effect, than some little unforeseen trouble or other manifested itself. All this is very consoling to the average gas manager, who has generally found the way of technical improvement selected by himself sown by the same kind of thorns. It seems so obvious, upon a course of reasoning suggested by some successful laboratory experiment or other source of information, to make this or that amelioration of the processes of gas manufacture—the data are all in order, the conclusion is so evident! And so it is tried, with the frequent consequence of the whole scheme tripping up over an unsuspected obstacle—trifling, perhaps, but sufficient to stop progress along that line for an indefinite period. Happily, these are junctures where mutual help is apt to be better than self help. A solitary worker who has been brought up "all standing" against a wall of difficulty, learns in friendly converse with a kindred spirit that the latter has "been there," and perhaps has seen the way out—which he promptly discloses to his brother technician. So in the present instance, when Mr. Shadbolt had progressed so far with his purification researches that "the matter was "allowed to stand over for some time," he heard Mr. Dexter's Gas Institute paper on the same subject. It gave him the "lift" he needed, and sent him on his way rejoicing. When a writer of a technical paper hears of such a result as this, it repays him tenfold for all his pains in observing and recording his facts and formulating his suggestions.

Features of the Latest Gas Legislation.

The Gas Acts of the present year, though not numerous, present several points of interest, as will be seen from our summary of their principal provisions which appears in another column. Parliament has not shown any pedantic fear of extending to the cases of Scarborough and Newmarket the consolidation of stock upon a basis more nearly approximating to the investment value of the property which has already proved advantageous to other provincial gas undertakings; so that it may be hoped that when next the question of unification is broached in connection with a Metropolitan Gas Company, the road to a satisfactory solution will be made easier by that potent lubricant "precedent." The treatment of the sliding-scale by Parliament, as exhibited in the instances of Newmarket, North Middlesex, and Hayward's Heath, shows signs of a progressive movement, and deserves attention. At last the anomalous position of new 7 per cent. stock, which in older Acts enjoyed the same rate of increase or decrease of dividend under the sliding-scale as original 10 per cent. stock, has been corrected. The expedient of the "neutral zone" has not, however, been repeated this year. Measures have been taken to remove the uncertainty that has hitherto existed with regard to the period of time over which increases or decreases of the price of gas must extend in order to legalize a corresponding alteration of the rate of dividend. The solution now given to this problem appears reasonable; and, in all probability, sliding-scale companies generally will conform in this regard to the spirit of the latest Acts. It is to be noted, not with satisfaction, that gas legislation is still accidental, and destitute of controlling principle, in respect of many points of contact between the suppliers and consumers of gas. The attention of parliamentary authorities might profitably be directed to the discordances that exist in many Acts, and are repeated every session, between the conditions imposed in such matters as the giving of notices of discontinuance, the rate of interest payable on consumers' deposits, the requirement to pay in advance for gas, and other matters of considerable practical importance. It is difficult to understand why what is law in one district in any of these respects should not be law elsewhere, if it is good and expedient; or why certain gas undertakings or their consumers should be favoured or hampered with special regulations which other districts are able to do without. This may or may not be an opportune time for the drafting of a new Gas-Works Clauses Bill. But the Committee on Police and Sanitary Regulations might, if necessary, have their powers extended to inquire into the need for these special enactments when introduced into Private Bills.

The Examinations in Gas Manufacture.

The programme of the Technological Examinations of the City and Guilds of London Institute has been published, and may now be obtained by those who are interested in the cause represented by the Gresham College organization. Readers of the Journal will naturally be most attracted by the examinations in Gas Manufacture (now under the control of Mr. Alfred Colson), which are fixed for May 5 next. We are able to compliment the Examiner upon his syllabus, and also upon his helpful catalogue of works of reference suitable for the use of students. The "papers" set by Mr. Colson for the last examination (given in the Journal for July 2) were pointed and imbued with the

modern spirit in a highly satisfactory degree, although, if anything is to be said by way of criticism, it is that the character of the two sets of questions, for the Ordinary and Honours grade respectively, tends to become more uniform than seems to be altogether desirable. This is a point that we are not disposed to insist upon very strongly, because the Examinations Board may be credited with being in touch with the candidates, and with the desire to suit the questions to the class of students who present themselves for examination. Mr. Colson must beware of repeating himself. Last May he asked (Question 6, Ordinary Grade) what is the use of an exhauster; and next year, according to Paragraph 12 of the syllabus, he may require the similar information. It is difficult to vary technical questions without departing from the general level of difficulty; and we shall know better, when the report on the results of the last examination appears, how the last papers struck the candidates. A rule that seems a good one for the preparation of "papers" of this kind is that the Ordinary Grade questions should refer mainly to simple manual operations, such as constitute the very A B C of gas manufacture; while the advanced questions might probe deeper into the stores of information which students aiming at the professional *status* might be expected to have at command. And there might be one or two real "twisters" thrown in, to test the judgment and critical faculty of the aspirant, as well as his merely assimilative powers. We offer these observations, not with the desire to make the work of the Examiner more difficult, but rather to help in establishing something like a standard to which both Examiner and candidates could refer. There can be no doubt that these examinations are doing real good in systematizing the study of gas manufacture, and emancipating learners from the unintelligent following of routine.

The Trade Union Congress.

The twenty-eighth Trade Union Congress meets at Cardiff this week; and the public are curious to see the issue of the gathering, in the exceptional circumstances. The Congress used to be a very humdrum affair—at least for outside spectators—before 1890, when for the first time the fresh element known as the New Unionism manifested itself in force. Thereafter the proceedings became infinitely more lively. The new element was composed of a pack of hungry Socialists rejoicing in having found in the new unions of unskilled workers that means of support, both material and moral, which they had previously lacked; and with these mercenaries were mingled a few honest enthusiasts who thought the millennium was nigh at hand. The new unions were springing up all over the land; and their "leaders" were to be counted in scores. The representatives of the older unions at the 1890 and following Congresses were swamped by the new hordes, marshalled as these were by professional chiefs who knew no more about the real needs of organized labour than they did of the principles of political economy or the rules of fair play and right dealing as between man and man. But what these parties did know was how to make themselves notorious. Like certain demagogues of olden times, they "sucked no small advantage" out of the individual and collective eminence which the upheaval of the New Unionism (with themselves on the top) conferred upon them. And they made the Trade Union Congress more Socialistic, or Collectivist, every year. The practical cause of the worker disappeared into the background, while these mountebanks passed resolution after resolution for the construction of a new industrial world upon the most fashionable Collectivist principles. The interval of dementia culminated at the Congress last year, when a large majority of delegates, mostly sent by the newest of the new Unions, and being men individually of no importance whatever, carried a resolution pledging the Congress to favour "the nationalization of the land, mines, minerals, "royalty rents, and the whole of the means of production, "distribution, and exchange." Mr. Keir Hardie was at the bottom of all this; and mightily he and his associates plumed themselves upon their triumph. But it was as short-lived as it was utterly barren. A good many things have happened since this Norwich Congress. Among others, the saner heads of Trade Unionism saw that it would never do to allow the movement to be dragged at the heels of visionary Socialists; and so they bestirred themselves to amend the rules governing membership of the Congress, with the result that the whole order of professional agitators having no real connection with the trades they pretend to represent, will be shut out from the organization. The broom has been applied unsparingly; but it is not to be supposed that the clearance will pass unquestioned. As soon as the Congress meets, the battle between the Old and the New Unionism will be set; and, if fought out to the last extremity, one or the other side will be driven from the organization. The issue is not doubtful; for while Trade Unionism has done, and can do, without Socialism, Socialism or Collectivism can do nothing without Trade Unionism, upon which it is merely a parasitic growth.

WATER AND SANITARY AFFAIRS.

The five East-end Vestries and District Boards who, in the course of last week, sent a deputation on the subject of the water supply, first to the County Council, and subsequently to the President of the Local Government Board, were doubly armed in the latter instance, their verbal arguments being fortified by a requisition duly signed by twenty inhabitant householders of the East London district, asking that the grounds of complaint respecting the water supply should be inquired into in accordance with the provisions of the Metropolis Water Act, 1852. This requisition is said to have been presented to Mr. Chaplin after the deputation had come to the end of their interview. According to another account, the requisition was forwarded to Mr. Chaplin in the letter from the Vestry Clerk of Hackney, which sought that the deputation might be received. In either case, the requisition is lodged; and we may suppose that it will be acted upon, though it seems to introduce an incongruity. There is an air of compulsion on the one hand; and, on the other, the inquiry is simply asked for. The deputation found Mr. Chaplin thoroughly impressed with the importance of the subject they brought before him; and quite ready to hear what they had to say as to the alleged negligences and offences of the East London Company. Mr. Kyffin, who was the chief speaker of the deputation, did not believe in the drought, nor in any failure in the quantity of water available for distribution. What he believed in was the perversity and stupidity of the Company in creating an artificial famine. Mr. Chaplin, in reply, would not undertake to believe anything off-hand, either for or against the Company, though he was sufficiently fair to the latter to cite the terms of their defence. He saw no insuperable objections to the inquiry which the deputation wanted; but he apprehended certain difficulties, and desired to become better acquainted with the powers possessed by his department in carrying out such an investigation. While holding his final decision in suspense, he undertook to lose no time in coming to a conclusion, and said he would communicate his decision at the earliest moment. Mr. Sydney Buxton, "as a Liberal member," thanked Mr. Chaplin "most cordially" for what he had said, and accepted the "half promise" as something more than he (Mr. Buxton) had ventured to expect. It was evident, from some of the remarks offered by Mr. Chaplin, that any inquiry which he might make as to the supply of water, would be mainly directed to the discovery of such methods as would prevent a recurrence of the recent misfortune. Precautionary measures for the future would thus be aimed at, rather than the apportionment of blame for the incidents that are past.

Apart from a result to which we shall immediately refer, the visit of the deputation to the County Council, which took place three days before the interview with Mr. Chaplin, was chiefly remarkable at the time for giving Mr. Kyffin an opportunity of getting his acrimonious attack on the East London Company into print. In the name of a million and a quarter of people, Mr. Kyffin asked that the Council should take proceedings against the Company for the purpose of enforcing penalties. But Dr. Collins, the Chairman of the Committee before whom the deputation appeared, expressed considerable doubt as to whether the Council had so much law on their side as would enable them to take action of the kind proposed, with a reasonable prospect of success. Counsel's opinion was rather discouraging on this point; but the Committee would give the matter further consideration, and would do all that lay in their power "to secure an efficient supply of water for the East-"end of London." Dr. Collins might have added that

during 1893 and 1894 the Council had done all they could in the opposite way. The further result to which we have alluded as connected with the deputation, consists in the use made of a statement emanating from that source, that while the East London Company averred there was a drought, they continued a full supply of water to those of their customers who were served by meter, to the detriment of the ordinary customers who paid by rate. The Committee are now collecting evidence on this point with the aid of the Hackney Vestry, in the expectation that the Council will take proceedings against the Company under the Metropolis Water Act, 1871. Had the factories and other establishments been deprived of water, how would the wages class have been affected? And what benefit would it have been to the ordinary consumer if the factories had not been supplied?

It may not unreasonably be made a matter of surprise that, though the East London Company have a larger capacity in their reservoirs for unfiltered water than any other Company, their district should be the only one in the Metropolis which has suffered any scarcity of water in consequence of the drought. In this apparent anomaly we probably find a clue by which the entire question may be solved. The Companies drawing their supplies from the Thames have not suffered any privation, for the simple reason that, while their subsiding reservoirs are less capacious than those of the East London Company, they have in the Thames what is virtually an inexhaustible reservoir. The East London Company have no such resource to fall back upon. They may, indeed, draw ten million gallons a day from the Thames; but that is scarcely one-fourth their entire daily supply. They may also draw from the Lea. But that is a river of much smaller dimensions than the Thames; and its stream is subject to certain demands from the New River Company and the Conservators. Hence the East London Company are under the necessity of constructing large impounding reservoirs, to make the storage in a great measure quite independent of the Lea. With a rapidly-increasing population, the reservoirs must necessarily be increased in size or number from time to time; otherwise the supply cannot keep pace with the demand.

The Managership of the King's Lynn Gas-Works.—Mr. E. G. Smithard, of Chelmsford, has been appointed Manager of the King's Lynn Gas-Works, for which position applications were invited in the JOURNAL for May 28 last, under No. 2533.

The Gas Supply of Montreal.—A correspondent, writing from Ottawa on the 20th ult., says: "The Montreal Gas Company have now officially obtained the contract for supplying gas to the city of Montreal at $1·20 per 1000 cubic feet, and $1 for heating, for the next ten years, with the option of another five years by paying 3 per cent. of the gross profits. This ends the vexed question for the next fifteen years. Mr. E. Herbert Stevenson and Mr. H. S. King arrived, two days after the acceptance by the Council, with a new opposition scheme, and were much disappointed at being too late. They have both returned to London."

Eastern Counties Gas Managers' Association.—We learn from Mr. H. Wimhurst, of Sleaford, the Hon. Secretary and Treasurer of this Association, that the fourteenth general meeting will be held in the Town Hall, Wisbech (by permission of the Mayor, Mr. A. W. May), on the 12th inst. Luncheon will be provided at the gas-works, by the Directors of the Gas Company; and the business will commence at two o'clock, under the presidency of Mr. C. W. Grimwood. Two new members will be proposed for election; and three subjects will be brought forward for discussion—viz., "The Incandescent System as Applied to Public Lighting," "The Regenerative System of Firing," and "The Manufacture of Sulphate of Ammonia on Small Works." The officers for next year will be elected; and the date and place of meeting fixed. At the close of the business, the members will dine together.

The Federated Institution of Mining Engineers.—The annual general meeting of this Institution is to be held to-morrow week at Shelton, near Stoke-upon-Trent, under the presidency of Mr. W. N. Atkinson. Among the papers to be submitted is one on "The Depth to Productive Coal Measures between the Warwickshire and Lancashire Coal-Fields," by Mr. C. E. De Rance, F.G.S. Papers presented at previous meetings will be open for discussion; among them being the following: "Mining Explosives," by Professor Vivian B. Lewes, F.I.C., F.C.S.; "The Change of Composition Produced in Air by Flames and by Respiration" and "The Limiting Explosive Mixtures of Various Combustible Gases with Air," by Professor Frank Clowes. These papers have been already noticed in the JOURNAL. At the close of the business, the members will drive through Trentham Park, the seat of his Grace the Duke of Sutherland; and on their return will dine together. The following day will be devoted to excursions.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 501.)

THERE was quite a revival of activity in the Stock Exchange last week, after the quiet period which had preceded it. Although it was account week, the business of the settlement by no means monopolized attention; but fresh business proceeded briskly. Taken all round, the markets were active and strong, with but few exceptions, and prices were buoyant. The most notable incident of the week was the sensational jump of British South African shares, which was made in response to large buying orders after some little vacillation. The settlement was easily got through; and this helped to impart a roseate hue to the general complexion of affairs. As a matter of course, money was more than abundant; and, within reasonable bounds, there need never be any difficulty in meeting the fortnightly requirements. The Gas Market meanwhile has pursued its own normal course, unaffected by feverish speculation. Business was on a fairly moderate scale as far as volume was concerned; and the general firmness was fully maintained, heightened by one or two considerable strides upwards and some other more moderate advances; while in only one instance was there a retrogression in value. Gaslight "A" was firm and steady, with a little tendency to improve towards the close, when stock changed hands more than once at 295. Very few transactions were marked in the secured issues; but they showed great strength—the 6 per cent. debenture stock in particular fetching 205. South Metropolitans were moderately active, and prices were good; while the quotations sprang up freely upon *ex div.* correction. In Commercials, business was confined to the debenture stock, the quotation of which was left unchanged, though the stock realized a better price. Not a single transaction was marked in Suburbans or Provincials; but several quotations rose considerably. Business in the Continental division was next to nothing. Unions had a smart rise; but Imperial fell back a point. The rest were not noticeable. All the Water Companies were quiet, and decidedly flat; several quotations being written down freely.

The daily quotations were: The Gas Market opened very quietly on Monday, and hardly anything was touched but Gaslight "A." Prices were firm. Continental Union improved 5; and South Metropolitan debenture, 1½. In Water, Southwark fell 2½. On Tuesday, business in Gas was inconsiderable, and nothing moved. Water was flat again—Southwark receding 2 more; and East London, 4½. There was a much better show of activity in Gas on Wednesday; but again quotations were left standing unchanged. On Thursday, the course of things tended to relapse into inactivity; but prices in general were good, except for Imperial Continental, which fell 1. In Water, West Middlesex was 2 lower. Business was extremely quiet on Friday; but both Alliance and Dublin issues rose ½. Lambeth Water fell 1½. Transactions on Saturday were on about the same level; and quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

Electrical Supply at 230 Volts—The 8-Candle Power Incandescent Lamp—The Electrician's Trouble.

A SOMEWHAT remarkable article, with the title "Electrical Supply at 230 Volts," recently occupied the leading position in the columns of the *Engineer;* and one might, at the first sight of such an essay in such a place, naturally wonder at the circumstance. Like the celebrated analogy of the appearance of straws in amber, it is not so much the richness or beauty of the object that arouses interest in the phenomenon, but wonder as to how it got there. Are there not electrical periodicals enow, that our old engineering contemporary should give up its ample space to the discussion of questions of detail in regard to the distribution of electricity? What is the point, at any rate, that this particular article aims at elucidating? Some study of the composition in question is necessary to the obtaining of an answer to this query, inasmuch as it is written in the "journalese" dialect favoured by certain popular newspapers. It begins by talking about driving a coach-and-four through an Act of Parliament, and concludes with a dissertation on the advantages of 8-candle power incandescent electric lamps. Upon examination, the whole thing appears to have been suggested by some experience in electric supply gathered at Bradford, where the pressure in the mains is maintained at 115 volts; and the conclusion sought to be enforced is that to change from 115 volts to 230 volts would be a "grand step.' It seems to be the writer's idea that this is to be the fashionable electric pressure of the future, because it will enable existing mains to do so much more duty, without apparently sacrificing the principle of low pressure with its supposed concomitant safety. Only this prospect brings up the question of the lamp—especially the 8-candle lamp; and hereby hangs an interesting development of the commercial aspect of electric supply.

Fairly serviceable incandescent lamps can, it is stated, be had for a 230 volt supply, but not of so low a power as 8 candles

This consideration starts our contemporary upon certain most instructive reflections as to the uses of lamps in private dwellings. We are told that economies that were never dreamt of when paraffin lamps or gas were used are regularly and readily practised by consumers of electric light; and that "not the least of these economies is the use of 8-candle power lamps, especially for passages, staircases, bed-rooms, and lamps for occasional use." It may be easily believed that users of electric lamps need to practise all the economies they can think of, if their bills for light are to be kept down to within three or four times the cost of equivalent gas or petroleum lighting. It is possible that the 8-candle lamp may be useful in this regard. But, if we remember rightly, this pattern of lamp was introduced deliberately by certain electric supply engineers in charge of West-end central stations with a view to delude consumers into the belief that they were equivalent in lighting power to an average gas-burner or oil-lamp. They were not demanded by the consumers in the first instance, but formed part of an artfully concocted scheme for reducing the scale of interior house illumination. It was argued that if the consumer had a bright light here and there in his house, while the rest were of low illuminating power, he would have the impression that these others were dull. It would never do to fit up an ordinary dwelling-house with (nominally) 16-candle power incandescent lamps throughout, because then the first quarter's bill would cause the loss of the connection. So the less terrible 8-candle lamp was recommended; and most, if not all, of the London electric lighting companies reckon their numbers of lamps connected by this standard. For shops and business purposes, however, the 8-candle lamp has never been a success, either in London or anywhere else.

The conclusion of the whole matter is that the cost of electric lighting to the consumer is still, and will probably continue to be, the greatest bugbear for electric supply engineers. This is really the burden of the *Engineer* article, which thus only ventilates with reference to a particular case those considerations which are more often present to the minds of followers of the electric lighting interest than any of those mathematical or physical problems that usually fill the columns of the electrical journals. It does little good to the cause to continually harp upon this trouble; and therefore the prudent electrician habitually acts upon Gambetta's counsel in regard to the question of the lost provinces of France—speaking of the subject never, but thinking of it always. He knows full well that electric supply, as distributed from a central station, is an expensive luxury, and accordingly he does everything that lies in his power to help the user to economize in its use. He would rather supply current to an 8-candle lamp than to a 16-candle lamp in an ordinary dwelling-house, as the writer of the *Engineer* article frankly confesses. His remark is that, "Many a manager of a London supply company would sooner connect one hundred 8-candle lamps spread over three houses than the same number of 16-candle lamps in one house." No doubt. "The big house will be shut up for half the year, and the bulk of the lights will only be used when guests are being entertained. The small houses, on the other hand, will use a steady number of lamps nearly all the year round, and will not haggle for rebates. These are the consumers to encourage; and the economical lighting of small houses is made possible by the use of 8-candle power lamps." It is further confessed that to "afflict" such customers with 16-candle power lamps throughout "would be either to raise the cost very considerably, or to push their already economical habits to very irksomeness." Just so. It is only by persuading the householder to put up with a very much lower standard of lighting than he could indulge in by the aid of ordinary gas or oil lamps, and, besides this, to practise a degree of economy with respect to the lighting and extinguishing of his lamps which renders his life almost a burden to him, that he can be persuaded to "do with" electric lighting at all. Even then, his attitude with regard to the advantages of the system at current prices is in such an unstable state of equilibrium, that the sight of an incandescent gas-burner in the hall of the next-door house is frequently enough to upset him. For it must be remembered that what the electrician calls an 8-candle lamp is usually so only in the sense of a useful convention. It may have been able to give a light equal to that of 8 candles when at its best; but its best never lasts long. The 8-candle lamp is a concession to the exigencies of the electric supply business, rather than a true friend of the consumer. It is a frail creature if put up to do its duty fairly; and, if made durable, it is far more voracious of current than liberal in its returns.

The Chairman of the Wakefield Gas Company.—The shareholders of the Wakefield Gas Company have passed a resolution, requesting the Chairman (Mr. W. Statter) to allow his portrait to be painted for the Board-room, and setting aside £200 for the purpose. Mr. Statter has presided over the Company for upwards of fifty years.

The Action of Water on Coal.—Experiments made by M. Georges Arth on the action of water on coal have shown that powdered coal of various kinds, containing from 1·6 to 8·3 per cent. of oxygen, when subjected to the prolonged action of air and of stagnant and running water, is not appreciably affected with regard to composition, yield of coke, or calorific power.

GAS ACTS FOR 1895.

The following are the particulars of the Private Acts relating to gas supply in the United Kingdom which became law during the last parliamentary session. One Bill—that of the Rotherham Corporation—which contained gas clauses, was held over on account of the dissolution, and has not yet been disposed of by the new Parliament.

The Hayward's Heath Gas Act incorporates a limited Company formed in 1865, having at the date of incorporation a share capital of £6500, of which £6000 was fully paid up, and the Company had borrowed on debentures £2400 and £400 on a promissory note. The limits of supply are defined, and a portion of the parish of Cuckfield is included, subject to the proviso that, unless and until the Company shall have purchased and acquired the undertaking of the Cuckfield Gas Company, Limited, they shall not, without the consent in writing of the Urban District Council of Cuckfield and the Cuckfield Gas Company, supply gas or exercise any of the powers of the Act within the said urban district, except that portion wherein their mains are already laid. Provided, also, that if the Urban District Council aforesaid shall at any time before the transfer in question themselves undertake to supply gas throughout all or any part of their district, the Company shall not be deemed to be a company authorized by statute to supply gas within the district, within the meaning of the Public Health Act, 1875. The capital of the Company is £30,000, instead of £50,000 as asked for in the Bill; whereof £6000 is called the original capital, and the balance is to be new 7 per cent. ordinary or 6 per cent. preference capital. Borrowing powers are granted to the extent of one-fourth of the paid-up capital, not to be converted into share capital. The standard price to be charged for 15-candle gas is 5s. per 1000 cubic feet, with power to allow discounts not exceeding 10 per cent. The sliding-scale is corrected so as to equalize the benefits derivable by the holders of original and new capital, by allowing a range of 5s. and 3s. 6d. per cent. for a penny in the two classes respectively. The period of error for defective meters is limited to the current quarter, unless the contrary is proved to the satisfaction of the inspector. The Company may make contracts with public authorities and others for the supply of gas in bulk, for periods not exceeding seven years. The clause of the Bill proposing to relieve Directors of disqualification by reason of their holding other office under the Company or becoming interested in a contract with the Company, is modified into an enactment that no person shall be so disqualified by reason of his or any partner of his being or becoming interested in a contract with the Company, either in his own behalf or as a member of any other company, corporation, local authority, or partnership; but no such person shall, as a Director, vote in respect of any question as to such contract. The Company are to pay 5 per cent. interest on deposits; but are not authorized to demand payment in advance. They may erect workmen's cottages on their own land. Certain lands are to be compulsorily acquired within three years. The Newmarket Gas Company's Act incorporates the Victoria Newmarket Gaslight and Coke Company, constituted by deed of settlement in 1840, and registered as a limited company in 1865. The present capital consists of £30,000 of ordinary stock fully paid up; and there is no mortgage debt. Dividends at the rate of 10 per cent. per annum and upwards have for many years been paid upon the ordinary capital. The limits of the statutory Company are such part of the counties of Cambridge and Suffolk as lies within a radius of 5 miles from the Newmarket Town Hall. The new Company is renamed the Newmarket Gas Company, with capital arrangements as follows: From and after Sept. 18, £30,000 of ordinary stock of the limited company is to be converted into £60,000 ordinary stock fully paid up, with a dividend at the standard rate of 5 per cent. per annum. The capital of the Company is to consist of £75,000; whereof £15,000 is to be additional 5 per cent. capital, capable of being converted into stock when fully paid up. The Bill proposed an additional £20,000 of 7 per cent. capital. Borrowing powers to the extent of £15,000 are granted in respect of the original capital only. The Auditors need not be shareholders. An interim dividend may be declared without calling a meeting of shareholders. Contracts for the supply of gas for public purposes are not to be for more than ten years. The initial price of the Company's 15-candle gas is 4s. 8d. per 1000 cubic feet, with the sliding-scale at 2s. 6d. for a penny. This was the figure proposed by the Bill. Interest on consumers' deposits at the rate of 4 per cent. is to be allowed. Consumers desiring to discontinue, are to give 24 hours' written notice; and on neglect are to be liable to pay for all gas registered by the meter "up to and until the expiry of 24 hours from and after the discovery of the Company of the omission to give such notice." The Company are empowered to apply for an Electric Lighting Order or Licence, employing their ordinary capital in respect thereof. The North Middlesex Gas Company's Act incorporates a limited Company formed in 1862, which obtained Provisional Orders in 1871 and 1876, having a present capital of £45,000 fully paid, and £11,250 borrowed on debentures. The limits of supply are defined; the whole being situate in the parishes of Finchley and Hendon,

Middlesex. The capital of the Company is £80,000; whereof £45,000 is the old capital. Only £15,000 of this is 10 per cent. capital, all the remainder, including the new capital, bearing a 7 per cent. dividend. The usual proportion of borrowed capital is sanctioned, not to be converted into shares or stock. There is to be one Auditor of the Company; and he need not be a shareholder. Additional land is to be acquired, subject to the provision that works for the manufacture and storage of gas shall not be erected within 100 feet of the main road leading from Hendon to the Mill Hill Railway Station. The initial price of gas (15-candle power) is 4s. 3d. per 1000 cubic feet, with a corrected sliding-scale. The Bill proposed 4s. 9d. per 1000 cubic feet. The period of error in defective meters is limited. Workmen's cottages may be erected; and contracts for the supply of gas in bulk or for public purposes are limited to seven years. Interest on consumers' deposits is payable at the rate of 5 per cent. The Company are to make and keep up to date a map of their mains, on a scale not less than 25 inches to the mile, and allow the same to be inspected by the officers of the Finchley and Hendon Urban District Councils.

The above three Acts are the only statutes incorporating gas companies that came before Parliament for the year; and they are also the only Acts that embody the sliding-scale. In view of the importance attaching to this system of regulating gas prices and dividends, we desire to make a special reference to the terms in which the sliding-scale has been enacted in these three instances—particularly as they differ in some respects from earlier drafts. The Hayward's Heath and North Middlesex clauses are almost identically worded. They recite, in the first place, that "In respect of any year during *any part* of which the price charged by the Company shall have been one penny *or part of a penny* above the standard price, the dividend payable by the Company shall, in respect of each penny *or part of a penny* by which the standard price shall have been increased, be reduced below the standard rate of dividend by five shillings on every one hundred pounds of ordinary paid-up original capital, and so in proportion for any fraction of one hundred pounds, and by three shillings and sixpence on every one hundred pounds of ordinary paid-up additional capital, and so in proportion for any fraction of one hundred pounds." Then, for the reverse process it is enacted that "in respect of any year during *the whole of* which the price charged by the Company shall have been one penny or more below the standard price, the dividend payable by the Company may, in respect of each penny by which the standard price shall have been reduced, be increased" in the same proportion. In the Newmarket Act, the words printed here in italics are omitted. The object of the Legislature in the other instances obviously was to remove the uncertainty that has been felt by some Boards of Directors as to the period over which an increase or reduction of price must extend to authorize an alteration of dividend.

The British Gaslight Company, Limited (Staffordshire Potteries), Act empowers the Company to expend for the purposes of this particular undertaking a further capital sum of £75,000, whereof £45,000 only is to be capital stock of the Company, to bear a 5 per cent. dividend, and the remainder is to be borrowed money at 4 per cent. The first £15,000 to be spent must be borrowed, and all loans contracted under the Act must be raised on the best terms obtainable at the time of borrowing. Power is given to the Corporation of Hanley to appoint an Auditor, who is to be authorized to examine the accounts of the Company in relation to the undertaking annually at any time within two months after such accounts shall have been made up for the year then last past—all reasonable facilities thereto being afforded by the Company. It is provided, however, that the signature of the Auditor to the published accounts shall not be necessary; and he shall not be entitled to interfere in any way with the management of the undertaking. The remuneration of the Auditor is to be fixed by the Corporation; and the Company are to contribute an annual sum of not more than twenty-five guineas to this payment. A section of a former Act, which provides that any person appointed by a lighting authority under the section to test the illuminating power and purity of the gas supplied by the Company shall not be a member or officer or servant of the lighting authority is repealed. It was proposed in the Bill to spend £80,000 of capital on the undertaking, bearing 5 per cent. dividend. The Scarborough Gas Act empowers the Company to consolidate their different classes of ordinary stocks and shares into a uniform 5 per cent. stock, at any time after three years from the passing of the Act, and with the sanction of three-fourths of the votes of the holders present in person or by proxy at a general meeting specially convened for the purpose. New capital to the amount of £60,000 is to be issued, bearing a 5 per cent. dividend, to carry borrowing powers in the proportion of one-third of the fully-paid stock. The Bill asked for £79,000, with the usual borrowing powers. It is directed that the provisions as to auction and tenders for new stock issues shall apply also to debenture stock and mortgages. Additional lands are to be acquired compulsorily, for storing and purifying gas, under certain restrictions. The Company may supply gas in bulk; but not for consumption in the district of another statutory gas company without the consent of the latter. In addition to their existing testing-station, the Company are to provide a second testing-place at their office in Westborough. If tested at the former, the illuminating power of the gas is to be 16 candles; and if at the latter, 15½ candles. The gas supplied by the Company shall be deemed to be of less purity than it ought to be within the meaning of section 36 of the Gas-Works Clauses Act, 1871, if on three consecutive days it is found to contain, upon the average, more than 4 grains of ammonia or more than 25 grains of sulphur "in any one hundred cubic feet." No forfeiture is to be incurred if the default can be proved to be due to unavoidable cause or accident. In the event of the gas examiner finding any defect of illuminating power or purity in the gas, he is to forthwith give notice thereof to the Company at their office. The maximum price of gas is fixed at 3s. 6d. per 1000 cubic feet inside, and 4s. 6d. per 1000 cubic feet outside, the borough. The charge for the public lamp supply within the borough is to be 20 per cent. less than the price to private consumers, whenever the quantity furnished to such lamps is more than 10 million, but less than 15 million cubic feet, and 25 per cent. less when the supply exceeds the latter quantity. The Company may allow discounts not exceeding 10 per cent. to private consumers, in consideration of prompt payment or large consumption. At least one of the Auditors of the accounts of the Company must be a member of the Institute of Chartered Accountants or of the Incorporated Society of Accountants; and it is not necessary for an Auditor to be a shareholder. The period of error in defective meters is limited. Discontinuing consumers, in neglect of giving written notice, are liable to pay for gas registered by the meter up to the next ensuing indexing. Notice of this provision is to be endorsed on every demand note for gas-rental. Any notice required to be served by the Company is to be sufficiently authenticated by the name of the Secretary; or if it is a notice to pay a charge for rental, by the name of the Secretary or collector being affixed thereto in print or in writing (including lithograph), or by a stamp. The Company must not, under the powers of the Act, raise more than £6000 before Dec. 17 next; and if by this date the Corporation have deposited a Bill for the acquisition of the undertaking, the Company are not, without the reasonable approval of the Corporation, to raise any further sum of money until such Bill shall have been withdrawn or rejected by Parliament. If such a Bill becomes law, the price to be determined for the undertaking by arbitration as on a compulsory sale is to have regard to the following bases: In respect to stock or shares issued before the passing of this Act, the Corporation shall pay the full value determined as aforesaid. In respect of stock or shares issued after the passing of the Act, the Corporation shall pay the price at which they were issued, without allowance for compulsory sale. The Company are not to oppose the Corporation Bill except as to details. The second provision is to hold good for three years; but the Company are not to regard the Corporation as having any right to obtain compulsory purchase powers after the expiration of three years from the passing of the present Act.

The Carburetted Water-Gas Plant at Blackburn.—Pending a full report on the Merrifield-Westcott-Pearson water-gas plant at Blackburn, we are informed it was started on the 1st ult., or one month before the time called for in the agreement made with the Blackburn Corporation, and that it has been running satisfactorily since that date. It is said to demonstrate the assertions of the patentees as to the qualities of this type of plant, as it is running considerably under their guarantee with the Corporation, and, we learn, giving remarkable fuel results.

South-West of England District Association of Gas Managers.—The autumn gathering of this Association is to be held at Barry, near Cardiff, on Tuesday next. The meeting will be opened at the unusually late hour of three o'clock, so as to enable most of the members, if they wish, to leave home the same morning. But there is so much to see at Barry that all who can do so are advised to arrive there on Monday evening. In addition to the usual business, Mr. Lowe will propose an important step, having reference to the suggested amalgamation of the Southern and South-West Associations. Mr. S. W. Durkin, of Southampton, will submit a paper on a question that has acquired considerable importance of late years—viz., "The Want of Mutuality between the Various Authorities using the Subsoil of the Public Roads." After the meeting, there will be a visit to the docks, where extensive operations are now in progress. This will be followed by a dinner at the Barry Hotel; and here it is well to remind intending visitors that there is also a *Barry Dock* Hotel, and that the two are sometimes confused. An excursion for the Wednesday morning is also in contemplation. It will probably include a visit to the water-works pumping station (three miles out), and other places of interest. Barry is eight miles from Cardiff; and there is a frequent train service. At the spring meeting, it was decided that the autumn meeting should be held at Torquay. But the local member, Mr. Beynon (who was not present), represented to the Committee that important extensions are in hand, and he expressed a wish that the visit of the Association should stand over till they are complete. Under these circumstances, the Committee accepted the suggestion of Mr. F. M. Harris, the Manager of the Barry and Cadoxton Gas and Water Works, that the members should meet at Barry, especially as it was accompanied by cordial promises of support. Mr. Harris has been most energetic in arranging for the visit and excursions, and it is hoped that a good number of members will take part in this, the first, visit of the Association to South Wales.

NOTES.

The Spraying of Water and Air.

The attention of gas engineers and others requiring for industrial purposes a finely-divided water-spray may be directed to the seemingly paradoxical appliance described by Mr. Arthur Kitson to the Franklin Institute, under the name of the "ball nozzle." It is an appliance that has been introduced as a fire-hose fitting, and is of extremely simple construction; consisting merely of a bell-mouth nozzle and a ball. The nozzle is connected to a water or air supply, and the ball is placed loosely in its mouth; being kept from falling off by a cross-bar, which does not touch it. The peculiarity of the action of the appliance is that when a stream of air or water is turned on through the nozzle, the ball steadfastly adheres to it, and refuses to fall away, no matter in what position the nozzle is held. Variations of pressure between a few ounces and hundreds of pounds to the square inch fail to change the nature of the seeming paradox. In the case of water, the effect of the ball is to divide the jet into a thin, fan-shaped spray, spreading in a circle round the orifice. It is in this respect that the utility of the device appears, since there are many purposes for which an equable sprinkling of water is desirable. With a pressure of 80 lbs. to the square inch and a ball surmounting a $\frac{3}{16}$-inch hole, it is in this manner possible to distribute a water supply evenly over a circular area 60 feet in diameter. For ventilation also its use would be indicated. The action of the ball in remaining in close contiguity to the nozzle, notwithstanding the force of the water or air that appears to be driving it away, is referable to the atmospheric pressure upon the opposite side; the equal and similar pressure upon the side towards the nozzle being temporarily overcome by the momentum of the issuing water or air.

Saint's Water-Spraying Device.

Another water-spraying device which might perhaps be found useful for the washing of gas and other industrial purposes is the arrangement recently described by Mr. William Saint, one of Her Majesty's Inspectors of Mines, at a meeting of the Manchester Geological Society. This appliance is used for damping coal dust in mines, with a view to the prevention of explosions. It consists essentially of a sprayer, filter, and back-pressure valve combined in a metal fitting about 4 inches long, screwed for attachment to a ½-inch water-supply pipe. The body of the fitting contains sponge for removing any mechanical impurities that may be contained in the water, and might interfere with the proper action of the spraying attachment. This consists of a diaphragm fixed at a short distance below the orifice of the fitting, pierced with one or more diagonal holes, not central with the orifice itself; there being thus a small chamber between the plate and the orifice, into which water enters and whirls itself into a spiral discharge. The effect is described as the formation from the outlet of the fitting of a cyclonic and uniform mist-like spray. This mist issues with a noise and appearance similar to that of steam escaping from the safety-valve of a boiler; and it is so finely divided as to be readily carried along by even a slowly-moving current of air. The back-pressure valve is a simple affair, found necessary to prevent syphoning when several sprays are connected with the same supply. Mr. Saint referred to the performance of one of these sprays supplied with water under a pressure of 330 lbs. per square inch, when it discharged 5 gallons per hour; and the influence of the moisture was felt for 80 yards in a mine gallery. The inventor claims that this appliance will work at any pressure of water above 50 lbs. per square inch, and that by changing the plates the discharge can be varied from ½ gallon per hour upwards.

The Waterproofing of Bricks and Stone.

At a recent meeting of the Australasian Association for the Advancement of Science, Professor Liversedge read a communication relating his experience in the matter of waterproofing brickwork and sandstone with oils, which is summarized in the *Engineering and Mining Journal*. The experiments in question were directed mainly to ascertain the length of time that the waterproofing or protecting of brick and porous stonework with oil remains effective. The oils employed in the experiments were the three cheapest and commonest that could be most readily procured for the purpose, such as raw and boiled linseed and the crude mineral oil, known as "blue oil," used for protecting timber. The exposures were made upon the flat roof of a laboratory building, fairly open to the sun and weather. Good, sound machine-made bricks were chosen for testing. It was found that the sandstone (a local product) was much less absorptive of oil or water than the bricks. Raw and boiled oil appeared to be absorbed in equal proportions; but the mineral oil was taken up much more freely. By the end of twelve months, however, the whole of the blue oil had evaporated; the bricks returning to their original weight. The bricks treated with raw and boiled linseed oil remained unchanged. After a second oiling, in November, 1890, and exposure for a further period of nearly four years and two months, these bricks still retained all their oil, inasmuch as they had not lost weight, and were nearly impervious to water. The sandstone appeared to lose its oil—the specimen cubes returning to their original weight; but the good effects of the oiling were not lost, as the stone continued to be practically waterproof.

The Reason for the Non-Visibility of the Ultra-Red Rays.

It is sometimes asked why the human eye cannot perceive the rays below the extreme red end of the spectrum; and speculations are occasionally published as to the extent to which the visual perceptions of animals or insects may exceed ours in this respect. The explanation is that infra-red light is invisible to us either because the humours composing the eye are opaque to it, or else because the light is incapable of exciting the retina if it reaches it. All observers have found that, as a matter of fact, these rays are strongly absorbed in passing into the eye; and Helmholtz considered this absorption sufficient to account for their invisibility. Herr Aschkinass has demonstrated, in a paper published in *Wiedemann's Annalen*, that, though the eye does absorb a proportion of rays, there is no sudden increase of absorption for those lying beyond the red end of the spectrum, and that the absorptive powers of the various media of the eye are practically the same as that of water. The apparatus used in this investigation contained a fluor-spar prism and a bolometer. Thin layers of the humours of the human eye and that of the ox were placed in the path of the rays from a zircon burner; and the absorptive effects were measured by means of the bolometer. It was found that, throughout the limit of the visible spectrum, the absorption was at the rate of 5 per cent. for the whole human eye. This speedily increased beyond the limits of visibility, with a curious break in the gradual rise of the process at one particular point, until it attained 100 per cent. of the total absorption at 1·4 μ. This determination shows that, before total absorption occurs, a large proportion of infra-red light does actually reach the retina through the substance of the eyes, but is not capable of exciting the nerves, and so producing visual sensation.

The Use of Coal Gas in Gun Manufacture.

A remarkable application of coal gas is mentioned by Mr. Hiram S. Maxim in a description of a method of gun manufacture supplied by this prolific inventor to the *Engineer*. It occurs in connection with a proposal made by Mr. Maxim for turning out solid steel guns, as an improvement upon the usual built-up ordnance. He states that at Erith he has lately made a number of 45-pounder guns from the solid—has, in short, succeeded in doing with steel what was formerly accomplished with cast iron. In this process, steel capable of receiving a spring temper is first rough bored, and afterwards turned approximately to shape. The forging is then annealed. It is next turned nearly to the right size outside, smooth bored, and rifled. It is again mounted in the furnace in a vertical position; and while rotating in the furnace, a stream of coal gas is passed up through the bore. The coal gas of course expels the air, and at the same time a portion of its carbon is set free by the high temperature, and combines with the steel of the inside of the gun; thus raising the quality of the metal, and hardening it. While the gun is red hot, the gas is shut off, and a stream of cold oil under high pressure is forced through the bore while the gun still revolves in the furnace. The result is that the inside is very quickly cooled without decomposing more than half a pint of the oil; and the distribution of the stresses in the metal is exactly the same as if the gun were built up in coils, with the inside in compression and the outside in tension. One of the guns made in this way actually became smaller in the bore after firing a heavy charge. Mr. Maxim declares them to be the best guns that have ever been made, besides taking only half the weight of steel, half the time, and half the cost of making.

Dock Pumping with Gas-Engines.—Great interest is being shown in the new system of pumping by gas-engines carried out at the graving-dock of the River Wear Commissioners, at Sunderland, to which reference has been already made in the JOURNAL. At No. 1 dock, the installation consists of two 40 nominal horse power Tangyes' gas-engines, each connected direct to a 21-inch centrifugal pump, also of Tangyes' manufacture; one 8 nominal horse power gas-engine, working in conjunction therewith an 8-inch Tangyes' centrifugal leakage pump, and through a friction clutch an air-exhausting pump for charging the two main pumps with water at starting. The 40-horse power gas-engines have the beds cast with large flanged facings, so that the centrifugal pumps can be bolted to them; thus removing any fear of the engines and pumps getting out of line with each other. The pumps are each capable of discharging upwards of 2600 tons of water per hour, and of emptying the dock in less than two hours at the highest spring tides. When the pumps are doing their maximum duty, the gas-engines will each be capable of indicating more than 120-horse power. To ensure that the engines will start without fail, and unaided by manual labour, they are fitted with Tangyes' latest pressure-starter (Pinkney's patents). The 3-horse power engine has a small pump attached to its bed; and it can be thrown into and out of action at the will of the attendant. It is employed to pump a charge of gas and air into a mild steel receiver to a moderate pressure. This receiver is connected to the two 40-horse power gas-engines by means of piping and starting-valves, so arranged that the pressure in the receiver shall put the engines into motion a little distance before the charge is ignited, with the result that there is no fear of their failing to start. The engines are driven by town gas; and, as evidence of their economy, it may be mentioned that the dock was recently emptied within 1¼ hours, at a cost of less than 6s. 9d.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting at Buxton.

The One Hundred and Third Quarterly Meeting of this Institution was held on Saturday last at Buxton. The party, which set out from the Central Station, Manchester, arrived at Buxton at about 11 o'clock; and they were then conveyed in coaches to the gas-works, of which an inspection was made under the guidance of Mr. George Smedley, of Buxton, the President, who explained the various features of the works, in which the members were greatly interested.

Before leaving the gas-works, the party were joined by Mr. E. C. Milligan, the Chairman of the Gas Committee, who extended a very hearty welcome to the visitors on behalf of the Committee. He said he should like to have been with them earlier, and heard their expressions of opinion upon the various parts of the undertaking, in which he had taken a good deal of interest; but he had been prevented. The gas production in Buxton had once been—when his father was Chairman of the old Gas Company before the transfer—only a very small affair; but now the concern was in a very satisfactory condition. The financial position was, however, now a very good one. They had in Buxton good gas; the independent analyst who reported on the matter said the average quality was about 20 candles, and the cost to the public was 2s. 6d. per 1000 cubic feet net. He (Mr. Milligan) thought this was very satisfactory for a small place like Buxton, especially as they paid a high price for coal. The profit obtained on the gas undertaking was about £1000 a year, which helped to reduce the rates to the extent of about 4½d. or 5d. in the pound. He supposed Mr. Smedley had been indebted to members of such societies as theirs for a good many hints in the course of his work. One of the most beneficial effects of the meetings of such Associations certainly was that any member who was deficient in some particular respect could receive assistance from others; and he thought the public generally owed many thanks to the members of their own and similar societies for the various improvements that had been made in gas production, which had helped to reduce the price at which it could be supplied. He again welcomed the members heartily to Buxton, and hoped their short stay there would benefit them. He also wished success to the Association with which they were connected.

Mr. John Chew, in moving a vote of thanks to Mr. Milligan, Mr. Smedley, and their Secretary (Mr. S. S. Mellor) for the arrangements made for the reception of the members, said he had known their President for the past twenty-five years; and when he heard some of the figures the Chairman had given them, and thought of the condition of the Buxton gas supply ten years ago, he was amazed at the progress made. They had reduced their capital from £60,000 to about £45,000, and were now producing gas to supply at 2s. 6d. per 1000 feet; and when they compared this with the cost of gas in some large cities, and also noticed the quality of the coal used, they could not but think the Buxton undertaking a success, and that Mr. Smedley had done credit both to himself and to the works with which he was connected. In regard to the object of the Association, it was certainly their aim to help each other over the stepping-stones. He must again say that the success of the Buxton Gas-Works reflected the greatest credit on the Gas Committee, the Chairman, and Mr. Smedley, the President of the Institution. He had much pleasure in proposing the vote of thanks to them.

Mr. Isaac Carr seconded the proposal. He said his only regret was that the attendance of members was not larger; but it was then just in the middle of the holiday season. He had been greatly struck with the appearance of the gas-works, which were excellently equipped and well arranged; and he was pleased to have had an opportunity of inspecting them. That the arrangements were acting satisfactorily was proved by the low selling price of 2s. 6d. per 1000 cubic feet, out of which, he understood, a good profit was being made.

The vote of thanks having been carried, with acclamation,

Mr. Milligan, in responding, paid a tribute to the work done by Mr. Smedley, who had brought the undertaking into such a satisfactory condition. He was pleased to know they considered that Buxton had such nice little gas-works.

After further inspection of the works, the party were conveyed to the Royal Hotel, where luncheon was served. After lunch, the members held the business meeting—Mr. George Smedley, the President, occupying the chair.

The Hon. Secretary (Mr. S. S. Mellor, of Northwich) read the minutes of the previous quarterly meeting, which were confirmed.

Mr. W. Dickenson, of Hindley, near Wigan, was elected a member of the Institution.

Mr. R. G. Shadbolt, of Low Moor, read a paper on

SOME EXPERIENCES IN GAS PURIFICATION.

In these times of strict economy and searching analysis, any method, simple or complex, which will enable the manufacturer to reduce the prime cost of his wares, be they in the gaseous, liquid, or solid form, is as a rule readily welcomed. Needless to say this is a rule which predominates the commercial world, and one to which we, as a body of manufacturers, are certainly no exception.

There are many things to engage the attention of greater magnitude and apparent importance, than the reduction of the labour cost of gas purification by a fraction of a penny per 1000 cubic feet; but it does not logically follow that it should be neglected on that account. The ordinary duties of a gas manager may be said to consist of a host of small things, few of which have a greater fascination for him than the purification of gas in closed vessels; and although one may not claim to have achieved this in its entirety, still a step in the right direction, however small, is sure to be of interest and benefit to those concerned. Therefore, at the invitation of our Committee, the writer purposes recounting some experiences in gas purification, more particularly respecting the use of air and steam as aids to the work.

It will be some eight years or so ago since we commenced experimenting at Fleetwood (being then with my father) in the use of air in gas purification. The purifiers were three in number, and getting rather small for their work. Two were used in the ordinary way—being changed alternately; and the remaining one was used as a check or catch box. Being unprotected from the weather, the work of emptying and recharging was not always of the most pleasant character; nor were the circumstances such as would conduce to the best working results. It was therefore with a view to reducing the one, and increasing the other, that attention was turned in this direction.

Operations were commenced by introducing atmospheric air into the gas at the foul main—immediately before the condensers; drawing it in in the orthodox fashion, by setting the exhauster governor to give a slight pull. At first, all seemed to go well; for, contrary to expectations, not only were the purifiers beneficially affected, but an actual and appreciable increase took place in the illuminating power of the gas. But, alas! this state of affairs was very short-lived; for, when once the coating of naphthalene, &c., on the inner side of the pipes and connections of the different apparatus had disappeared, and all become practically clean, our troubles began.

Naturally enough, an attempt was made to determine the requisite proportion of air to revivify the oxide of iron (this being the principal purifying material) without removal, and whilst in action. But there was no escaping the fact that the cost of enrichment required to counteract the ill effects of the resultant nitrogen upon the illuminating power of the gas, would be far in excess of the saving effected in purifying labour.

The next step was to ascertain if possible, what proportion of air the gas actually would take without increasing the cost for enrichment—thereby securing the greatest advantage possible from the partial, instead of complete, revivification of the oxide whilst in action. But very soon another drawback presented itself. Drawing in air by means of the exhauster appears quite feasible in theory; but, when put into practice, it is another thing entirely. It had become quite evident by this time that 1 per cent. of air was all the "watering" the gas would stand; but though this proportion was very carefully measured and checked, sudden and perplexing variations in the illuminating power of the gas were noticeable—these variations generally being on the "down grade." A little investigation clearly showed this to be attributable to the vagaries of the exhauster governor, which, although every care was taken to measure the air introduced at one particular point, often brought about the wholesale introduction of air at other places—to say nothing of furnace gases drawn in from the settings through cracks in the retorts. Then, again, the exhauster was of the steam-jet type; and by setting the governor to give a pull, an increased quantity of steam was required—reducing the strength of the ammoniacal liquor, which was sufficiently weak already.

Suffice it to say, this method of introducing air was abandoned; but after a short respite another was determined upon. This time the governor was set to give a level gauge, and the air introduced at the exhauster inlet—the point of least resistance—by means of a power meter. In this case, much more success was attained than in the other. The strength of the ammoniacal liquor was not unduly affected. A much more regular illuminating power was maintained, and the life of the purifier charges considerably extended. But, although a regular method of working was soon attained, it was not for very long; for, after changing the boxes once, we were again compelled to discontinue the use of air, owing to the caking of the oxide, with all its attendant disadvantages.

Some three-and-a-half years ago the scene of action was changed from Fleetwood to Low Moor; and it may not be considered out of place to briefly describe some of the apparatus found there. Considerable alterations and extensions had been carried out—including, amongst other things, four new purifiers each 20 feet square by 5 feet deep; and two catch or check boxes each 17 ft. 6 in. by 11 feet by 5 feet deep. The latter were constructed from four old purifiers replaced. The condensing and scrubbing plant was totally inadequate to meet the maximum requirements; and almost the first work to be carried out was the erection of new condensers, and the doubling of the capacity of the scrubbers. Prior to this, traces

of tar and plenty of ammonia found their way into the purifiers, which were then worked as follows: The four large purifiers were charged entirely with oxide of iron—three being in action at once, and one off for cleaning purposes; and the two check boxes, with lime only. Owing to the extension of the condensing and scrubbing plant, ere the winter season came on, neither tar nor ammonia could reach the purifiers. The oxide in use at that time being about spent, it became necessary to dispose of and replace it; and the selection of new oxide was rather unfortunate. Not only did it prove to be an oxide that fouled quickly; but, having been purchased rather late in the year, it contained an extraordinary proportion of water. Its unsuitable condition, along with the practically entire absence of ammonia from the gas, made the complete removal of the sulphuretted hydrogen almost an impossibility. In fact, had it not been for the judicious use of a little lime in each of the four larger boxes, it would have been quite so. As there was no way of escape, the only course lay in making the best possible use of what first came to hand. A considerable proportion of dry sawdust was thoroughly mixed with each charge after revivification, and the proportion of moisture quickly reduced. As soon as this was brought down sufficiently low, each charge—a few days prior to its return to the purifier—was well sprinkled with ammoniacal liquor of about 4° Twaddel; thereby increasing the life of each charge by from 80 to 100 per cent. Still, as the make of gas increased, it became a difficult matter to keep pace with the fouling material; and once more, atmospheric air was pressed into the service.

This time no definite proportion of air was admitted; but it was made to vary according to the illuminating power of the gas. The exhauster governor being set to give a slight pull, an open pipe was attached to the condenser inlet, varying in size from time to time as the quality of the gas would allow. This, of course, was but a temporary measure, to give relief when in a "tight corner"—sufficient nevertheless to again set one thinking.

Before proceeding further, it may be of interest to give the results of some laboratory experiments made in the early part of the present year on three different samples of oxide of iron, with a view to ascertaining what benefits were derived from the admission or addition of ammonia. The three samples used were one of Irish bog ore, and two of prepared hydrated peroxide of iron. These contained respectively 69·4 per cent. and 22·6 per cent. of free sulphur on the dry basis; the third sample being new and containing no sulphur whatever.

A sufficient sample having been taken from each of the three lots of oxide before mentioned, each sample was divided into two; one half being treated with water and the other half with dilute ammonium hydrate—sufficient in each case to bring the oxide to a proper state of moisture for use in purifying. Two test-tubes were used as purifiers—the first one a straight tube 8 inches long by 1 inch internal diameter; and the second one a U-tube 9 inches long by ½-inch internal diameter. Both tubes were filled with the oxide to be tested, and then connected to a service-pipe conducted from the main leading from the scrubbers to the purifiers. A No. 1 burner was attached to the outlet of the U-tube, which acted as a catch-box; and after the air had been driven out, the gas was there burned, giving a light about the size of a small pea. The flow of gas was continued through the test-tubes, at this rate, until it turned the lead test-paper at the outlet of the U-tube. The gas was then turned off; the oxide removed from the test-tubes—that in the U-tube being thrown away; revivified thoroughly; and then analyzed for free sulphur on the dry basis.

Each sample—three treated with water and three with dilute ammonium hydrate—was treated exactly in this manner; and the results obtained were as shown in the accompanying statement, Table A. These figures will, in the writer's opinion, account for many apparent inconsistencies between parcels of oxide obtained from the same source.

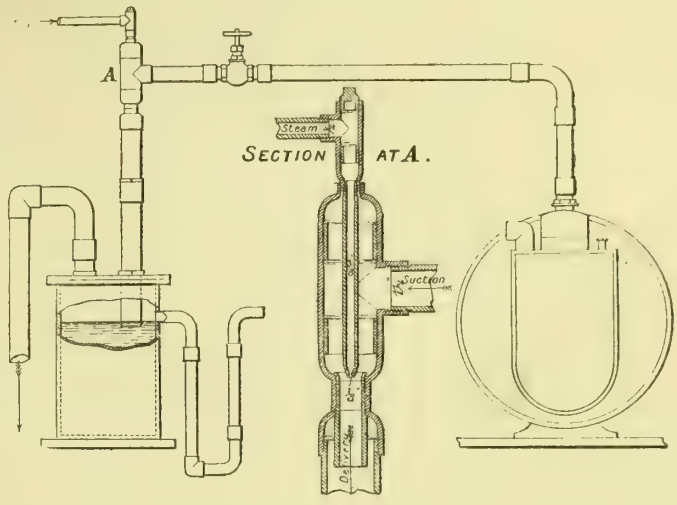
TABLE A.

Description of Oxide of Iron Used in Experiments.	Free Sulphur Contained before Testing.	Free Sulphur Contained after Testing Treated with Water.	Free Sulphur Contained after Testing Treated with Ammonium Hydrate.	Increase of Free Sulphur due to Treatment with Ammonium Hydrate.	Increased Duty due to Treatment with Ammonium Hydrate.
Irish bog ore .	69·40 p. c.	70·60 p. c.	72·00 p. c.	1·40 p. c.	116·66 p. c.
Prepared oxide	22·60 ,,	24·30 ,,	25·40 ,,	1·10 ,,	64·70 ,,
,, ,,	Nil.	6·10 ,,	10·90 ,,	4·80 ,,	78·60 ,,
					3)259·96
				Average increased duty . . .	86·65 p. c.

After pulling through the winter with the aid of ammonia and atmospheric air, and having to deal with gas practically free from ammonia, it was a matter for grave consideration as to whether atmospheric air could not be permanently and successfully utilized. After due reflection (fully bearing in mind past experiences), it was concluded that it should be done if the air could, by any simple means, be admitted into the gas at the inlet to the purifiers, where it would go straight to its work without in any way deranging, or interfering with, any other part of the plant or machinery, and would probably achieve the maximum amount of revivification with a minimum of resultant nitrogen. But, still, no means presented themselves for successfully dealing with caking oxide: and the matter was allowed to stand over for some time.

Last year it was the writer's good fortune to hear Mr. Dexter's paper read before the Incorporated Gas Institute, on the use of steam in oxide revivification, which resuscitated an idea that had been previously dismissed as likely to do more harm than good. It seemed likely that, by using live steam, instead of exhaust, much less would be required; and the pressure required could be utilized in some kind of an injector, which would, in the simplest manner possible, enable one to introduce the air against any back-pressure likely to arise, and at the point already decided upon—viz., the inlet to the purifiers.

The first step now was to devise a suitable injector. Suffice it to say, that the first attempt was almost successful; for, with but very slight alteration, the injector was made in the first instance as shown on the sketch. After testing it as to pressure and



vacuum, it was fixed in position close to the purifier centre valve, with meter, trap, &c., as shown. The first difficulty experienced was with the valve and float of the meter, which would suddenly close owing to sudden pulls of the injector caused by stray drops of water passing the nozzle of the steam jet. The valve and float of the meter were removed, and a throttle valve placed on the suction pipe of the injector; giving complete control of the whole apparatus. Owing to the air regulating valve, no more pull is put upon the meter than is actually required to work it. In fact, so easily does the meter work under this arrangement, that the water-level does not seem to be disturbed in the least. As the depth of winter drew near, and the make of gas increased, the maximum capacity of the injector, as then constructed, was arrived at; and after reaching that point, the more steam applied the more irregular it became in its action. The injector was taken out, and the length of the neck increased as shown; and no difficulty has since been experienced.

The delivery of the injector dips ¾-inch into water, as shown, giving a safety seal against 20 inches of back pressure; and any water in the mixture of steam and air is there deposited and trapped off. The stream of hot air and steam proceeds forward immediately into the gas-main, at a point about 9 feet from the centre-valve. It intermingles with the gas, and goes straight to its work.

The apparatus is visited once a day, at noon. The state of the meter is then taken, the water-line readjusted, and the quantity of air passing altered if necessary. It is perfectly under control; and any temperature between 80° and 200° Fahr. can be obtained by simply opening the steam-valve, and checking the air-valve for higher temperature, and *vice versâ* for lower temperature.

Perhaps the time when the greatest benefit accrued from the use of this apparatus was in the early part of the present year, during the severe frost, when the gas leaving the scrubbers was often much below freezing point, but entered the first purifier at a temperature between 90° and 100° Fahr., and this with the steam-valve unaltered.

The accompanying diagram [next page] will give a better idea of its effect upon the gas temperature than any wordy explanation. The temperatures there shown are at the inlets to the first and second purifiers, station meter, and of the atmosphere; and they extend over the six months ending July 31, 1895, including the coldest and warmest parts of the present year. The proportion of air admitted to the make of gas was 1½ per cent., until January this year, when it was increased to 2 per cent., after making sundry tests, as shown in Table B. As 2 per cent. of air extended the life of each purifier charge by six times, and 1½ per cent. of air only three times, and 2 per cent. caused only an infinitesimal diminution in the illuminating power of the gas, 2 per cent. of air has been admitted since January, in preference to 1½ per cent. The apparatus has been working altogether ten months—the first three months with 1½ per cent. of air and the last seven months with 2 per cent.

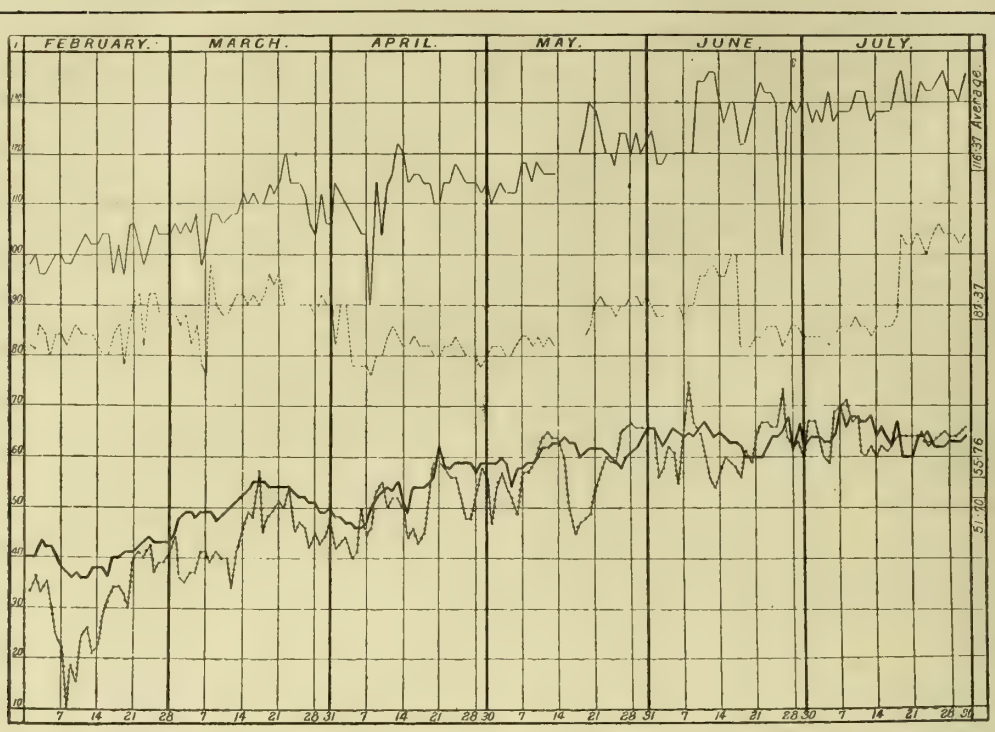


TABLE B.

Proportion of Air.	Illuminating Power of Gas without Air, in Standard Candles.	Illuminating Power of Gas with Air, in Standard Candles.	Decrease in Illuminating Power, in Standard Candles.	Decrease in Illuminating Power.
1½ p. c.	17·23	17·23	Nil.	Nil.
2 "	17·60	17·49	0·11	0·62 p. c.
2½ "	17·60	17·20	0·40	2·21 "

The temperature of the gas is perfectly under control. No extra back-pressure is given, however long the charge may run; and the removal of the material when fouled is accomplished without any extra difficulty. Neither the quantity of gas purified per charge, nor the percentage of sulphur taken up, has been here given, as it would be unfair to the oxides now in use—one half being natural oxide, containing 60 per cent. of sulphur on the wet basis, and the other a prepared oxide upon which experiments are being made respecting the best proportion of moisture at which to work it. It is hoped, however, that this will be sufficient excuse for a little reticence in this respect.

In conclusion, it may be said that the injector, as here shown, is quite capable of dealing with greater pressures than are ever likely to arise, and with a much larger quantity of air than has been requisite in the present case.

Discussion.

Mr. JOHN CHEW (Blackpool) said he should like to know what were the advantages claimed for the use of steam. Mr. Shadbolt had given some very interesting particulars as to the use of air rather than the use of steam. He (Mr. Chew) had read Mr. Dexter's paper—referred to by the author—and he thought it very interesting. With regard to enrichment, he should like to know whether it was Hawkins's enrichment process that was referred to.

Mr. SHADBOLT: Ordinary enrichment; cannel enrichment.

Mr. CHEW (resuming) said the author stated that he used from 1½ to 2½ per cent. of air. With regard to his (Mr. Chew's) experience, he had very large oxide purifiers, also lime purifiers, which were ordinarily worked against 2 inches of back-pressure; and last year he had the misfortune to have an explosion owing to the oxide becoming coated by tarry matter. The reason was that the Livesey washer trays had become ineffective. This year he resorted to the Pelouze and Audouin condenser, and had the trays renewed, and new grids and sieves put in; and he now experienced no difficulty. He might say that he ordinarily used about 1½ per cent. of air, which was, in his opinion, as much as could be put in, without endangering the illuminating power of the gas. If lime was used for purifying, the foul lime, when put out into the air, would cause a public nuisance; and with regard to oxide, when the heat from it was being given out, it became very offensive indeed. The object of introducing air was, in many cases, not to gain anything specially, but to mitigate the smells given off by oxide when it was thrown out of the purifiers. By using 1½ per cent. of air, he made the purifiers last as long again as without it. If the steam process would break up the tarry coating at the bottom of the oxide, which was often found, it would serve a good purpose. From what he could gather, practically nothing had been absolutely gained by the use of steam.

Mr. SHADBOLT: It prevents back-pressure, and supplies the motive force for injecting the air.

Mr. CHEW said he used an ordinary Roots blower, which was as regular as clockwork. There was often a danger of the back-pressure coming on suddenly. He remembered one day when at 6 o'clock the ordinary working pressure was only about 18 inches, in a few hours it was 70 or 80 inches, which was caused by the caking of the oxide at the bottom of the purifier—not that his purifiers were small, by any means. If this was avoided by using steam, it would be a good thing. Personally, he was very chary about discussing the introduction of air into gas, as the public, immediately they heard "air" mentioned, thought the object of those responsible for the manufacture of gas was simply to increase the consumers' bills. Gas engineers had to fight against such prejudices on the part of the public. He need not say they were entirely without basis, as regards any honourable member of the profession. However, as the public had this opinion, they must be careful, when speaking about introducing air, as to how they dealt with the matter.

Mr. ISAAC CARR (Widnes) said, though he much regretted that Mr. Shadbolt had been prevented from reading his paper before, he was pleased to know that the delay had allowed him to extend his observations. To his own mind, the lesson of the paper was in a nutshell. It was that the work of the purifiers could be greatly increased, and profitably increased, by the introduction of air, moistened by steam, instead of the introduction of air alone, as had been the common practice in years past, at the hydraulic main or the condensers. He had himself been trying to arrange for experiments on these lines; but he had not yet been able to put them into effect. He should certainly, however, after the reading of Mr. Shadbolt's paper, introduce air by means of a steam injector, at the inlet of the purifiers, instead of the old stereotyped method of drawing it in at the inlet of the exhauster.

Mr. CHEW said he drew the air in at the outlet of the condenser, and used a Roots blower for the purpose, and a small engine which regulated the operation to a nicety.

Mr. J. BRADDOCK (Radcliffe) observed that he had had some little experience during the last few years in methods of prolonging the life of purifiers; but he had not come to quite such an elaborate system as had been presented in the paper. His efforts had recently been in the same direction; but they took this form—that he introduced the steam at the inlet of any one of his four purifiers, and not at the main inlet through the centre-valve. His reason for doing this was that, by bringing the air in through the centre-valve, the valve (which was of peculiar construction) was affected by the heat of the steam to a deleterious extent—owing, perhaps, to the heat setting up unequal expansion. Whatever might be the cause of this, he dispensed with the previous arrangement, and now introduced the air to any one of the four purifiers that he cared to apply it to. It certainly had a beneficial effect, not only in prolonging the life of the purifier, but in very considerably preventing the caking of the oxide; and instead of having, at this time of the year, to use the pick and spade, the spade itself was quite enough. Another advantage was that the purifier was not so objectionable to the men as it would be under ordinary conditions. In regard to illuminating power, he was at present using about 2 per cent. of air; and it was only at this time of year that he could use such a percentage. If it were continued to the busier season, it would prove very unsatisfactory.

Mr. A. SHEIRS (Kidsgrove) said he was at present considering the question of alterations at his works; and he should have liked more information on this matter than the author had given. In his case, the gas entered the condensers at 147° Fahr., and

left at 60° Fahr. After going through the exhauster and the washer-scrubber, he found that at the outlet of the purifier it increased to 90°, and then decreased to 55°. By introducing steam, caking took place; and this caused some choking or back-pressure, bringing on a stoppage of the purifiers—the water blowing out of the lutes. He did not know whether he was using the proper quantity of steam; but he certainly found that the material caked and caused back-pressure.

The President said the paper had been specially interesting to himself. It was about 11 years since he first introduced air into his purifiers. He then used Hawkins's patent, which was simply an air-pump—the quantity of air being measured into the purifier according to the make of gas. The air was passed through a chamber containing all the tar that was made on the works; and heated up to 75° or 80°. The air was then passed direct into the purifiers; and, he must say, he found great benefit from doing this, as it made the purifiers last twice as long, and effected a great saving of labour. This went on for a number of years, until in 1894 the shaft of his washer-scrubber broke, and he was compelled to pass all the gas direct to the purifiers. Then, whereas prior to this occasion the ordinary work of the purifiers had been about 750,000 cubic feet, the first purifier after the breakdown of the scrubber purified about 5,966,000 cubic feet—lasting about 21 days. The second one ran for 31 days, and purified about 6,000,000 cubic feet. He read the paper by Mr. Dexter (referred to by the author) on the injection of steam into the purifiers; and first of all he injected the steam as near as possible to the air-pump. But in this case, he did not find much benefit, because the steam was so far condensed before it arrived at the purifiers that it was ineffectual. He might say that the temperatures he could get with his purifiers had been 65° to 70° upon the foul purifier. He then set to work, and injected the steam with Hawkins's pump, close to the valve of the purifiers; and he could then raise the temperature up to 95° or 100°. Since he had done this, he could run the purifiers as long as he thought proper, without any back-pressure, and the average work was about 2,000,000 cubic feet. He was now convinced, from what Mr. Braddock had said, that the proper way to inject the steam was into the bottom of each purifier, and then the temperature—which had a great deal to do with all chemical processes—could be increased to at least 100°, and thus the oxide would do its work better. He was satisfied that the author was going in the right direction, and that Mr. Braddock had given a valuable suggestion.

Mr. Shadbolt, in replying to the discussion, thanked the members for their complimentary opinions, which would induce him, if again called upon to bring forward a paper, to do so with pleasure. With regard to Mr. Chew's remarks, he might say that prior to Mr. Dexter's paper he had been deterred from trying the steam process, owing to several gentlemen he knew saying it would not act. But Mr. Dexter convinced him. With regard to Mr. Dexter's paper, however, that gentleman had, he believed, some kind of steam-scrubber similar in construction to an annular condenser, which cost a good deal of money, and therefore could not be used in such works as his own. A £5 note would pay for the whole affair that he had described, and it could be made to turn out enough gas for ten works like his own. The matter of cost was therefore an important item. In Mr. Chew's case, the 1½ per cent. of air he admitted, extended the life of the purifier to twice its previous life. In his (Mr. Shadbolt's) case, it increased it three times; and 3 per cent., six times. The question as to the non-caking of oxide was one of the special advantages of steam. Mr. Braddock's experience with the centre-valve was most remarkable and exceptional. Mr. Sheirs's case was exceptional. He (Mr. Shadbolt) should fancy that with the gas entering the purifiers at 80°, it would probably have not only light, but heavy oils in it before it reached there, and the steam injected would convert it into a kind of pitch, which would prevent the progress of the gas almost immediately. Of course, they must remember that the conditions varied with each works; and no doubt, if the whole of the conditions at Mr. Sheirs's works were understood, the difficulty could be removed. The President's remarks bore out his own experience. He might add that, if they allowed too much ammonia to go through the purifiers, pressure would be produced. It was all a question of proportion. There was still a good deal to learn about gas purification; and he was glad they thought his paper had given them some useful suggestions.

Mr. Mellor proposed a vote of thanks to Mr. Shadbolt.

Mr. Merrell seconded the proposal, which was supported by Mr. Chew, and heartily accorded by the meeting.

The Excursion.

Immediately after the close of the meeting, the members made an excursion, in coaches, to the "Cat and Fiddle," returning *via* Axe Edge. On reaching Buxton again, tea was served at the Royal Hotel. At the close,

The President expressed his pleasure at meeting the members in the town with which he was connected. He was glad they had chosen Buxton for their visit; and he hoped they had both learned something and enjoyed themselves during their short stay. He only regretted there were not more present.

A vote of thanks was unanimously accorded to the President, Mr. Milligan, Mr. Isaac Carr, and the Secretary, for the arrangements they had made for the convenience and enjoyment of the members, and the proceedings closed.

SOCIÉTÉ TECHNIQUE DE L'INDUSTRIE DU GAZ EN FRANCE.

Further Abstracts of the Papers.

(*Concluded from p.* 436.)

The sale of coke locally was the subject of a paper by M Ymonet, who explained the means adopted at Rennes for developing this branch of the Gas Company's business. At the outset, he laid down two propositions—viz., that coke should be offered to the working classes at their doors at the same price as at the works; and that the middle classes should be afforded every facility for sending their orders to the works in full confidence that they would be executed with but little delay. After making a trial, in an outlying locality, with a small coke-store which was thoroughly successful, the town was divided into four districts, in each of which there was established a similar store capable of containing from 600 to 700 bushels of coke in sacks. Each of these stores served as the residence of the lamplighter, whose wife, when he is away, sells the coke by retail for ready money, and receives orders for transmission to the works. During the spell of very cold weather from Jan. 1 to March 31 last, the coke sales reached 17 per cent. of the total local sale. The price charged is the same as at the works. Keepers of tobacco-shops are also utilized for the receipt of orders, which are collected by the lamplighter, and forwarded to the works. During last year, the orders obtained in this way reached 13 per cent. of the entire local sale. The service is so regulated that at six o'clock in the morning the yard foreman knows exactly how to prepare his deliveries for each district. The outdoor men also assist in the work; being provided with price-lists, and so forth, so as to be in a position to take orders. Last year, 16 per cent. of the local sales were effected through their agency. The tobacco-shop keepers are allowed about 6d. a chaldron, and the Company's servants about 3½d. for the same quantity. The store-keepers get 4 per cent. on the small sales for ready money. With regard to delivery, which has caused some trouble, the following rule has been adopted: Delivery at the house to be understood to mean that the coke is to be deposited in the cellar; but quantities of less than about 14 bushels may, at the request of the customer, be taken upstairs. In no case, however, are the carters to be expected to carry the coke up to the attics, owing to the dangers attending it. As to the method of dealing with the coal merchants, the Company allow them 10 per cent. on the selling price, and give them a bonus of a bushel for every 12 bushels of coke sold. These terms are good enough to keep the merchants from buying coke coming from outside sources. From next winter, merchants will be allowed a small supplementary premium. For the first quarter of the current year, the coal merchants disposed of 34 per cent. of the coke sold locally; the orders received at the works or at the office reaching 37 per cent. The author closed his paper with the confident expectation of an assured local sale, under good conditions, of almost the whole of his coke.

M. Ymonet also described a safety appliance for sending gas into the holder by the outlet-pipe, in the event of the accidental closing of the inlet. He acknowledged having obtained his idea from the apparatus devised by M. Coindet for preventing the extinction of gas in the town as a consequence of the stoppage of the outlet. In appearance and construction, M. Ymonet's appliance very much resembles a station governor; and, like that of M. Coindet, the bell has a rack which prevents it falling unless operated by an attendant. The arrangement of the author's governor-house was shown by a drawing. It contains two horizontal pipes placed end to end, but separated by a bye-pass valve. One of the pipes has upon it all the gas-holder inlet-valves; the other, all the outlet-valves and also the pressure-regulators. No error is likely to result from this arrangement, as all the valves are within easy reach of the attendant, who has not, as in the case of some works, to go from one holder to another. The two appliances—M. Coindet's and the one devised by M. Ymonet—are in operation at Rennes, and prove an effectual safeguard against accidents. They are both stated to work with great precision; and they are so sensitive that, during the intense cold of last winter, they served as indicators of the presence of ice in the gasholder tanks. The racks might be connected with electric signals, so that if either of the appliances began to work, the attendant would be at once apprised of the fact.

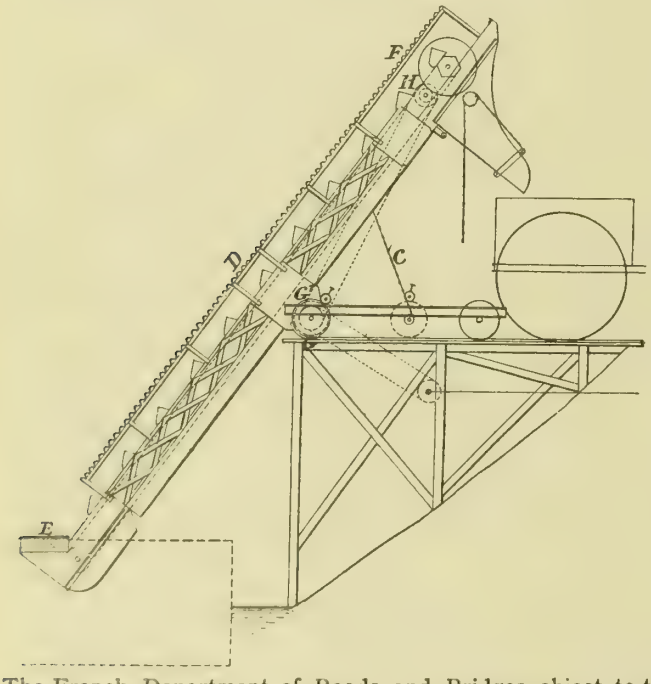
A new kind of circular street lamp was described by M. Chauveau, its inventor. Its consists of a metal framework and cover; but the glazing, instead of being of ordinary glass, consists of glass tubes, with a piece of glass at the bottom. For cleaning purposes, or for replacing the tubes, all that is needed is to raise the cover on its hinge. The spaces between the tubes are so small as not to allow the passage of wind or rain; and, moreover, the cylindrical form of the lantern does not leave many spaces exposed to the direct force of either element. Consequently, the light burns steadily even in a violent storm. The advantages claimed for the new lamp are: A better utilization of the light by reason of the comparative absence of shadows; the enlargement of the flame; a more equal distribution of the light in every direction owing to the multiplying effect of the glasses; and the reflecting property of the cover, which is whitened inside. The lantern may be used for gas, oil, or electric lighting.

The employment of incandescent gas-burners in public

lamps has led MM. Borias and Dutertre to devise a practical method of lighting them, whether singly or in clusters. The arrangement for a single burner comprises a lamp-base, a lighting-cock, and a wind-guard, with or without a reflector. For lamps containing more than one burner, a flame-carrier is added, which is movable around the principal burner-holder, or can be made to pass under all the burners in a circle. M. Borias has also devised a dry isolator to aid In discovering escapes of gas.

In a short "Note" by M. Henri Villiers, he summarized recent publications dealing with the subject of the deterioration of gas-pipes laid in proximity to electric tramways, and reviewed the various methods of electrical installation which are favourable or otherwise to the preservation of the pipes. Having explained the phenomena, he stated that at certain points the current passes from the pipes to the rails, and *vice versâ*. This sets up electrolysis; and the gas-pipes are attacked at the points where they are positive in regard to the rails (in other words, where the current leaves them), but never where it penetrates them. Very interesting investigations of American engineers have indicated the cases where the danger is greatest; but they have not pointed out the infallible remedy.

M. de Billy submitted to the meeting a short paper, in which he brought under the notice of the members an appliance for discharging coal-barges, for which he claimed certain advantages as compared with the steam or the hand crane. In the first place, the former is costly to instal; then it is very liable to cause accidents, owing to its having to be worked at high pressure; and, lastly, it is exposed to the rigorous weather of winter. The hand crane, while furnishing a partial solution of the difficulty, is not altogether satisfactory; and, moreover, it cannot be employed when the distance from the water to the bank is considerable. After turning his attention to various machines, the author fixed upon the one shown in the accompanying illustration. He commended it as being simple in construction and economical in working; while another point in its favour is that it affords an opportunity for further utilizing gas for motive power.



The French Department of Roads and Bridges object to the erection of any fixed machine upon wharves. It was therefore necessary to make the appliance portable. It consists of an ordinary chain of buckets, mounted, at a point close to its centre of gravity, upon a carriage, and so contrived that the lower portion E D is rather heavier than the upper part D F. Its inclination is regulated by means of the chain C, which passes round a winch. It can therefore be easily raised or lowered as the barge rises or falls with the tide. Motion is given, by the cog-wheels G G^1, to the pinion H, and thence to the chain of buckets. The action of the chain is continuous, whatever may be the angle of inclination of the elevator; the distance between G and H being always the same. At the upper end of the machine, there is a receptacle, having a capacity of 12 to 14 bushels, closed by a trap-door, movable by hand, wherein a quantity of coal can be stored pending the replacement of one truck by another. This continuity of motion allows about 100 tons of coal to be unloaded in twelve hours with a 1 horse-power engine; whereas one of 12 to 15 horse power would be required to do a similar quantity of work with a crane. The coal is shovelled into the hopper, which is so constructed that it can be filled from all points. The barge, therefore, has not to be moved more frequently with this appliance than with a crane. If the stores happen to be close to the wharf, the coal can be deposited, at a height of 8 or 10 feet, on endless bands, and distributed in the sheds, so as to save the cost of wheeling, estimated at about 2d. per ton; or, as in the author's case, it can be shot into waggons which are run up to the stores, raised to a height of 10 feet, and then discharged in a heap without further handling. Motive power, if easily procurable, might be furnished subterraneously, or electricity transmitted, for working the elevator. If these means were impracticable, a gas-engine could be fitted on the carriage of the machine itself. This would probably be the most economical arrangement. The appliance is suitable for gas-works receiving by water at least 4000 tons of coal per annum; and the author believes that its installation would be productive of considerable economy in the cost of unloading.

A short paper by M. le Roy contained a description of a portable trestle to facilitate the charging of retorts with the scoop. The author found that the stokers usually raised the fore part of the scoop too high, and then let it fall sharply upon the casting of the mouthpiece; thereby shaking the retort, and causing the joints to become defective and leaky. The portable trestle almost entirely gets rid of this trouble. Instead of the scoop filled with coal resting on the retort, it is supported on a movable roller of cast iron, placed in the projecting portion. The labour of getting the scoop inside the retort is considerably diminished, as it is, so to speak, drawn along mechanically by the roller turning freely upon its axis. The trestle consists of two double T-shaped iron uprights, connected above and below by two round iron bars strongly bolted, so as to give great rigidity to this part of the trestle. The base rests upon a flat iron frame, fastened to the two uprights by strong bolts, and supporting at each of its extremities two iron cheeks, in which are fixed four small wheels, carrying steel blades for clearing away the coke. An iron traction-rod, fixed to one of the uprights, enables the trestle to be easily moved backwards or forwards. The portion of the appliance of most interest is the roller, which turns readily when touched by the scoop. This is easily withdrawn after the charge has been deposited. By the use of the trestle, the men have to endure much less fatigue than without it; and very little time—twenty minutes at the most—is required to charge an ordinary setting of seven retorts with about 2000 lbs. of coal. The author has found in practice that the appliance works regularly, without requiring repair.

M. Delahaye presented a "Note" on the consumption of coa in central electric supply stations in the United States. It was explanatory of a table reproduced from the report of the proceedings at the last meeting of the National Electric Light Association, held at Cleveland (Ohio) in February. The figures were obtained by the Committee on Data of the Society; and though a smaller number of stations are given than in previous reports, they consider the particulars furnished are more accurate. Taking the average of the figures for ten stations, each supplying upwards of 5,000,000 watts per 24 hours, the yield of electricity is 147·5 watts per pound of coal, or one electric horse-power-hour per 4 lbs. of coal.

The use of acetylene for the production of lighting gas was dealt with in a paper by M. Bullier. He gave an account of the researches of M. Moissan, M. Berthelot, Mr. Willson, and others, in connection with the production of calcium carbide; and discussed the claim to priority as between the first and the last named investigator. He thought the credit for the discovery must be given to M. Moissan, in whose researches he had taken part. Convinced of the commercial importance of the substance in question, M. Bullier, in 1894, patented a method for its preparation. He dwelt particularly upon the fact that, the carburets obtained by his process being producible at a price which is a function of the motive power necessary to generate the electric current, he could obtain considerable quantities of them, which would be capable of subsequently producing acetylene at a moderate price, and that the application of this material then became practicable. He specially indicated lighting as one of the purposes to which it could be put. He went on to say that, if an attempt is made to burn acetylene at ordinary pressure, the resulting flame is smoky and red—this tint being due to the carbon resulting from the decomposition of the acetylene, which escapes combustion, and which consequently cannot be utilized in flames as an incandescent body. In the presence of this large excess of carbon, which seemed to render illusory the employment of acetylene as a lighting medium, M. Bullier sought first of all to increase the luminosity of gases already possessing light-giving power. The results of these researches were embodied in a patent taken out in the early part of the present year. M. Berthelot has established the fact that acetylene is an endothermic body. It is known, moreover, that, when diluted with air, it is capable of forming with oxygen explosive mixtures which are extremely dangerous. M. Bullier accordingly diluted it with an inert gas. Eliminating wholly or partially the oxygen of the air, and taking nitrogen alone (or even mixtures of nitrogen containing only from 3 to 4 per cent. of oxygen), he succeeded in suitably diluting acetylene to allow of its application to lighting purposes by means of the appliances ordinarily employed. Other inert gases, or mixtures thereof, may, however, be substituted for nitrogen, without increasing the net cost. In the author's laboratory in Paris, he determined the photometric values of different mixtures. A compound of acetylene and nitrogen, in the proportions of 85 per cent. of the former and 15 per cent. of the latter, consumed at the rate of about 3 cubic feet per hour, gave a light equal to 190 candles. With a smaller consumption—for example, 1·75 cubic feet—from a batswing burner, a mixture of 70 per cent. of acetylene and 30 per cent. of nitrogen had a

luminous intensity of 70 candles. The following table contains the results of burning acetylene in various mixtures and with different burners :—

Percentage Composition of Mixture.	Burner.	Consumption in Litres (100 litres = 3·53 c.f.).	Luminous Intensity in Carcels (1 C.=9·5 Candles).
Acet., 85 ; N., 15·0	Bray, No. 2	90	20·00
„ 85 ; „ 12·0 ; O., 3·0 (air).	„ „	90	19·00
„ 80 ; „ 19·0 ; „ 1·0 . .	„ „	90	18·00
„ 65 ; „ 31·3 ; „ 1·7 . .	„ No. 1	80	13·00
„ 70 ; „ 24·0 ; „ 6·0 (air).	„ No. 2	104	18·00
„ 80 ; „ 19·0 ; „ 1·0 . .	„ „	84	16·00
„ 100	Batswing, No. 2	50	12·00
„ 85 ; „ 15·0	Bray, No. 1	80	16·00
„ 85 ; „ 15·0	Batswing, No. 2	50	10·00
„ 65 ; „ 31·3 ; „ 1·7 . .	Bray, No. 2	95	14·00
„ 85 ; „ 12·3 ; „ (air) . .	Batswing, No. 2	50	8·50
„ 80 ; „ 19·1 ; „ 0·9 . .	Bray, No. 2	100	18·00
„ 70 ; „ 30·0	„ „	90	13·50
„ 70 ; „ 30·0	Batswing, No. 3	90	14·00
„ 85 ; „ 12·0 ; „ 3·0 (air).	„ No. 1	50	9·50
„ 85 ; „ 12·0 ; „ „ . .	Bray, No. 1	80	15·00
„ 70 ; „ 24·0 ; „ 6·0 (air).	„ No. 2	97	15·00
„ 50 ; „ 40·0 ; „ 10·0 „ .	Batswing, No. 5	120	13·00
„ 80 ; „ 19·0 ; „ 1·0 „ .	Bray, No. 1	84	14·50
„ 50 ; „ 40·0 ; „ 10·0 „ .	Batswing, No. 7	160	17·00
„ 50 ; „ 40·0 ; „ „ „ .	„ No. 6	142	15·00
„ 80 ; „ 19·0 ; „ 1·0 . .	Bray, No. 1	73	12·00
„ 65 ; „ 31·3 ; „ 1·7 . .	„ No. 2	82	17·00
„ 50 ; „ 40·0 ; „ 10·0 (air).	Batswing, No. 11	65	17·00
„ 70 ; „ 30·0	Bray, No. 1	80	10·50
„ 100	„ No. 2	70	14·00
„ 100	„ No. 1	79	16·00
„ 70 ; „ 30·0	Batswing, No. 1	50	7·00
„ 70 ; „ 30·0	„ No. 2	60	8·50
„ 70 ; „ 24·0 ; O., 6·0 (air).	Albo-car., No. 1	92	13·00
„ 70 ; „ 24·0 ; „ 6·0 „ .	Batswing, No. 8	146	19·00
„ 50 ; „ 40·0 ; „ 10·0 „ .	„ No. 10	150	15·50
„ pure	„ No. 11	42	8·00
„ 70 ; „ 24·0 ; „ 6·0 (air).	„ No. 4	140	18·00
„ 50 ; lighting gas, 50 . . .	Albo-car., No. 1	50	7·50
„ 70 ; „ 24·0 ; O., 6·0 (air).	Batswing, No. 3	102	13·00
„ 100	Albo.-car., No. 1	64	11·50
„ 65 ; „ 31·3 ; „ 1·7 . .	Batswing, No. 1	44	5·00
„ 100	Albo.-car., No. 2	92	16·00
„ 50 ; „ 40·0 ; „ 10·0 (air).	Batswing, No. 4	103	9·00
„ 50 ; lighting gas, 50 . . .	„ No. 2	70	7·75
„ 75 ; carbon dioxide, 25 . .	Albo.-car., No. 2	90	11·00
„ 50 ; nitrogen, 50	Batswing, No. 7	135	10·50
„ 100	Albo.-car., No. 2	53	8·00
„ 50 ; N., 40·0 ; O., 10·0 (air)	Batswing, No. 3	80	6·00
„ 50 ; „ 47·5 ; „ 2·5 . .	„ No. 1	40	3·00
„ 50 ; „ 50·0	„ No. 6	130	9·50
„ 50 ; „ 50·0	„ No. 5	120	8·50
„ 50 ; „ 40·0 ; „ 10·0 . .	„ No. 8	100	6·50
„ 70 ; „ 24·0 ; „ 6·0 (air).	„ No. 2	58	5·80
„ 100	Manchester	36	5·00
„ 50 ; „ 50·0	Batswing, No. 4	110	7·55
„ 50 ; „ 50·0	„ No. 12	100	7·00
„ 100	M. Bullier	17	2·30
„ 70 ; „ 30·0	Batswing, No. 1	51	5·00
„ 50 ; „ 40·0 ; „ 10·0 . .	„ No. 2	45	3·00
„ 50 ; lighting gas, 50·0 . .	Albo.-car., No. 2	100	11·00
„ 100	Batswing, No. 1	39	5·50
„ 50 ; N., 40·0 ; O., 10·0 (air)	„ „	38	2·15
„ 100	Albo.-car., No., 2	32	3·30
„ 50 ; „ 40·0 ; „ 10·0 (air)	„ No. 1	80	4·50
„ 100	M. Bullier	12	1·20
„ 50 ; „ 50·0	Batswing, No. 3	90	4·50
„ 50 ; „ 50·0	„ No. 8	110	5·50
„ 50 ; „ 40·0 ; „ 10·0 (air)	Albo.-car., No. 1	70	3·50
„ 50 ; „ 50·0	„ No. 2	90	3·70
„ 100	„ „	22	1·70
„ 50 ; „ 50·0	Batswing, No. 2	50	1·20
„ 50 ; „ 50·0	Albo.-car., No. 1	80	2·70
„ 50 ; „ 50·0	Batswing, No. 1	24	1·10
„ 50 ; carbon dioxide, 50·0 .	„ No. 12	70	2·10
„ 10 ; lighting gas, 90·0 . .	„ No. 6	200	5·50
„ 10 ; „ 90·0 . .	„ No. 1	52	0·90
„ 10 ; „ 90·0 . .	Albo.-car., No. 2	100	1·10
„ nil ; „ 100·0 . .	Batswing, No. 1	50	0·20

The cost of the light depends solely on the price of carbide of calcium, which, as stated in M. Bullier's first patent, is a function of motive power. The raw material, being very widespread, is not costly. M. Bullier and M. Moissan put it at 150 frs. a ton. When acetylene was first introduced as a lighting medium, it was thought by some that danger would arise from its coming in contact with any copper employed in the existing appliances, and forming an explosive compound. M. Bullier regarded all these fears as exaggerated. He is justified by some experiments of M. Berthelot, who has proved that bright copper does not act upon acetylene. Moreover, M. Bullier has demonstrated its innocuousness by an experiment he himself carried out. He, however, found, as M. Berthelot had done before him, that iron burners are not suitable for the combustion of acetylene, as this gas is destructive to the metal, and causes enlargement of the holes. With regard to the alleged poisonous properties of acetylene, some doubt seems to exist. M. Bullier and his assistants manipulated large quantities of it during a period extending over several months; and they never suffered any inconvenience therefrom. M. Bullier concluded by remarking that lighting is not the only branch of industry in which acetylene gas can be utilized; while in the chemical arts acetylene itself is susceptible of numerous applications. This new discovery of the manufacture, by the aid of the electric furnace, of the crystallized carbides of calcium, barium, and strontium, allows of the production of a very luminous gas at a cheap rate, and at the same time assists the industries in which figure the salts of baryta or strontium.

M. Denayrouze showed to the members his incandescent burner, which was described in the JOURNAL for June 11 last (p. 1256), and was referred to in high terms by Professor Lewes in his paper read at the meeting of The Gas Institute in Edinburgh. M. Denayrouze lit a lamp of 760-candle power, the light from which was so brilliant as to be unbearable by the naked eye. It is stated that, with a consumption of 4 or 5 litres (say 0·14 or 0·18 cubic foot) of gas, an illuminating power equal to 9·5 candles is obtainable with this remarkable burner.

Gas-Engines and Electric Lighting.—The Battersea Polytechnic (says the *Daily News*) reports an achievement in electric lighting that looks almost too good to be quite reliable. It has been from the first lighted throughout by a complete installation on the premises, designed for 1100 lights in various parts of the building. There are two dynamos and a 12-horse power gas-engine; and it is reckoned that the glow lamps cost at a rate equivalent to only 1s. 9d. per 1000 cubic feet of gas. This result is so exceptionally brilliant that it is to be feared that something has been left out of the reckoning. It was calculated at the outset that, by running their own electric light, they would effect a saving representing 8 per cent. on the outlay; but if the light is obtained at the rate specified, they must surely be doing a good deal more than that.

The Cause of Fire by Electricity.—The chief of the Electrical Department of the Philadelphia Underwriters' Association (Mr. W. M'Devitt) recently gave a demonstration of some of the ways in which fires may be caused by electricity. According to the *Boston Transcript*, he showed that the first danger is that arising from the common practice of grounding telephone wires on gas-pipes. A bad connection is generally made—quite sufficient for telephone purposes—and then if the telephone wire becomes crossed with an electric light wire, the larger current meeting resistance at the ground connection heats the joint, makes a hole in the gas-pipe, and the arc formed lights the gas. Mr. M'Devitt gave a complete demonstration of the gas and insulation on the wire burning simultaneously. He also exhibited a section of gas-pipe that had caused a fire in this way. The wires in the sockets of electric lamps are liable to touch the casing, when an arc may be formed. For this reason, no drapery should be used around the lamp sockets. The advantage of using metal conduits with insulated lining through which to run the wire was demonstrated, a wire outside being dangerously heated, while from that inside the conduit there was no risk. A caution was given against rough handling of flexible cords used for electric lights as a common cause of short circuits and fire. There are other dangers due to ignorance on the part of the general public of the character of the electric current. In one case on record, the walls of a room were upholstered with stuff in which were interwoven a great number of metal threads. These were in contact with the electric light wires; and when the current was turned on, the whole room was set ablaze.

Received.—*La Technologie Sanitaire.* (Louvain: A. Uystpruyst-Dieudonné.) This is a new bi-monthly publication devoted to questions of water supply and applied hygiene. It is produced under the supervision of an Editing Committee, the Secretary of which is M. Victor J. van Lint, C.E., of Brussels. The two numbers to hand contain an article by M. Kemna, the Manager of the Antwerp Water-Works, on "Sand Filtration;" and a large instalment of one by Mr. Percy Boulnois, M.Inst.C.E., of Liverpool, on "Refuse Destruction." Reviews are included; and there is a bi-monthly international supplement, giving particulars of books, pamphlets, &c., on sanitary matters. The publication is of convenient size; and it will no doubt prove a useful addition to hygienic literature.——"Sulphate of Ammonia as a Manure." (Sydney: Turner and Henderson.) This is an illustrated pamphlet prepared by Mr. H. C. L. Anderson, M.A., Belmore Gold Medallist in Agricultural Chemistry at the Sydney University, and lately Director of Agriculture for New South Wales, in order to present in a concise form a few facts, obtained from the experience of practical and scientific agriculturists in Great Britain, Europe, and New South Wales, as to the manurial value of sulphate of ammonia. The illustrations show the marvellous effects resulting from the use of nitrogenous manures.——"Gas-Fitting." (London: Crosby Lockwood and Son.) This is the second edition of a practical handbook, by Mr. John Black, treating of every description of laying on and fitting gas. It is substantially a reprint of the first edition; but there is a supplementary chapter on recent improvements in burners, the incandescent system of gas lighting, "penny-in-the-slot" meters, and other modern developments of the mechanical side of gas supply. The book is one of Weale's Rudimentary Series; and the text is amply illustrated.——"Die Fabrikation der Mineralöle und des Paraffins aus Schweelkohle, Schiefer, &c." By Dr. W. Scheithauer. (Brunswick: F. Vieweg and Son.)——"Programme of Technological Examinations of the City and Guilds of London Institute, Session 1895-6." (London: Whittaker and Co., Paternoster Square.)

PACIFIC COAST GAS ASSOCIATION.

Annual Meeting in San Francisco.

The Third Meeting of this Association, held on July 16 and 17, disclosed satisfactory progress. There are now 88 members, fifteen of whom were elected on this occasion; and more than half of the members were present. Mr. C. W. QUILTY, of San Jose, President for the year, occupied the chair.

In his Inaugural Address, the President said that, with regard to gas business on the Pacific coast, the past year had been one of growth, improvement, prosperity, and confidence. Though most of the coals used were imported, the district furnished oils that could be used for making gas; and large quantities of petroleums had been sent in from South American States for this purpose. Gas was now sold in San Francisco as cheaply as anywhere in the States; and most of their principal towns had been able to so far reduce the price as to secure a large amount of business for purposes other than lighting. Their climate was so equable, that a gas cooking-stove was a welcome domestic article all through the year; and there were no Eastern winters requiring coal fires for six months or so. Gas-engines were coming into use for various purposes; and in two places in California they were used for generating electric light. Speaking of acetylene, the President remarked that they had large water power, with good supplies of coal and limestone; and in no other part of the world were the conditions more favourable to its manufacture. Many towns and cities in their district were furnished with electricity from distant sources; and, with one exception, the plants installed for the purpose were the largest in the world. The greatest danger that threatened their industry was the propositions for municipal control and ownership. Where everything was quiet and satisfactory, the promoter would come along, and stir up the City Council to own a gas plant; and this would be carried out without reference to, or consideration of, existing vested interests. There was plenty of law for other interests, but none for the protection of a gas company; and he had drafted a Bill for this purpose, and distributed copies of it in pamphlet form. He urged the members to take up this question promptly and energetically; and he concluded by insisting on such a policy of cheap gas, moderate dividends, and skilled working as would leave no possible excuse or loophole for competitive gas schemes in their districts.

Mr. John L. Howard, the General Manager of the Oregon Improvement Company, contributed an entertaining paper on "Welsh Anthracite Coal." He commenced with a consideration of the theories respecting the formation of coal, and summarized the different classes of coal known, and their respective chemical constitutions. Comparing the composition of anthracite and coke, he called the former a natural coke, and proceeded to outline the position of the anthracite coal-fields in America and in South Wales. California was, he said, the only one of the States that imported from South Wales; and the reason for this was because the coal was brought back at a cheap freightage on the return journeys of vessels that took out wheat. The earliest importation was in 1883; and the gas companies were the first large patrons. The properties of Welsh anthracite for raising steam, and the best ways of using it for this purpose, were next considered in detail; and the reasons why many had failed to get satisfactory results from it were pointed out. But the freightage was now so low that Welsh anthracite was the cheapest steam-raising fuel obtainable in the district. Compared with oil at current rates, a dollar's worth of oil would evaporate 2905 lbs. of water; but a similar value of anthracite would evaporate 4293 lbs. For making water gas, a hard and well-screened coal was needed. But a softer kind would do for raising steam; and the importers were beginning to recognize the different qualities required in each case. Owing to the short time allowed for loading, it was difficult to obtain any special brand of anthracite; and the amount of breakage in the cargoes as received rendered it impossible to say whether or not it had been properly screened in the first place. The future supply of fuel to the district lay between bituminous coal from Vancouver Island, petroleum from California and Peru, and anthracite from South Wales; but it would be a rueful day for the Californian farmer if the latter was displaced. At present 800,000 tons of wheat were exported; and the effect of a loss of the freightage of coal on the return journey would be an increase of outward freights, which would render the present disadvantageous position of the Californian farmer even more deplorable.

Mr. Eichbaum, who claimed to be pioneer in the use of Welsh anthracite for water gas, remarked that when taking charge of the works belonging to the Pacific Gas Improvement Company, in 1883, he found about 20 tons of this kind of coal in stock, part of a cargo taken on trial. It was said to be useless, as it destroyed the grate-bars. On making a test, he found this was correct; and that it burnt down so close to the bars as to melt and destroy them. But he found this difficulty could be successfully met by placing about 6 inches of clinkers on the bars, in the first place, before charging the generator. It was quite true that the coal was not properly screened. Sometimes one-third of a cargo would pass through a ⅜-inch screen. He used up the 20 tons, and then bought more; and the value of it soon became known. Mr. Britton agreed with the previous speaker. At Oakland, he had used Welsh anthracite for some years; but he could not get a settled brand, and also found that the screenings would come up to 35 per cent. of the whole. He was, however, able to use the small under a steam-boiler, with the aid of a forced draught. If the Welsh shippers could guarantee a known brand and a minimum of small, it would be an advantage. Mr. E. C. Jones said that his Company were large users of the material under discussion; and for some time the impression prevailed that it would not do for generators by itself, but must be mixed with patent coke. Some time ago, however, he happened to run out of coke, and then found that it could be employed alone with excellent results. He mixed the screenings with boiled tar, and used them for making steam. Mr. Britton said he formerly used patent coke, but found he could do better without it. With one-fifth coke and four-fifths anthracite, 38 lbs. per 1000 cubic feet of gas was required; but with the anthracite by itself, from 30 to 32 lbs. was sufficient. Mr. Allen said that Colorado anthracite was clean and free from small, but more costly than Welsh. He thought the Welsh coal was properly screened before loading, but that it broke upon the trip.

Mr. J. Bryant Grimwood, of San Francisco, followed with a paper on "Technical Gas Analysis," describing in detail the methods and apparatus employed daily at the North Beach Gas-Works in that city. These comprise Hempel's burettes and absorption bulbs. A 33⅓ per cent. solution of potassa, fuming Nordhausen sulphuric acid, sticks of phosphorus, and an acid solution of cuprous chloride are the chief reagents used. The hydrogen is oxidized, by passing it through a U-tube charged with about half a gramme of palladium black, mixed with asbestos fibre, and immersed in a beaker of boiling water. The marsh gas is measured by explosion in the usual way. Specific gravity is estimated by Schilling's apparatus.

After some further proceedings, Mr. T. R. Parker submitted a well-arranged collection of "Wrinkles," which he had received from members of the Association. Many of these serve to illustrate the proverb "Necessity is the Mother of Invention," as they show how temporary shifts can be made in out-of-the-way places, where there are no gas engineering works within hailing distance. One of the "wrinkles" is an arrangement for throwing water on the top of a gasholder, consisting of a perforated pipe carried round the top circle of girders. This is said to be useful in case of wooden buildings in the vicinity taking fire; and also for cooling the gas, if the holder is full and threatens to "blow" in the glare of the noonday sun. Another device is simple pressure and vacuum valves for oil-tanks, consisting of flat conical valves opening inwardly and outwardly respectively. A small cistern with float-valve, for automatically maintaining the correct level in water-meters, was also described. An apparatus for dissolving naphthalene consisted of a small tank, with sight-feed arrangement, intended to be charged with naphtha, and attached to the gas-main at the offending spot; and a regulated supply of naphtha is caused to drop into the main, where it vaporizes and destroys the deposit. One gentleman, careful for the comfort of his workmen, causes the drinking water to circulate in a pipe at the bottom of his gasholder tank; and thus reduces it 20° to 40° in temperature. The fact that gas managers on the Pacific Coast run high heats, is illustrated by two of the "wrinkles" applying to dealing with the mouth-pieces of retorts when the holding-bolts are burnt through. A charging car for the upper retorts, affording standing room for the stoker, is an ingenious device that is worthy of more extended adoption; as the proper placing of coals in top retorts is a general, and not a local, difficulty.

After the reading and discussion of several other papers, which dealt with matters of local interest only, and the consideration of the contents of the question-box, the meeting was brought to a close.

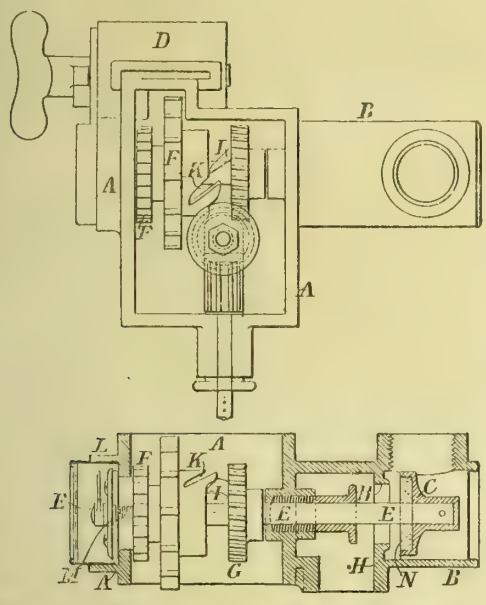
Motors for Horseless Carriages.—In the House of Commons on Monday last week, Mr. Macdona called the attention of the President of the Local Government Board to the recent performances of the petroleum motor owned by the Hon. Evelyn Ellis, and asked him whether he would consider the desirability of repealing the Locomotives Act of 1865, in order to permit of other than steam motors being more extensively used in the country. Mr. Chaplin replied that he had already noticed the matter, and intended to carefully consider it in connection with the Bill introduced by his predecessor last session.

Failures of Reservoir Dams.—A series of articles on reservoir dams in *Le Génie Civil*, by Mons. A. Dumas, contains an account of the principal failures of which authentic records are available. So far as earthen dams are concerned, M. Dumas finds the catastrophe has always arisen from one of the five following causes: (1) Perviousness of the dam itself, or of the ground on which it stands. (2) Insufficient size of the byewash leading to the water topping the bank. (3) The laying of pipes for drawing off the supply through the bank. (4) Wave action on the interior face of the dam, which in the case of large and deep reservoirs, exposed to strong winds, should be protected not merely by stone pitching, but by a bearing masonry wall on the inner slope. This wall should at the same time be made in comparatively small sections, so that unequal settlement shall not cause any serious dislocations. (5) The use of unsuitable material in the core.

REGISTER OF PATENTS.

Prepayment Gas-Meters.—Hawkyard, J., and Braddock, J., of Oldham. No. 17,706; Sept. 18, 1894.

This invention relates to improvements in apparatus described in patents Nos. 12,584 and 14,655 of 1890, wherein the meter supply-valve was fixed near one end of a spindle capable of an endwise and also of a revolving motion, and upon which spindle are fitted two wheels, to one of which motion is given direct from the action of the meter, and to the other motion is communicated by a coin in a reciprocating, oscillating, or revolving coin-receiver—the endwise motion, for opening or closing the valve, being imparted to the spindle by an inclined plane or cam surface on one wheel acting on a fixed projection on the other, or *vice versâ*.



The illustration shows a plan and a longitudinal section of the apparatus.

A is the outside casing; B, the valve-box; C, the valve; D, the coin-receiving box; and E, the sliding and revolving spindle of the apparatus, upon which the wheels F and G are mounted. The valve C is placed outside the seating H, with its face towards the wheels above mentioned, so that its closing movement can be obtained by a pull instead of a push or thrust. Another advantage is said to be that the frame A and the valve-box B and seating H can be all cast in one piece, if desired; and access may be had to the valve C for repairs or renewal, without disturbing the other parts of the apparatus.

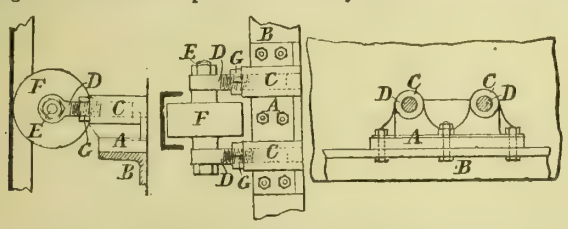
One of the wheels G is provided with a sloping projection or finger I, and the other with a corresponding sloping notch or slot K; so that when one wheel overtakes the other, the side of the notch acting against the side of the projection (or *vice versâ*) will thrust the wheels F and G asunder, or draw them together, and thus open or close the valve C, by giving the requisite endwise motion to the valve-spindle E. This closing motion is given by a forward pull, and the opening motion by a backward thrust as before described, without the necessity for any spring or other auxiliary. The wheel G is fixed on the valve-spindle E, and the end of the latter can both slide and revolve in a hole in the boss of the wheel F; the latter being prevented from moving endwise by a loose collar L, fixed by screws M.

By preference, the patentees make the stop-valve C of metal; and in the face of it there is an annular groove or recess, in which a ring N of yielding substance (preferably cork) is inserted; or the ring may be put round the outside of the metal face.

The seating H is made with an annular projection or rim, in order that the yielding substance N of the valve may come into contact with its seating just before the metallic surfaces meet. For this purpose, either the substance itself or its opposite face must project slightly. If, however, the cork should at any time become too much worn, or otherwise give way, then the metal face of the valve would come into contact with the metal surface of the seating H, and again shut off the gas.

Guide-Carriages for Gasholders.—Cutler, S., of Millwall. No. 18,417; Sept. 28, 1894.

The patentee states that the object of this invention is "to provide a bottom guide-carriage for gasholders, which can be readily adjusted while the gasholder is in work, and which does not require packings or wedges to maintain its position after adjustment."



A substantial base-plate A is attached to the bottom curb B of the holder; and projecting from this base are two long bearings or sleeves C, in which are eye-rods D, the eyes of which form bearings for the axle E of a roller F, and the reverse ends of which enter the sleeves, and are fitted with screw-nuts G. The base-plate is first bolted to the bottom curb of the holder, and afterwards the roller is exactly adjusted, by means of the screw-nuts, and maintained in position by the nuts which abut upon the faced end of the sleeve.

Condensing and Washing Gas.—Kirkham, Hulett, and Chandler, Limited; a communication from F. D. Marshall, of Copenhagen. No. 18,441; Sept. 28, 1894.

This improvement in battery condensers is shown in the accompanying engravings—fig. 1 being a plan of the apparatus; figs. 2 and 3, sectional elevations at right angles to each other; and fig. 4, a sectional plan.

Fig. 1.

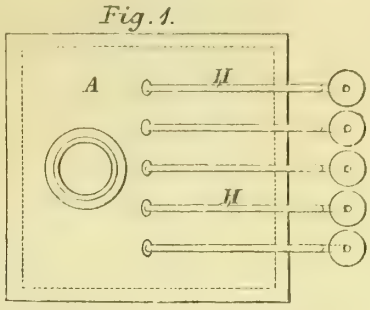


Fig. 2.

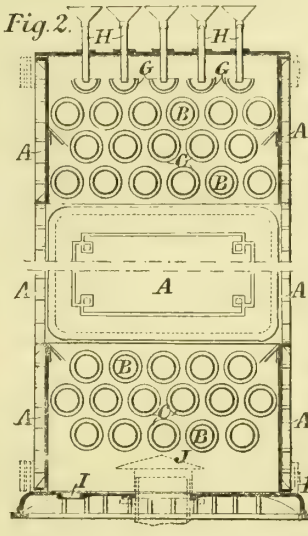


Fig. 3.

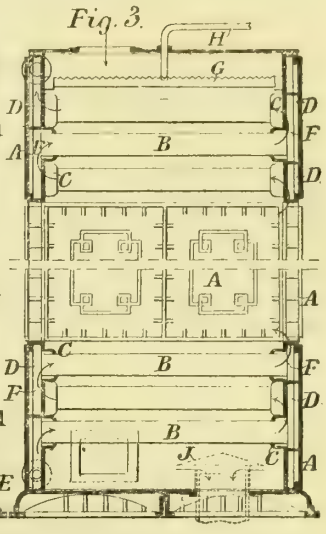
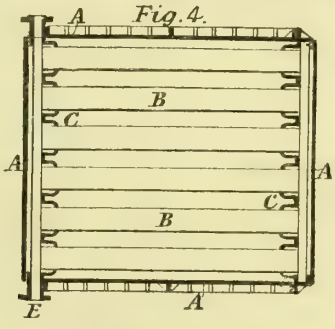


Fig. 4.



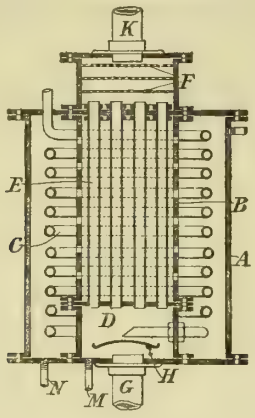
The walls of the apparatus A, for convenience of construction, are made in sections. B are the cooling pipes, carried at their ends in sockets C, formed on two opposite walls of the apparatus, and communicating with chambers D, formed in the walls, so that a cooling medium will circulate from an inlet E in the direction of the arrows F. All these parts being arranged in the usual manner, require no further description. G are a series of troughs arranged over the cooling pipes B, and adapted to be supplied with water through tubes H, provided with funnels. The troughs are notched at their edges, so as to divide the water which overflows from them into fine streams, and thereby cause it to be distributed over the cooling pipes B. The water which overflows from the troughs trickles down over the pipes, so that tar and other impurities condensed from the gas on the pipes may be washed off, and carried to the bottom of the apparatus, whence they escape through an opening I—the gas passing off through an opening covered by a cowl J.

As the water flows in at the bottom of the apparatus and escapes at the top, the hottest gas first comes in contact with the warmest of the cooling pipes, and leaves the apparatus after having passed over the coolest of the pipes.

Enriching Gas.—Kemp, W., of Kingston-on-Thames. No. 18,510 Sept. 29, 1894.

In constructing a gas enricher according to this invention, a casing A (which may be in the form of a vertical cylinder) is divided by an annular partition B into two compartments—a central compartment and an annular compartment surrounding it. In this latter compartment is a pipe-coil C, through which liquid hydrocarbon is passed, while the compartment is kept charged with steam. The hydrocarbon thus converted into vapour issues from the coil into a chamber D (at the bottom of the central compartment), into which gas is admitted by a pipe G, against a deflector H, and mingles with the vapour. The mixed gas and hydrocarbon vapour ascend a number of tubes E exposed to the heat of steam admitted through holes in the partition B to the space around the tubes. The mixture of gas, thus heated with the vapour,

after flowing through the tubes, passes through wire-gauze or perforated metal screens F, "thus becoming thoroughly mingled;" and the mixture issues at K. The supply of hydrocarbon is regulated by a valve:



and should there be excess, such of the liquid as is not vaporized is caught by the screens, and returns to the chamber below, whence it can be run off by a pipe M. The condensed steam passes away by the pipe N.

Coin-Freed Apparatus for the Sale of Gas in Fixed Quantities.—Glover, R. T. and J. G., of St. John's Street, Clerkenwell, E.C. No. 22,830; Nov. 24, 1894.

The object of this invention is: "First, to open a valve or faucet of a meter, to admit of a supply of gas to a consumer's pipes proportionate to the amount of rotative movement imparted to a screw by an inspector or other authorized person after the receipt from the consumer of an equivalent value, or . . . the necessary rotative movement may be imparted to the screw by the consumer turning a handle after the insertion of a given coin. Second, to close the valve or faucet, and stop the supply of gas, after the amount of gas prepaid has been supplied to the consumer, by the rotation of a second screw operated by the ordinary mechanism."

Fig. 1.

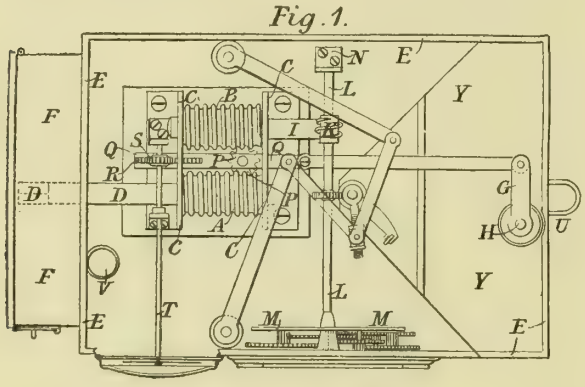


Fig. 2.

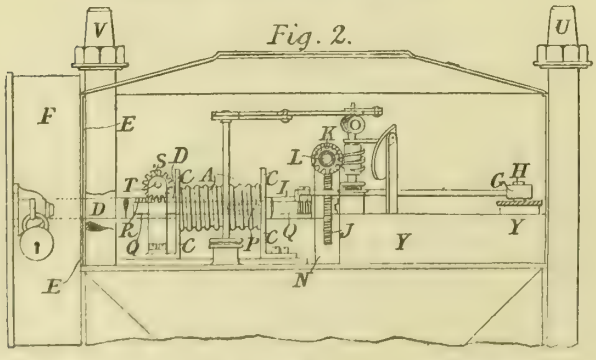


Fig 3.

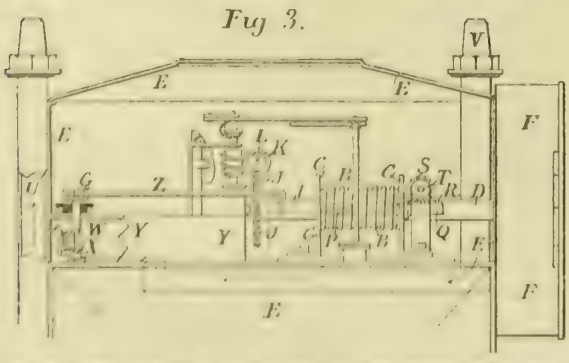
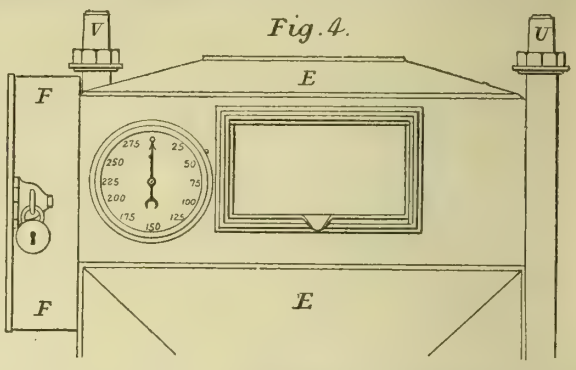


Fig. 1 is a top plan of an ordinary dry gas meter, with the cover removed. Fig. 2 is a part sectional front elevation. Fig. 3 is a part sectional back elevation. Fig. 4 is an exterior front elevation of part of the meter.

Two screws A B are mounted between frames C, and have reduced ends or spindles D I that revolve in bearings formed by the frames C. The end of the spindle D projects through the meter-casing E into a box F, to which a hinged door is secured. The end of the spindle I, projecting from the screw B, is fitted with a worm-wheel J, that gears with a worm K fixed to a spindle L, one end of which is supported by the usual registering mechanism frame M, the other end by a pillar or bracket N. Each screw A B is in gear with a pinion P, on opposite sides, for imparting a rectilinear motion to the bar Q, to which the pinion is pivoted when either of the screws is rotated. A rack R is cut upon, or attached to, one end of the sliding-bar for gearing into a pinion S, secured to a spindle T, rotating in supports. Upon the end of the spindle T is a small index-finger that, moving over the indices of a dial, shows to the consumer the amount of gas prepaid or remaining unconsumed. The valve X is preferably enclosed within the usual bellows-valve chamber Y, and is operated by a link connected to the end of the sliding-bar Q and the crank G fixed to the end of the vertical spindle H projecting from the stuffing-box of the chamber Y.

Fig. 4.



The action is as follows: Assuming that the invention is not used in connection with coin-freed mechanism, but that a consumer wishing to obtain a supply of gas has paid for the delivery of a given quantity, the gas company's representative would open the box F, and (by means of a key or handle) turn the spindle D and screw A, which, by gearing into the pinion P, causes it to turn upon its pivot and move over the teeth of the other screw B, as upon a rack. This would cause the bar Q to slide longitudinally in its bearings a distance proportionate to the number of times the screw is rotated by the official, who would continue the rotation until the index-finger moved to the numeral representing the quantity of gas in cubic feet for which he has been paid. The longitudinal movement before mentioned of the bar Q, by the intermediation of the link and spindle H to which the valve X is connected, removes the valve from the orifice or seating W, and allows the gas to enter the consumer's pipe from the outlet U. When being consumed, the gas enters the meter by the inlet V, and operates the bellows and usual radial link-gear in the ordinary manner; but it also rotates the screw B, by means of the worm K gearing into the wheel J fixed to the end of the spindle I. This rotation of B, consequent upon the passage of gas through the meter, turns the pinion P upon its pivot in the reverse direction, and moving over the teeth of the first screw A as upon a rack, it causes the bar Q to return and move the index-finger to zero, and the valve X to close and stop the supply.

APPLICATIONS FOR LETTERS PATENT.

15,559.—Lang, J., "Device or meter for indicating the quantity of liquid passing through a tap, pipe, or the like." Aug. 19.

15,617.—Hall, C. F. N., and James, T. W., "Device to prevent the explosion or the igniting of the gas inside gas-burners, such as are known by the name of Bunsen burners." Aug. 20.

15,629.—Middlebrook, C., "Apparatus for receiving coin and supplying gas in exchange." Aug. 20.

15,659.—The Economical Gas Apparatus Construction Company, Ltd., and Merrifield, L. L., "Manufacture of carburetted water gas." Aug. 20.

15,780.—Challender, J., "Illuminating clocks, lamps, and signs, &c." Aug. 22.

15,795.—Walther, R., "Incandescence filaments and other similar bodies for use in incandescence gas or vapour lamps." Aug. 22.

15,857.—Edge, K., "Motor for use with air, gas, steam, or liquids under pressure." Aug. 23.

15,890.—Rohrbeck, E., "Gasifying and increasing the heating power of the gases of easily inflammable liquids." Aug. 23.

15,974.—Picken, W. B., "Governor gas-burner." Aug. 24.

Adoption of the Sale of Gas Act in Kent.—At a meeting of the Kent County Council last Wednesday, the Weights and Measures Committee reported that they had received many complaints that there are no inspectors in the county authorized, under the Sale of Gas Act, 1859, to examine and test gas-meters. Being of opinion that both buyers and sellers of gas ought to be protected against meters which register incorrectly, the Committee recommended the Council to resolve that the Administrative County should be brought under the operations of the Act, and that the Inspectors of Weights and Measures should be appointed to carry out the duties. The recommendation was adopted; and the Committee were directed to report as to the apparatus required.

Bradford Corporation Water Supply.—The Bradford Corporation are incurring considerable expense in connection with their water undertaking. They have had to bear the cost of the litigation with Mr. Pickles, as lately mentioned in the Journal; and now a claim for £30,000 is put forward by Mr. T. E. Yorke for an easement, seven or eight miles in length, for the new pipe-line from the Nidd Valley reservoir, through his estates at Stonebeck and Appletreewick. This matter has been submitted to arbitration; and Mr. Oakley has been appointed Umpire. It is reported that the contents of the Chellow Dean reservoir—some 30 million gallons—have had to be run to waste owing to the discovery of decomposed human remains therein. The value of this water is put at £1200.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Comparative Cost of Electricity and Hydraulic Power.

SIR,—I have only to-day seen Mr. Denny Lane's letter in your issue of Aug. 20, in which he calls attention to what he supposes to be a mistake in the figures taken from my paper read at the recent meeting of the Institution of Mechanical Engineers at Glasgow.

A Board of Trade unit of electricity is 1000 watts flowing for one hour. One horse power=746 watts; so that a Board of Trade unit of electricity=1⅓-horse power. 2·76d. per unit=2·07d. per horse-power-hour. 3d. per brake-horse-power-hour is correct on the assumption that the efficiency of the hydraulic motor is 69 per cent. If the efficiency is taken at 75 per cent., the cost per brake-horse-power-hour would be the same as the cost of the unit of electricity.

Mr. Lane has confused the brake horse power with the energy of the electric current.

E. B. ELLINGTON.

Palace Chambers, Westminster, Aug. 28, 1895.

Illuminating Gas for Heating Purposes.

SIR,—Mr. Frederick Siemens, in his paper on this subject (*ante*, p. 439) made many statements which will not bear examination, and which unfortunately are made at the expense of other manufacturers' reputations. A few of the statements are appended in the order given, and also the actual facts, which are easily verified.

"A heating apparatus must be cheap." The price of a Siemens stove, in common sheet iron, is £7 10s. How long this stove will last, without rusting through, many of your readers will know. Referring to cast-iron stoves, he states: "The heated iron permits the poisonous gases of combustion, for instance, *carbonic acid*, to pass through it." It is well known, even to young beginners in chemistry and hygiene, that carbonic acid is *not* poisonous, and is as inert as nitrogen, which is the largest constituent of ordinary air. He states: "I classify under the head of 'common stoves' all stoves of which the external surface is heated to over 212 degrees." This is, as stated by Mr. Siemens, to prevent the charring of organic matter floating in the air; and very strong language is indulged in. He may safely classify his own stove along with these, as it readily chars paper or any organic matter placed on any of the heating surfaces.

Mr. Siemens makes the usual statement that "a regenerative gas-flame radiates at least twice the heat of a common gas-flame." This is a tale which has become almost historical by reiteration. That a regenerator *lamp* radiates much heat, is true. That the *flame* does this, has yet to be proved; and certain facts point to the contrary. I do not wish to advertise any maker; but I have in my possession some reflector stoves (which are not regenerators) which burn the same quantity of gas for the size and width as the Siemens, and which give a far greater percentage of radiant heat. These may be tested by an expert for comparative duty as regards radiant heat. The fact is that the gas consumption in the Siemens stove—*i.e.*, 3 cubic feet for every 1 inch length of burner = 24 cubic feet per hour in an 8-inch burner—is enormously in excess of that which has been considered in this country desirable for stoves of this class; and, given a gas consumption as large as that in the Siemens stove, there is no difficulty in making good reflector stoves without regenerator, which, for radiant heat, will compete successfully with any incandescent fire.

Those who have had experience with regenerator burners will be able to judge of the permanence (or otherwise) of a regenerator made of sheet iron.

THOS. FLETCHER.

Warrington, Aug. 31, 1895.

LEGAL INTELLIGENCE.

A Water-Rate Question at Kingsand.

At the Torpoint Petty Sessions last Wednesday, ten persons were summoned by the St. Germans District Council for the non-payment of water-rates due. The first case taken was that of Mr. P. M. Phillips, of Kingsand; the amount claimed being 1s. 10½d. Mr. F. Cleverton, who represented the Council, mentioned that some time since £7000 was borrowed for the purpose of providing Millbrook and the district with a water supply; and a scale of charges was drawn up. Mr. Clark, a turncock, admitted that for the past three months there had been only one available stand-pipe in Kingsand from which the inhabitants could obtain any water; all the other taps being dry. Mr. Harris, the Manager of the Torpoint Water-Works, stated that he regarded the charges as very reasonable. Mr. Martyn, for the defence, before dealing with the question of supply, submitted that the only way in which the Council could make a rate was under section 56 of the Public Health Act, which specified that the rate must be made on the net annual value of the premises. In the case in point, it was on a sliding-scale, and the defendant would have to pay on a rateable value of £6; whereas the sum under the Act was £4 10s. He said that section 62, upon which Mr. Cleverton relied, only applied to cases where the inspector reported that it was necessary to lay on a water supply. The Magistrates upheld the objection, and dismissed the summons. Mr. Cleverton was granted leave to appeal; and the other nine summonses were accordingly adjourned for a month.

A New Reservoir for Holyhead.—In consequence of the recent scarcity of water and the growing needs of the town and neighbourhood, the Holyhead Water Company have decided to construct a new reservoir. It will be the third open reservoir, and will cover an area of 2½ acres. The cost, including the site, will be £5000.

MISCELLANEOUS NEWS.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The revenue of the Abingdon Gas Company for the six months ending June 30 was £2200; and the expenditure, £1613—leaving £587 to be carried to the profit and loss account. The amount available for distribution is £825; and, at the meeting of shareholders next Thursday, the Directors will recommend dividends at the rate of 6s. 3d. per share on the original shares, and of 4s. 4½d. per share on the "B" shares, which will absorb (after deducting income-tax) £428, and leave £397 to be carried forward.

The shareholders of the Cork Gas Consumers' Company had their 53rd ordinary general meeting on the 21st ult., when the Directors stated in their report (which was signed by Mr. Denny Lane, the Secretary) that notwithstanding the reduction in the price of gas, amounting to upwards of £1200, which has been in operation since December last, the rental in the six months ending June 30 showed a satisfactory return. This arose partly from the fact that very cold and dark weather prevailed in the quarter ending March. In consequence of having accumulated a large stock of coke, the Directors were induced to lower the price of that article throughout the half year; and this led to a diminution in the receipts from residuals. Sulphate of ammonia realized a fair price; but the Directors did not regard the prospects as favourable. The Company's Engineer (Mr. G. Anderson) reported that the works had been kept in efficient order, and were more than adequate to meet all demands. Since the introduction of the system of gaseous firing in the old works, much more gas is made there than formerly; and this has caused a deficiency in condensing plant. The Manager (Mr. T. Travers) is now enlarging this by bringing into action some vessels which have been out of use since the employment of wet lime in purification was discontinued. This has Mr. Anderson's entire approval. Generally, the capacity of the works is ample for the next two years. The accounts accompanying the report showed that the revenue in the six months covered by it amounted to £26,141; the expenditure, to £18,827—leaving £7314 to go to the profit and loss account, which with the balance of £5708 brought forward made a total of £13,022. A sum of £600 was added to the depreciation fund; and the payment of interest, &c., brought the balance down to £5428. As the dividend would absorb £5652, it was necessary to take £224 from the reserve, which would then stand at £14,296.

In moving the adoption of the report at the half-yearly meeting of the Derby Gas Company last Wednesday, the Chairman (Mr. H. Swingler) described the railway race to Aberdeen as similar to the contest at Derby between gas and electricity. Fortunately, they could now see the actual result of the contest in Derby; and contrary to the opinion of some, it was not detrimental to gas. The first complete comparison between the two illuminants had been made; and he was delighted to be able to tell the shareholders that the increase in the consumption of gas during the six months ended June 30 had amounted to 13,031,000 cubic feet over the corresponding half of last year. Against this there was a slight drawback, as the item for public lighting showed a decrease of 1,285,000 cubic feet. The gross revenue for the half year had been less by £11,073; and the expenses had been £750 more. This might sound inconsistent, but he had a good explanation to offer. There had been a reduction of 3d. per 1000 cubic feet in the price, which had made a difference in the revenue of about £1800. Besides this, there had been low prices obtained for residuals, with the exception of tar, which showed a slight increase. The principal item of decrease was in sulphate; and altogether they had lost £985 on the residuals. There was, nevertheless, an increase in the quantity of gas consumed by private customers, a great part of which had arisen through the introduction of gas-stoves, of which they had 619, against 300 at this time last year. After paying the statutory dividends of 10, 7, and 5 per cent., they were enabled to place a comfortable sum to the reserve fund; and he felt the Company had nothing to fear from competition.

The ordinary meeting of the Douglas Gas Company was held yesterday week. The Directors reported that the net profit for the past half year was £3272 in advance of the corresponding period of 1894. The Directors also stated that, in consequence of an exceptionally favourable coal contract, they would be able shortly to reduce the price of gas 2d. per 1000 cubic feet. A dividend of 30s. per £25 share was declared; being an increase of 2s. 6d. per share.

At the half-yearly meeting of the Eastbourne Gas Company yesterday week, the Directors submitted a report showing a profit of £6111, which, added to £9671 brought forward and £225 received for interest, gave £16,007 available for dividend. The Directors recommended that a dividend for the past half year be declared at the rate of 14 per cent. per annum on the £20,000 original capital and also on £12,490 (the amount raised on "C" shares), and at the rate of 11 per cent. upon the £65,000 paid-up capital raised on "B" shares, which will absorb £5849, and leave £10,158 to be carried forward. The Directors also referred to the loss to the Company of Mr. G. Lenny, who was for many years a Director. In addressing the shareholders, the Chairman (Dr. G. A. Jeffery) made the satisfactory statement that the sale of gas had increased from 97,716,000 cubic feet in six months last year to 107,724,000 cubic feet this half year—a gain of 10,008,000 feet. The leakage was 2,504,000 cubic feet, or only 2 per cent., as against 2·84 per cent. This was extremely low; but it was borne out by the returns of 1892, 1893, and 1894. With respect to the residuals, they had not fetched so much in the market. The make of tar had been 10 gallons per ton. Sulphate of ammonia had increased to 21·4 lbs., as against 20·7 lbs. last year. On the other hand, the sale was very much less than it was in the previous half year. He supposed this was owing to the agricultural distress; farmers not being able to use so much for manure, as they could not pay for it. Of coke the yield was 9·5 sacks, as against 9·1 sacks; and the fuel account had been 20·6 per cent., as against 23 per cent. The motion was unanimously carried. Resolutions were afterwards passed, voting £105 towards the cost of the erection of a statue in Eastbourne to the memory of the late Duke of Devonshire; and electing Mr. C. Diplock to the vacant position on the Board. The thanks of the shareholders

were also tendered to the Chairman and Directors, and to the Consulting Engineer (Mr. H. E. Jones), the Manager (Mr. J. Hammond), and the Secretary (Mr. J. H. Campion Coles).

The Falmouth Gas Company will hold their fifth annual meeting next Thursday, when the Directors will report continued steady progress in the Company's business. Improvements in burners and the introduction of prepayment meters have tended to further popularize the use of gas. Up to June, 1894, there had been fixed 53 of these meters; but by the close of last June they numbered 131, and a consumption of nearly a million cubic feet of gas was registered by them during the year. With the view of showing the advantage of the incandescent system for public lighting, the Directors have put up seven burners in Market Street; and they express the hope that the Corporation will be induced to adopt the new light throughout the borough. The works and plant (under the supervision of Mr. J. W. Buckley) have been maintained in good order, and some improvements made; the chief of which has been the raising of the coal-store roof, to facilitate the stacking of coal in the outer portion of the store. It is proposed to pay a dividend at the rate of 12 per cent. per annum for the past half year—making 11 per cent. for the year; to transfer £135 to the reserve fund; and to carry forward the balance.

It was reported at the annual meeting of the Hartlepool Gas and Water Company last Thursday that the quantity of gas supplied during the year was 297 million cubic feet, which was an increase of 5 per cent. over the previous year. The gross revenue was £62,297, an increase of £1070; and the expenditure was £34,862. The Directors had lowered the price of gas by 1d. per 1000 cubic feet. The water supply had been 36 million gallons for manufacturing purposes, and for domestic use 646 million gallons. The Company suffered much from the severe frost of January and February; but not so seriously, the Directors thought, as some other towns. Dividends were declared of 8½ per cent. on the "A" shares, 7½ per cent. on the "B" shares, and 7 per cent. on the "C" and "D" shares, all clear of income-tax.

At the half-yearly general meeting of the Hastings and St. Leonards Gas Company next Thursday, the Directors will report a continued increase in the demand for gas. In the six months ending June 30, there was a rise to the extent of upwards of 9½ million cubic feet, or at the rate of 6 per cent., over the corresponding period of 1894. The Directors propose making a further reduction of 2d. per 1000 cubic feet in the price of gas as from Jan. 1 next; bringing it to the uniform figure of 3s. per 1000 cubic feet. It is satisfactory to find that the supply of gas by the prepayment system has been very successful; and the demand for automatic meters is increasing. The Directors point out that the development of incandescent gas lighting has placed in the hands of consumers a convenient, brilliant, economical, and hygienic light, which, when properly installed, is, they say, superior to any other system of artificial illumination. Experiments and investigations have been conducted for some time past by the Company's Engineer (Mr. C. E. Botley, Assoc.M.Inst.C.E.), with the view of minimizing the difficulties caused by naphthalene deposits, and the consequent troubles and annoyances; and it has been arranged to put the results obtained to a practical test at as early a date as possible. The financial statements accompanying the report show that a sum of £1777 was expended in the past half year on capital account, mostly on new mains, services, &c.; but upwards of £640 of it was for new meters and stoves. They also show a profit balance of £12,337; and the Directors propose to pay a dividend at the rate of 12½ per cent. per annum on the £25 shares, and of 9½ per cent. per annum on the £20 shares—carrying forward the balance. The quantity of coal carbonized or used was 17,196 tons 8 cwt. of Newcastle, &c., and 231 tons 4 cwt. of cannel; the gas production being 177,674,000, of which 172,887,300 cubic feet were accounted for. The estimated production of residuals was: Coke, 10,740 tons; breeze, 878 tons; tar, 176,247 gallons; and ammoniacal liquor, 350,883 gallons.

In the report to be submitted by the Directors to the shareholders of the Keswick Gas Company at the eighth ordinary general meeting to-day, they state that there is a balance of £1113 on the working for the year ending June 30, which with a sum of £647 brought from the last account, makes the sum of £1760. Deducting from this amount £8 for interest on loan, there remains £1752, from which the Directors propose to set aside £110 to the depreciation fund, and £194 to a mortgage redemption account; leaving £1448 available for distribution. They recommend a dividend at the rate of 8½ per cent. per annum on the original capital, and of £5 19s. per cent. per annum on the additional capital. This will absorb £834, and leave £614 to be carried forward. In order to increase the storage at the works, the Directors have entered into a contract with the Whessoe Foundry Company, Limited, of Darlington, for the erection of an additional gasholder, which is now being constructed.

The half-yearly accounts of the Milnrow Gas Company disclose a disposable balance of £646, out of which it is proposed to pay a dividend at the rate of 8 per cent. per annum, free of income-tax. The sale of gas realized £1782; and the residual products, £274. The total expenditure was £1373.

Notwithstanding the depressed season at Morecambe, the consumption of gas in the year ending June 30 was slightly greater than in the preceding twelve months; and there was an increase in the number of consumers. The reduction in the price of gas, which came into operation in October, lessened the amount received from its sale; and the low prices of sulphate of ammonia reduced the receipts from this product. On the other hand, the increased income from the general sales of residuals, and a decrease in the cost of coal and in expenditure on repairs, enabled the Directors to submit a satisfactory balance-sheet at the meeting of shareholders last Friday. The profit on the year's working, after payment of interest on the preference stock and mortgages, amounted to £2198, and this added to the balance of £108 brought forward made a total of £2306 available for distribution. Out of this, an interim dividend of 5 per cent. was paid in March, amounting to £1000, and the Directors recommended a further dividend of like amount, free of income-tax—leaving £306 to be carried forward. Under the supervision of the Manager and Secretary (Mr. W. Duff), 3344 tons 2 cwt. of coal were carbonized or used during the year; the estimated production of residuals being: Coke, 2090 tons; tar, 50,000 gallons; sulphate and ammoniacal liquor, 33 tons 1 cwt.

The shareholders of the Normanton Gas Company have held their half-yearly meeting. The Chairman (Mr. W. Statter) was absent; and his place was occupied by Mr. E. Mitchell. In his remarks, he stated that the Company was formed 26 years ago, and had never until now paid a dividend of 10 per cent. For some time after its formation, they had no dividend; and then they began with 2½ per cent. Many companies who had charged a higher price for gas from the commencement had paid 10 per cent. long before this Company were able to do so. Although the Directors did not raise the price during the coal strike, they had now decided to reduce the charge for the gas taken by the Normanton and Altofts District Councils by 4d. per 1000 cubic feet from Oct. 1; and they hoped to be able to reduce the price to ordinary consumers. Reviewing the accounts, the Chairman said the increase in the make of gas was 1,170,000 cubic feet compared with the first half of 1894. Rates and taxes had advanced from £108 to £163. They had had much trouble with the rating authorities since they constructed the new gasholder; but after an interview with the Assessment Committee and the valuer, they obtained a substantial reduction in the original assessment, though not what they thought they should have had. The total expenditure on revenue account was £1460. From the sale of gas they received £1936; from coke, £312; from ammoniacal liquor, £64; and the stock was valued at £158. The net profit was £1016; and it required £1000 to pay the 10 per cent. dividend. The report was adopted.

At the half-yearly meeting of the Rochester, Chatham, and Strood Gas Company last Thursday week, the Directors reported that satisfactory progress had been made during the six months ending June 30. The demand for gas continued to steadily increase; and the use of the incandescent gas-light was extending. The new station at the Gillingham works is now in working order. The Directors have thought it advisable to raise the washing and scrubbing power at both works The statement of accounts showed a total income of £26,313, with a net profit of £3018. It was decided to declare a dividend at the rate of 10 per cent. per annum on the "A" and "D" shares, and of 7 per cent. on the "B" and "C" shares.

The Sunderland Gas Company report a continued increase in the consumption of gas; the quantity manufactured during the past twelvemonth being 30,422,000 cubic feet in excess of the previous year. The total revenue was £83,995; and the expenditure, £66,989—showing a profit of about £17,000. An interim dividend was paid in March last; and the Directors recommend a like dividend of 5 per cent. on the original stock, and 4½ per cent. on the additional capital stock. It is proposed to sell by auction 1000 £5 shares at the close of the annual meeting next Thursday.

The half-yearly meeting of the Sutton Gas Company was held on Monday last week. Mr. C. R. Mead presided. The report stated that the severe frost of January and February caused an unprecedented demand for gas, which was duly met by an exceptionally large production at the works. An extension of the exhausting and purifying plant was being effected this year to meet the growing consumption of gas. The Directors had decided to further reduce the price 2d. per 1000 cubic feet; making the general price 3s. 4d., less 6d. per 1000 feet discount, or a net price of 2s. 10d. To large consumers the price would be 2s. 8d. for all gas consumed beyond the first 100,000 cubic feet per annum. The profit for the half year amounted to £1980; and dividends at the rate of 10 and 7 per cent. per annum on the original and the additional capital were declared.

The Warminster Gas Company have earned a profit on the past year's working of £715, out of which a dividend at the rate of 6 per cent. has been declared. The 2d. added to the price of gas during the coal strike is to be taken off from Sept. 29; and this will make the charge 3s. 6d. per 1000 cubic feet.

The revenue of the Wellingborough Gas Company, Limited, for the half year ending June 30 was £5653; and the expenditure, £3828—leaving £1825 to go to the profit and loss account. As the consumption of gas has increased, and the Directors have been able to make rather more favourable contracts for coal, they purpose reducing the price of gas 2d. per 1000 cubic feet as from the 29th inst. At the half-yearly meeting on Monday last week, dividends of 5½ and 4 per cent. for the half year were declared on the three classes of the Company's stock, free of income-tax.

The ordinary meeting of the Wolverhampton Gas Company was held last Tuesday, when it was reported that a profit of £8281 had been made in the half year ending June 30 last; and the Directors recommended dividends of 5 and 3 per cent. upon the various classes of stock. The Chairman (Mr. H. Ward) reminded the proprietors that the Directors had reduced the price of gas from 2s. 9d. to 2s. 6d. per 1000 cubic feet. The lower price came into operation last quarter, when the least gas of the whole year was consumed. There was reason, therefore, to believe that they had not yet experienced the full effects of the reduction. The price at which the residuals were sold had seriously declined; and the falling off last half year amounted to between £700 and £800. He complained of the rise in the rates and taxes; these charges having been increased in two years from £2221 to £2921. The gas-rental was large; and they had no reason to anticipate a reduction, nor had they cause to fear the competition of the electric light. The Directors were now asking for a further increase of capital. Twelve years ago they had £8500 to their favour at the bank; but now they had an overdraft amounting to £7088. It was not in the interests of the Company to allow this condition of things to continue; and it was therefore intended to raise additional share capital in order to cover the expenditure which had produced the change in the balance of their banking account. The motion having been passed, it was decided to create and issue £15,000 of new ordinary stock, to bear interest at 6 per cent. The Chairman explained that at the last sale of stock each £100 share realized £121. He said they had only power to raise £80,000, including premiums on the shares; and it was expected that £15,000 of stock would realize £18,000.

Water Companies.

At the half-yearly meeting of the East Warwickshire Water Company last Thursday, the Directors reported that the gross amount of water-rates was £1067, as compared with £997 in the corresponding period of 1894. The sources of water having proved insufficient, the

Directors have requested Professor Lapworth, of Birmingham, to report fully upon the water-bearing strata of the entire district. On the receipt of his report, they will be able to arrive at a conclusion as to whether or not the present works may be continued with advantage, or whether it would be advisable to erect works elsewhere, so as to secure an ample supply of water to meet the rapid increase of the town. The Chairman (Captain H. Townshend), comparing the expenditure of the half year, said there had been an enormous increase; but this was mainly due to the borings for water. Owing to its scarcity, the Company had not made more connections with houses than could possibly be helped. The work done at the wells had entirely failed to produce an increased supply of water; and the cost of boring and heading had been so considerable, that they had decided on stopping the works altogether. The time had arrived when the town would have to seriously consider what must be done to secure an ample service of water. The present wells would not yield an increased supply; and the Company were not prepared to commence new works, apart from their present ones. The report was adopted; but no dividend was declared.

The annual general meeting of the Lewes Water Company was held last Tuesday. The Directors reported that the receipts in the year ending June 24 amounted to £3331; and the expenditure, to £1295—leaving a balance of £2036. The interim dividend paid in February took £1035; so that there was left for disposal the sum of £1001. The Directors recommended dividends of 5, 3½, and 2½ per cent. on the various stocks for the half year (being 10, 7, and 5 per cent. for the year). These would require £1035; and therefore £34 had to be taken from the reserve fund. In moving the adoption of the report, the Chairman (Mr. F. Verrall) expressed regret at the loss the Company had sustained by the death of Mr. Lenny, who had been connected with the Company since 1865, and had occupied the chair for a great many years. Mr. Broad, in supporting the motion, said the proprietors would notice that the expenditure had been rather heavier than in the preceding year; but when they considered the frost of the past winter, it was not to be wondered at. They experienced great difficulty, and the Manager (Mr. A. Wells) was at his wits' end to keep pace with the leaks. After the frost they had a dry season, and the quantity of water sent out was immense. During the year, they had connected 29 old houses and 9 new ones, making 38 new customers. The estimated bulk of water pumped during the year was 119,897,000 gallons, as compared with 113,205,000 gallons in the preceding year; being an increase of 6,692,000 gallons. The report was adopted, and the dividends recommended were declared.

At the half-yearly general meeting of the Maidstone Water Company on the 22nd ult., the Directors reported that the water-rents amounted to £4701, and that there was a profit of £1890 available for division. They recommended the payment of a dividend, free of income-tax, for the six months, of £4 0s. 10d. per cent. on the 10 per cent. shares, and of £2 16s. 8d. per cent. on the 7 per cent. shares. These payments would absorb £1811. The dividends were respectively £4 12s. 6d. and £3 5s. in the corresponding half of 1894. The Chairman, in moving the adoption of the report, said he should like to have been in a position to tell the proprietors that the dividend was a little better, instead of a little worse, than it had been; but he saw no reason for any suggestion that things were not going on satisfactorily. They must remember that they had had a very trying half year. In the first portion of it, they had extremely severe frost for a very lengthened period; and at the latter part, they had a scorching drought. In the one case, damage to a considerable extent was done to the mains and pipes of the Company; and in the other, extra expense was incurred in pumping water to meet the large demand. Further, during the severe frost, the consumption of water fell short in consequence of meters being frozen in many cases for a long time; and in each instance consumers were unable to get water through them. Therefore, the Company had suffered in three different ways during the half year; and the fact that the dividend was not quite so much as usual was clearly accounted for. He was in a position to say that the works of the Company were in an exceedingly good state of repair; this being due to the earnestness, ability, and energy of their Engineer and Manager (Mr. W. Ware). The report was adopted; and the dividends recommended were declared.

At the half-yearly meeting of the South Staffordshire Water Company last Thursday (Mr. Frank James in the chair), the Directors' report, noticed in the JOURNAL on the 13th ult., was presented. In moving its adoption, the Chairman remarked that it covered the period of the great frost of the past winter, which, for severity and length had not been equalled within the memory of any of them. Its effect upon the Company was shown in the balance-sheet. It had absorbed a large amount of money, which fortunately they had in hand; and it would now be their duty to build up a balance such as they had before. They had always carried forward a large sum for contingencies; and this course had stood them in good stead during the late frost. It was sometimes said that water companies might provide against such contingencies by laying the mains, &c., deeper; and their works had been criticized. Their pipes had been laid to the best advantage. They had had to relay nine miles of mains that were burst through the frost; and considering that the length of a section was only about 9 feet, this represented more than 5000 mains which had been fractured. Engineering charges had been increased by £300, in consequence of a larger quantity of water than usual having been pumped. Something like 293 million gallons were pumped during the half year in excess of the corresponding period. An enormous quantity necessarily ran to waste through consumers leaving their taps running, or through the breakage of the pipes. The largest item was for maintenance of works, which was £6813, compared with £2547 in the corresponding period of last year. The sum included the cost of relaying the nine miles of mains and the cost of the pipes. The ever-increasing item which represented rates was £3744—£350 more than in the corresponding half year. On the other side, the water-rates received had advanced from £41,378 to £42,551. They brought down a balance of £15,956; and the dividend paid on the entire stock of the Company amounted to £15,817—leaving only £139 to be carried forward, as compared with £4779 in the corresponding period. The Directors had thought it wise not to decrease the dividend, as they looked upon the circumstances with which they had had to deal as purely exceptional. Mr. Townshend seconded the motion, which was agreed to. Formal resolutions were also passed declaring the dividends recommended. An extraordinary meeting was then held to authorize the issue of £30,000 of stock, the unissued portion of £50,000 of new stock created by resolution in August, 1893; and to raise a further sum of £50,000 of the new stock sanctioned by Parliament in that year. The Directors' proposals were agreed to.

The revenue of the Woking Water Company during the half year ending June 30 last amounted to £3109, and the expenditure to £1280. The outlay incurred through the late frost was £330; and one-third of this amount has been charged to the past half year—making the total expenses £1390. The balance carried to profit and loss account is £1719; and the sum available for division is £1527. An interim dividend at the rate of 4 per cent. per annum for the half year was declared at the meeting of the shareholders last Tuesday. This will absorb £1471, and leave £56 to be carried forward. The total expenditure on capital account to June 30 has been £79,978. The Directors in their report expressed deep regret at the death of their colleague Mr. Walter G. Gribbon, whose services were of great value to the Company. The vacancy has been filled by the election of Mr. W. Edmonds, J.P., who for many years has been Auditor to the Company.

CROYDON COMMERCIAL GAS AND COKE COMPANY.

The Half-Yearly General Meeting of this Company was held last Wednesday, at the Offices, Katharine Street, Croydon—Mr. CHARLES HUSSEY, J.P., in the chair.

The SECRETARY (Mr. W. J. Russell) having read the notice convening the meeting,

The CHAIRMAN moved the adoption of the report and accounts. In doing so, he first referred to the sale of gas, which had amounted in the half year to 283,754,300 cubic feet. In the corresponding period of last year, it was in the Croydon district 236,951,500 cubic feet, and in the Carshalton district 14,893,200 cubic feet, or a total of 251,844,700 cubic feet. This gave them an increase of 31,909,600 cubic feet, or an unprecedented advance of 12·67 per cent. This, of course, was an abnormal rise, and one easily accounted for by the Arctic weather experienced in January and February last. Having explained that such high rates of increase consequent upon severe weather were not always a great benefit to gas companies, he turned to the residual products, which, he said, on the whole, had not been so satisfactory as the Directors could have wished. For instance, although an additional 5987 tons of coal had been carbonized, only £9660 had been realized for coke, which was £858 less than in the corresponding period of last year—the loss being equal to 1½d. per cwt. Fortunately, another residual had come to their rescue. They had sold a much larger quantity of tar, and had realized ½d. per gallon more for it, which, in round figures, represented £1203, which more than wiped out the balance against them on coke. They had made a considerably larger quantity of sulphate of ammonia, which, however, showed a drop of something like £2 15s. per ton; and at present there was no prospect of improvement in the price. Although they had sold more sulphate, they had received £138 less for it. Regarding prepayment meters, 123 more cottages had been fitted up under this system; making the total number 1005. Additional cooking and heating stoves had been supplied; making the total now on hire 2837. In the report reference was made to the revaluation of the Company's property for local taxation. A re-assessment was ordered by the Assessment Committee of the Croydon Union; and they assessed the Company's property at a sum which the Directors considered most unreasonable. They tried their very utmost to meet the Committee fairly in the matter, and even went beyond what they thought they were justified in doing, in order, if possible, to prevent litigation. The Committee, however, would not meet them. The Company were very much indebted to their friend, Mr. Corbet Woodall, who, happily for them at the present time, was one of their Directors. He had spent a great deal of his time in going into this matter, with the object of meeting the Assessment Committee to the extent he thought was right—in fact, rather more than he thought was right. As the proprietors knew, they had two days' fighting, when unfortunately, at the request of one of the Counsel (who, the Directors thought, had an object in view in wishing to postpone it), the case was adjourned until Nov. 1, when the Directors hoped to get a reduction to considerably below what they offered as a mediation in the matter. The next matter to which he had to refer would, he believed, be pleasing to the consumers, and would, he trusted, meet with the approval of the proprietors. It was that the Directors had reduced from July 1 last the price of gas from 2s. 9d. to 2s. 8d. per 1000 cubic feet in the Croydon district, and from 3s. 6d. to 3s. 5d. in the Carshalton district, and had lowered the charges for meters from 1s. 3d. to 1s. per quarter. These reductions would give an immediate benefit to the consumers of £2800 per annum. Some of the proprietors might think it was time they had a further increase in dividend. But, of course, the Directors had to take all the circumstances into consideration; and they believed the course they had adopted was a wise one. The Directors proposed to place £1000 to the insurance fund, and to add £1755 to the reserve fund, which would make the total of the two funds upwards of £44,500. After paying the usual dividends, and transferring the two sums just referred to, there would be a balance of £4320 to be carried forward, or about sufficient to pay one-third of the next dividend. Turning to the accounts, he pointed out that the total capital expenditure to June 30 last was £316,776, which worked out to about £5 7s. per ton of coal carbonized, which was a low figure. The expenditure of capital during the half year amounted to £11,977. Nearly the whole of this was comprised of amounts that had been paid to Messrs. John Aird and Sons and Messrs. C. & W. Walker for the construction of the new tank and holder. Not only did he think so, but experts on gasholders had expressed the opinion that there was not a better holder in the kingdom. It was certainly light in appearance; and some of the proprietors might regard it as a flimsy-looking structure compared with their other holders. But it was not so, as in one case the columns were rolled

steel, and in the other of cast iron. This holder did their Engineer (Mr. J. W. Helps) infinite credit, because he designed it, and it had been carried out under his superintendence. It was intended to hold 3 million cubic feet of gas, or more than the whole of the three existing ones; so that for some time Mr. Helps, he believed, would be satisfied with his storage accommodation, and would not call upon them to spend another £33,000, which was the cost of this holder. The other items of capital outlay were: Mains, services, &c., £791; meters, £358; and stoves, £571. The balance of capital was only £1905. The receipts from sales of 283,754,300 cubic feet of gas in the six months amounted to £40,397. By an unfortunate mistake (which the Secretary wished him to explain), the quantity of gas used on the works was entered in the accounts as 1,169,400 cubic feet, instead of 3,661,200 feet —the error being due to a quarter's consumption having been taken instead of the half-year's. The total quantity of gas accounted for should therefore be 287,415,500 cubic feet, instead of 284,923,700 feet; and the amount unaccounted for 14,451,500 cubic feet, instead of 16,943,300 feet, which was equal to 4·77 per cent. on the quantity of gas made, which, for them, was rather a high percentage. He explained that some of the leakage was attributable to the condition o the Carshalton mains; but Mr. Helps was doing his best to eradicat the defective pipes as quickly as possible.

The Deputy-Chairman (Mr. A. J. Lambert) seconded the motion, which was unanimously carried.

The following dividends were next declared: At the rate of 14 per cent. per annum on £51,600 consolidated "A" stock; 11 per cent. on £157,500 "B" stock; and 9 per cent. on £25,000 "C" stock, and on 2500 ordinary £10 shares on which £2 have been paid (Carshalton capital).

Mr. Corbet Woodall then moved a resolution to the effect that a sum of £1755 15s. be placed to the reserve fund. He remarked that they had not at present a reserve fund amounting to the 10 per cent. authorized under the Act of 1847, before the sliding-scale was introduced. As no doubt the proprietors were aware, they could now only add to this fund out of money that might be distributed as dividend. The proprietors were entitled to a larger dividend than was at present declared; and this £1755 represented the balance that might have been paid to them had they chosen to take it. It was hardly necessary to say that a reserve fund was better for the Company than an inflated dividend; the accumulation of such a fund being a security that the dividends would be maintained for at least some time to come. It was right that he should call attention to the fact that the £1755 had not been earned in the half year, nor even the £1000 which had been transferred to the insurance fund; for, after paying interest and dividends out of the half-year's profits, they had only a balance of about £800 towards the two amounts referred to, and the rest was taken from the undivided profits. It was extremely satisfactory to the Directors to find the proprietors were in accord with them in regard to the reserve fund, as he felt quite sure it was to the true interest of the Company. The reduction in price that had taken place, would more than wipe out the balance of the half-year's earnings; but they had sufficient faith in the future of the gas industry in Croydon not to be afraid to go a little beyond what the actual earnings of the past half year would seem to justify.

Mr. J. Pelton, J.P., seconded the motion, which was passed.

The Chairman moved a resolution authorizing the Directors to raise £20,900 of consolidated "B" stock. He explained that they received the sanction of the shareholders in August, 1892, to raise £30,900 by the issue of ordinary £10 shares; and of this they had raised £10,000. By their Act of 1894, they had obtained power to issue stock instead of shares; so that he was simply proposing this resolution to bring them into conformity with the new Act.

The motion was carried.

Alderman Layton proposed a vote of thanks to the Chairman and Directors, remarking that he hoped the new coal contracts would enable the Directors to arrive at a larger return than last half year.

Mr. Magnus Ohren seconded the motion, which was agreed to.

The Chairman, in responding, observed that the Directors had made satisfactory arrangements with regard to coal; and he thought they could see their way clear to present on the next occasion an equally good balance-sheet to the present one.

The services of the Secretary and Engineer and their respective staffs were also duly acknowledged.

The Early History of the Company.

At the conclusion of the ordinary business at the above meeting, Mr. W. Hyslop, who, after having been a Director since the formation of the Company, resigned his seat last year, gave the proprietors a short account of the history of the concern. He said that gas-works were first established in the town some fifty years ago by a Mr. Defries. They were only on a small scale. Shortly after the works were purchased by Mr. Henry Overton, a brewer in the town. There was a great outcry as to the supply and the impurity of the gas, and more especially as to the price, which was 13s. per 1000 cubic feet. He himself was at that time a consumer. It was thought that something ought to be done; and he and one or two friends had several meetings to consider the question. These resulted in a Committee being formed; and those who constituted it called public meetings to discuss the object they had in view. Eventually it was resolved to negotiate with Mr. Overton with regard to the purchase of the works. He offered to receive £8000 for them; and, after a little consideration, this was agreed to. Then a Company was floated with a Board of eight Directors; but no sooner had they done this, than they were informed that an opposition Company was being started. The latter proceeded at a rapid rate; put in the foundations for their works; and went to considerable expense. They, however, saw danger ahead, and wished to meet the Directors of the first Company. A meeting was arranged; and, at the interview, they stated they would have no objection to withdraw the opposition if the Company would pay the expenses which they had incurred. They placed the amount at £1800, but accepted £1000. This Company then proceeded, under considerable difficulties, for ten years; the Directors acting without any fee or reward. The shareholders then granted the Directors £100 for division among them. There were at that time a great many complaints as to the impurity of the gas; and the Company at length agreed to remove the works to Waddon. There they had remained; and he hoped the prosperity that had attended them would continue. Mr. Hyslop was thanked for his interesting statement; the Chairman remarking that it testified to the continued clearness of his memory.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly Meeting of this Company was held last Friday, at the Albion Tavern, Aldersgate Street, E.C.—Mr. James Glaisher, F.R.S., in the chair.

The Secretary (Mr. Alfred Lass, F.C.A.) having read the notice convening the meeting, the Directors' report and the accounts, to which reference was made in the Journal for the 20th ult., were taken as read.

The Chairman said that, but for the exceptional weather which had been experienced in the past half year, there would have been little for him to say upon the balance-sheet. Dealing first with the accounts of the gas undertaking, they showed an increased revenue from gas amounting to £388. The residual products, however, had all turned out badly. Coke had returned about the average; but sulphate of ammonia and tar were below—the result being that on residuals they had received less than in the corresponding period of 1894 by £157. In the half year, they made more gas by 3,563,000 cubic feet; they sold an additional 2,553,000 cubic feet; and the unaccounted-for gas was 955,000 cubic feet more. Owing to the severity of the winter, no less than five of the gas-mains were split, which caused the unaccounted-for gas to be more than 8 per cent. of the make in the half year. At Lady-day last, the price of gas was reduced 2d. per 1000 cubic feet; and he had been curious to know whether this had produced any beneficial effect on the sale of gas. He found, by comparing the three months commencing Lady-day last year and the corresponding quarter of this year, that 138,000 cubic feet more gas was sold. But this was only the normal quantity; and so far as he could see, no increase in the consumption had arisen from the reduction. It was therefore clear that the increased sale of 7 or 8 per cent. in the six months was only due to the cold weather at the beginning of the year. The revenue from gas was only £237 more than it was in the first half of last year. Looking at the other side of the accounts, with an extra outlay for the renewal of mains and £109 more for rates and taxes, the expenditure amounted to £6310, as against £5912; resulting in a less profit by £161 than in the June half of last year. Regarding the water undertaking, more water had been sold; and the revenue for the half year was £527 more. This showed a very healthy state of things; and with the normal increase continuing, there was every prospect of a good year. Turning, however, to the opposite side of the accounts, maintenance and repair of mains (which in the June half of last year cost £139) in the past six months had cost £770—no less than £631 more. Then the rates had increased by £137; so that the gain in the water revenue was considerably more than swallowed up. The expenditure amounted to £4029; and last year it was £718 less. The result of the working of the water undertaking was that there was a profit of £4837, or a decrease of £191. Respecting the frost, it began at Barnet on Dec. 31, on which day their Engineer (Mr. T. H. Martin) registered a temperature of 18½°. This extreme cold continued, with the exception of a week in February, to the middle of March. It was experienced most severely at the beginning of February. On the ground, Mr. Martin registered on the 6th 4°; on the 7th and 8th, the temperature was at zero; on the 9th, it was 1½° 10th, 1°; 12th, 8°; 13th, 2°; and 14th, 1½°. In all his experience, which had been a long one, with respect to temperatures, he (the Chairman) had never known such consecutive low temperature. The mean for the month on the ground was only 13½°. The temperature on Feb. 7 in the air was down to 1°, which was lower than he had ever experienced, except in a balloon. The lowest he had ever registered was 5° at Blackheath in 1855. The mean for February, in the air at Barnet, was 18°. On 26 days, the minimum in the air was below 32°; and on some days, the temperature of the air was below 32° during the whole 24 hours. The greatest depth from the surface to the top of their mains was 2 ft. 4 in. to 2 ft. 6 in.; and the least depth was 1 ft. 6 in. The temperature of the water on entering the mains was always 54°, or 22° above freezing-point The frost penetrated into the ground more than 3 feet. The water, however, was not frozen in any main, except when the circulation had been stopped by the service-pipes being blocked. The main that was closest to the surface—1 ft. 6 in.—was never frozen throughout the whole of the cold weather. This brought him to the effect upon the Company's system. They had from 7000 to 8000 consumers; and if they had all done as he did—poured hot water upon the ball-cock every morning until it worked freely—many of their services would not have frozen. At Barnet they had two districts—the north, in which the ground had some gravel mixed with the clay; and the south, in which it was all clay. In the north district, owing to the frost, they had 13 2-inch pipes broken, and in the north 25. Of 3-inch pipes the figures were 40 and 23 respectively; of 4-inch pipes, 11 and 13; and of 6-inch pipes, 1 was broken in each district. Altogether they had 127 fractured pipes. The stand-pipes fixed in the North district numbered 88, and in the South district 180—making together 268. In one case, Mr. Martin had to open the ground for ¾ mile, in order to melt the ice to allow of the stand-pipes being used. The winter had been a very exceptional one; and, in his (Mr. Glaisher's) report to the Registrar-General in April, he stated that February had been the coldest period experienced in England since 1771. Having referred to the drought which succeeded the cold weather, and which necessitated pumping day and night, he said there was one other matter to which he wished to allude. As the shareholders were aware, they had been trying to obtain another source of water supply. They had already spent a large sum upon the Finchley works, to get water from there. Part of this expenditure not being productive, the Board had considered it advisable to write off out of revenue a further sum of £500; so as not to charge it to capital. They

had now bought a piece of land at Potters Bar, and had sunk a bore-hole there to the depth of 372 feet. The water had been analyzed, and reported by Dr. Frankland to be very good. They were hoping now to get water from this neighbourhood; so that in future when they had to carry on work at the bottom of the wells at Barnet, no consumer would know of it by the chalky appearance of the water. He concluded by moving the adoption of the report and accounts.

Mr. C. Horsley, J.P., seconded the motion, which was unanimously carried.

Dividends were then declared, less income-tax, at the rate of 9 per cent. per annum on the "A" and "C" stocks, 8 per cent. on the "B" stock, and £6 6s. per cent. on the "D" capital gas and water stocks.

The Chairman moved a vote of thanks to the officials (Messrs. Lass, Martin, and Wright) and their staffs.

Mr. I. A. Crookenden seconded the motion, which was heartily agreed to.

The proceedings concluded with a vote of thanks to the Chairman and Directors, proposed by Mr. Magnus Ohren, and seconded by Mr. Cecil.

NEXT YEAR'S EXAMINATIONS IN GAS MANUFACTURE.

Those of our readers who contemplate submitting themselves as candidates at the next examinations in "Gas Manufacture" by the City and Guilds of London Institute will doubtless be glad to learn the nature of the questions that will be put to them by the Examiner (Mr. Alfred Colson, M.Inst.C.E., of Leicester). This they will be able to do from the "programme" of the Institute for the season 1895-6, which has recently been issued by Messrs. Whittaker and Co., of Paternoster Square, at the price of 10d. net., or with postage 1s. 2d. The book furnishes full particulars, in regard to the examinations in all the subjects taken up by the Institute, and gives a mass of information likely to be of use to students. The examinations in "Gas Manufacture" will be held on Tuesday, May 5, 1896, from 7 to 10 o'clock p.m.; and the questions in the Ordinary Grade will be founded on such subjects as the following:—

1. The construction of a retort or oven best adapted for the destructive distillation of coal. 2. The setting of retorts, and the construction of retort-furnaces. 3, The effects of temperature in modifying the quantity and quality of the gas produced. 4. The description and arrangement of apparatus employed for the conveyance of the gas immediately upon its leaving the retorts. 5. The description of apparatus best adapted for cooling the gas. 6. The most suitable condition of the gas for effective purification. 7. A description of the various instruments used in gas-works for ascertaining and recording pressure and exhaust. 8. The laying of mains and service-pipes. 9. The construction of gas-meters. 10. The fixing of meters and the fitting up of premises for the supply of gas. 11. A description of the various kinds of gas-burners in general use. 12. The use of an exhauster. 13. The methods employed for controlling pressure at the works, so as to secure an adequate supply of gas at the various points of consumption, with a due regard for economical effect. 14. The simplest methods of ascertaining the purity and illuminating power of gas. 15. A description of the materials and methods employed for the purification of gas. 16. Influence of temperature and atmospheric pressure upon the volume of gas. 17. A description of the various tests employed for determining the values of ammoniacal liquor and spent oxide.

In the Honours examination, more difficult questions will be set in the above subjects, and, in addition, a knowledge will be required of—1. The characteristic properties of the various kinds of coal, and their value for gas-making purposes. 2. The effects of temperature upon the production of residuals. 3. The chemical composition of coal gas. 4. The chemistry of purification. 5. Gas analysis. 6. The development of illuminating power. 7. The practice of photometry. 8. Labour-saving appliances in the retort-house, and the working of retorts. 9. The construction of gasholders, purifiers, and other gas apparatus. 10. The working up of ammoniacal liquor. 11. The principles of combustion, and their application to the working of retort-furnaces. 12. Carburetted water gas. 13. The enrichment of coal gas by means of oil, &c.

As mentioned in previous notices of the "programme," it contains a list of teachers competent to give instruction in the various subjects; and a large section of it is occupied with the questions set at the last examinations—accompanied by diagrams where required—with the maximum number of marks allowed for each question. The papers in "Gas Manufacture" were given in the Journal for July 2 last (p. 44). In the Ordinary Grade, the 300 marks were divided equally between the ten questions. In the Honours Grade, they were divided as follows: 30, 30, 20, 30, 35, 35, 30, 30, 30, 30.

An allied subject is that of "Coal Tar Products," the Examiner in which is Mr. Arthur G. Green. The examination will take place on May 5 next, from 7 to 10 o'clock p.m.

THE INTRODUCTION OF GAS LIGHTING IN DURHAM.

An Interesting Record.

We have received a copy of the *Durham County Advertiser* for Jan. 3, 1824, containing an account of the first lighting of Durham with coal gas. The paper is interesting in several respects. It was the first newspaper established between York and Newcastle; it was a 4-page sheet, rather smaller than *The Times* of to-day; and its price was 7d. The introduction into the northern cathedral city of what was then the new illuminant, is thus recorded—

This city was partially lighted with coal gas on the evenings of Saturday and Sunday last [Dec. 27 and 28, 1823], and was generally illuminated with the same brilliant material on Monday evening, and every night since. The change which this substitution of gas for oil has effected is perfectly surprising, for we behold a city, long notorious for its nocturnal darkness, become at once, perhaps, the very best—at all events one of the best—lighted towns in the kingdom. The street-lamps, which are of a most elegant form, are placed much nearer to each other than is usual in most towns; and this circumstance, added to the brilliance of the flame they contain, completely fills our narrow streets with a bright, yet beautifully soft and pleasing light. The general lighting up of the city on Monday evening excited a great sensation; and a band of music, which paraded the streets in compliment to Mr. West, the spirited proprietor of the gas-works, was attended by some hundreds of men, women, and children, as anxious to feast their eyes on the improved appearance of the town, as to gratify their ears with the music. The bell-ringers of St. Oswald's also complimented Mr. West with a merry peal, on the successful completion of his arduous undertaking. We cannot close this article without offering our congratulations to our townsmen on the *enlightened* state of the city, nor without bearing testimony to the liberality of Mr. West, who has, at his sole expense, erected the works, laid the pipes, and provided the lamps; engaging to light the town with gas for the same sum per annum that the lighting it with oil has hitherto cost. Thus Durham has exchanged a light barely sufficient to render "darkness visible" for one of great beauty and brilliancy, without having been at a farthing expense. On Wednesday evening last, a beautiful effulgent gas-star, having in its centre the letter W, was exhibited over the Piazza in the Market Place, and attracted vast crowds of spectators, who generally expressed themselves in the highest terms of admiration. This star, which would have been displayed on Monday evening but for the boisterous state of the weather, was planned, made, and exhibited by Mr. West's foreman, in compliment to his employer, to both of whom it certainly did great credit. The bells of St. Nicholas rang merrily during the time of the exhibition.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Chief Engineer's Report on Available Sources of Water Supply.

(*Continued from p.* 450.)

IV.—*Disposal of the Available Sources of Supply.*

As it is clear that the Metropolis does not yet require so large a supply as that which can be obtained in Wales, and as it is important so to lay out the works that they can be gradually extended as time goes on, we have to look to the most economical arrangement for availing ourselves of the bountiful supply above spoken of. In connection with this, and considering the importance before mentioned of preserving in the future two independent lines of communication, we can at once divide the above sources into two portions of approximately 200 million gallons a day each. One of these portions would include the Llangorse and Usk with the Edw supplies. These yield respectively 182 and 18 million gallons, or a total of 200 million gallons a day. The second division would include the Yrfon and Towy supplies, 135 millions; the Ithon, 37 millions; and the Upper Wye, 43 millions—a total of 215 million gallons per day.

When I come, in a later portion of this report, to speak of the aqueduct which will convey the water to London, it will be found that I propose to form this in two channels, each of a capacity of about 200 million gallons a day. Therefore we may, for the purposes of this part of the report, divide the scheme into the two portions above spoken of—viz., the Usk, Llangorse, and Edw; and the Yrfon, Towy, Ithon, and the Upper Wye.

But as a preliminary in carrying out the earlier portion of the scheme, it might suffice to take in, as a first instalment, the Upper Usk and Llangorse; leaving the Edw to be added when time requires. In the same way, in constructing the second portion of the scheme, embracing the Yrfon, Towy, Ithon, and Upper Wye areas, the Yrfon reservoir could first be constructed, with which the supply from the Towy could be brought in. This, when exhausted, could be supplemented from the Ithon; and ultimately the Upper Wye source could be rendered available. Advantage will be taken of the great benefit that is derived from decanting one reservoir into another, so as to ensure a due settlement to the largest possible extent by causing the Upper Wye reservoir, the top water-level of which is 900 feet, to discharge into the Yrfon reservoir, the top water-level of which would be 606 feet. In like manner, the reservoir on the Ithon would discharge into the reservoir on the Edw. The first section of the main conduit to London would start from Llangorse; the main conduit for the second section would start from the reservoir on the Yrfon.

By the above scheme, I think I have laid out the works with the greatest economy, having regard to the gradual utilization of the various sources already described.

V.—*Main Aqueducts to London.*

The above being the arrangement by which the whole scheme of works is divided into two main portions, it will be understood that, in the completion of the whole scheme, two separate aqueducts would be required. There is also another point which I think is deserving of attention, and which arises out of the fact that London is divided in the proportion of about six to four by the River Thames; and as the population increases on the south side of the river, which is at present less built over than the area lying north of the Thames, we may anticipate that, in all probability, the London of the future will be pretty evenly divided by that river. Consequently, looking to a complete scheme of works fifty years hence, it would be advisable, if possible, to avail ourselves of the two aqueducts which we contemplate to afford us an independent supply on both the north and south sides of the Thames, and which, being situated at about equal altitudes, would permit of the water flowing indifferently from either aqueduct through the old distribution pipes of the Metropolis.

These general principles being understood, there are two possible lines of aqueduct from Wales to London. One, which I will call the northern or midland counties line, could be carried along a line which,

starting from Hay in the Wye Valley, would pass north to Leominster, cross the Severn south of Stourport, north of Bromsgrove, south of Warwick and Leamington, touch the watershed of the Thames north of Banbury, and, going south of Buckingham, pass south of St. Albans to a proposed service reservoir situated a little to the north of the Elstree Hills.

The second possible line of aqueduct could be made to discharge all its water into the same reservoir situated north of Elstree; but it would be carried in a different direction. Leaving Hay in the Wye Valley, it would pass in a south-easterly direction, crossing the Wye south of Ross, tunnelling through the watershed between the Wye and the Severn, a little north of Micheldean and under Mayhill, it would cross the Severn by a syphon-pipe 13½ miles in length a little north of Gloucester, and by tunnelling through the Cotswold Hills, it would arrive at a point on the Colne, a tributary of the Thames, about two miles east of the village of Chedworth, at a place south-west of Northleach. This point on the Colne would be the spot at which a southern line could be carried for the supply of the south side of the Metropolis. That for the north would pass north of Witney and Woodstock, and, crossing the Cherwell, would pass south of Buckingham, eastwards of Aylesbury, and westwards of St. Albans to the before-mentioned reservoir near Elstree.

The southern line, to supply the south side of London, which would commence at the Yrfon reservoir west of Builth on the Wye, would pass down that river to near Hay, when it could be carried parallel with the before-mentioned line by way of Ross and Gloucester to Chedworth, from which point it would branch off south-eastwards; passing east of Swindon, a little to the south-west of Hungerford, north of Kingsclere, south of Basingstoke, midway between Farnham and Aldershot, south of Guildford, and along the downs to its termination at Banstead.

These being the possible lines along which an aqueduct might be carried, it becomes somewhat important to consider for a moment their respective advantages. It is clear that what I have called the northern or midland counties line does not lend itself very well to a supply for both sides of the Metropolis. It would be some 13½ miles longer than the northern branch of the southern line; it would have longer syphon-pipes, and would consequently require a greater head of water to overcome friction; so that the water delivered by it could not be discharged at so high a level as that carried along either of the other lines. On the other hand, there is no doubt that, if the supposed security of the London Water Supply from the attacks of a foreign enemy are to be taken into account, it runs along a line of country farther removed than either of the southern lines from our southern coasts, and consequently would presumably be less open to attack.

This also is an advantage possessed by the northern branch of the southern line, which passes from Chedworth by Buckingham to Elstree; but as I am not one of those who anticipate any danger whatever from this source, I think, on the whole, that the southern line from Hay by Gloucester to Chedworth, with its two branches terminating at Elstree and Banstead, is to be preferred. Consequently, in making my estimates of first cost, I have based them on the supposition that an aqueduct from Llangorse to London *viâ* Glasbury, Hay, Ross, Gloucester, Chedworth, and Buckingham to Elstree will first be adopted. This aqueduct would be 150 miles in length, and would discharge its waters into a reservoir at an altitude of about 312 feet above sea-level.

The second aqueduct, to be constructed at some future date, to bring in the waters from the Yrfon, the Towy, the Ithon, and the Upper Wye, would be parallel to the former from near Glasbury, Hay, Ross, and Gloucester, to Chedworth, and would then pass, by way of Hungerford, Basingstoke, and Guildford, to Banstead. This aqueduct would be 176 miles in length, and would discharge its waters into a reservoir at an altitude of 300 feet above sea-level.

I need hardly point out that the determination of the several routes has occupied me for a considerable time, as they have involved many trial sections, and many considerations too tedious and voluminous for mention in a report like the present, but the result arising out of the study of which I think I have fully expressed in what I have above stated.

Of course, were the northern branch of the southern line—that is to say, from Hay by way of Ross, Gloucester, Chedworth, and Buckingham, to Elstree—first constructed, there would be no reason why the northern or midland counties line, by way of Leominster, Warwick, and Banbury, should not hereafter be adopted; and though I think it would be of advantage, looking to the distant future, that London should be supplied from both sides of the Thames, yet there is no absolute necessity that this should be the case, should further consideration lead to the conclusion that, on the whole, the two northern routes which I have described are to be preferred.

But in my estimates of cost I have assumed that the work will be carried out in two main instalments, with minor additions to each as occasion may require, both common from Glasbury, Hay, by way of Ross and Gloucester, to Chedworth—the one branching northwards by Buckingham to Elstree; the other passing southwards, by Hungerford, Basingstoke, and Guildford, to Banstead. These two aqueducts to correspond with the works in Wales will have a discharging power of a little over 200 million gallons a day each. They would be formed partly of masonry and concrete, and partly of iron or steel pipes at the valley crossings, and would be entirely covered over and free from pollution along their whole length. The masonry portions would be either constructed in tunnel proper or cut-and-cover, and would take the form of a conduit some 16 feet in width, arched over, and in which the water would flow to a depth of about 11 feet the fall being at the rate of 9 inches per mile. At the valley crossings, the water would be conveyed in parallel lines of pipes, with a fall of 3 feet per mile.

VI.—*Service Reservoirs.*

Though long aqueducts like those above described, when constructed of masonry, may be said to require but little repair or maintenance, yet occasionally, if only for purposes of inspection, the water must be drawn off for a few days. In the same way, the iron pipes may occasionally require repair. Consequently, at the termination of the aqueducts, both on the north and south sides of the river, at Elstree and at Banstead, service reservoirs would be required to contain about 16 days' supply—that is to say, of a capacity of 3200 million gallons each. These reservoirs would form an additional security against breakdowns, and permit of the water being more equally distributed under constant pressure to the Metropolis itself; for it must be remembered that, though the average flow of the aqueduct would be at the rate of 200 million gallons a day of 24 hours, the consumption of water is limited to about one-half of the 24 hours, and being drawn in greater quantities during some portions of the twelve working hours, will require pipes of large diameter to discharge the great volumes of water into the Metropolis.

From these reservoirs, connecting-pipes would be carried down, from which the water would discharge into the existing service and distribution reservoirs of the various Companies, or, looking to the future, into new service reservoirs which in course of time it might be found economical to construct at greater altitudes than those now in use. Consequently, we should make use for the present of the whole of the distributing plant of the existing Companies, and in the future add to it as necessity might require.

VII.—*Filter-Beds.*

Though the Chemist's analyses of the waters of the Usk, the Yrfon, the Towy, the Wye, &c., show that, in their natural state, they are of greater purity and contain less solid matter than the London water after filtration, and though these waters will be stored and be subjected to subsidence in the large reservoirs I have described, and in some cases will be decanted or drawn off from one reservoir into another, yet I consider that, when all precautions are taken, the water should be filtered before delivery to the consumer. Possibly this filtration may not be of so severe a kind as that required by the waters of the Thames, flowing as they do from a richly-cultivated and inhabited area; yet small particles of floating matter may fall into the waters. I think, therefore, the result would be that the filters would require much less attention and cleansing than in the case of the Thames; while the advantage of a pure, clean water, free from every particle of suspended matter, would be secured.

VIII.—*Connection with the Existing Distribution-Pipes.*

This is a matter requiring to be worked out in considerable detail; but in my estimate of cost I have included a sum which I believe to be amply sufficient to afford the necessary lines of communication-pipes with the existing system.

(*To be continued.*)

THE RECENT SCARCITY OF WATER AT THE EAST-END.

Report by the Chief Engineer of the East London Water Company.

In the House of Commons, on the 16th inst., Mr. J. Stuart put to the President of the Local Government Board the following question, of which he had given him private notice: "Whether his attention had been called to the report, dated July 30, of the Chief Engineer of the London County Council, in which, after the examination of certain facts as to the amount of water supplied by the East London Water Company before and after the frost of last winter, that gentleman states as his opinion: 'That what the Company are now suffering from is not an insufficiency of supply, but that their pipes became so shattered during the frost of February last as to become so leaky that the water is wasted and does not reach the consumers;' whether he was prepared to make any inquiry as to the correctness of this opinion; and, if it was correct, whether he would take any steps to require the Company to put their mains in proper repair." Mr. Chaplin could not answer the question—sufficient time had not been allowed him. The Secretary of the Company, however (Mr. I. A. Crookenden), forwarded to the Local Government Board the following report by Mr. W. B. Bryan, the Company's Engineer; and he subsequently sent it to the papers: "I have to state that the theory of the Chief Engineer of the London County Council is based upon a total misapprehension and want of knowledge of the facts. In the first place, every pipe belonging to the Company found damaged by the frost or any other cause within the County of London was replaced and made good by April 8; and every pipe in the County of Essex, by April 19. Since these dates, the Company's servants and contractors have been actively engaged in lowering such mains as, in the opinion of the Company, might at some future time be affected, should a frost as severe and prolonged as that lately experienced occur. A house-to-house inspection was commenced on April 24, and continued until June 29. More than 50,000 lead pipes belonging to consumers were found burst, of which several thousand cases were underground, or 'hidden waste,' ascertained by stethoscoping and in other ways by the Company's inspectors. As every ½-inch pipe running full bore wastes as much as 700 people require for domestic purposes, and as many of these pipes were not repaired in July—there being the greatest difficulty in householders obtaining sufficient plumbers to cope with the magnitude of the repairs required—it will be at once seen that the increase of 25 per cent. of water distributed last May over that of the previous May is easily accounted for. Consequent upon the abnormally dry weather of May and June, garden watering was also a source of very great waste. Several thousand hose-pipes were discovered and reported by the Company's servants as being allowed to waste day and night. Since the intermittent supply was given, each service-main has received a very much higher pressure than can be given when the supply is continuous. If there were the slightest truth in the 'shattered main' theory, each street should, as the water was turned on, have been flooded, and the surface of the road rendered dangerous by the blowing up of the pavement. Such a state of things, however, has not obtained. Upon inquiry as to the relative amounts of water distributed by the large municipal water-works in 1895 as compared with 1894, it has been found that the increase in the volume distributed by the East London Water Company compares most favourably with the increase in other large towns; thus proving the 'shattered main' theory to be untenable."

Deputation of Vestry Delegates to the County Council.

A deputation from the Vestries of Hackney, Shoreditch, Bethnal Green, Limehouse, and St. George's-in-the-East, waited last Tuesday afternoon upon the Joint Public Control and Water Committee of the London County Council, at Spring Gardens, relative to the supply of water furnished to the eastern district by the East London Water Company. Dr. COLLINS presided.

Mr. J. B. KYFFIN (Hackney), in introducing the deputation, said that, in addition to the Vestries represented, the Local Authorities of East and West Ham and Leyton would have liked to join in the protest against the defective supply of water served to the East-end; and they were only excluded for the reason that they did not come within the jurisdiction of the County Council. He thought he should be able to demonstrate that the so-called water famine was no famine at all; that, on the contrary, there had been abundance of water; and that any deficiency in the supply arose purely and simply through the negligence of the East London Water Company themselves. Up to the end of June, there had been a sufficient supply. After that, it became less. However, there was nothing much to complain about until the middle of July; and on the 14th, 15th, 16th, and 17th of that month, they had practically no water at all. The Company showed by their published returns that they did not take the quantity of water they were authorized to draw from the Thames by 5 million gallons. As to other sources, he, in company with others, had paid a visit to the Lea Conservancy offices, where they found that 22½ million gallons of water were passing over Field's Weir, on the River Lea. So long as this quantity was passing over the weir, the Company could take all the water they wanted. From July 16 to 21, this quantity had decreased to 18 million gallons; but on the latter date, it was restored by pumping the contents of the locks back again to the higher levels. So that, with the exception of five days during the present summer, they had the assurance of Mr. Child, the Engineer to the Lea Conservancy, that a sufficient quantity of water for navigation purposes was passing over Field's Weir. And yet during this period of scarcity, the Company were selling to the Hackney Vestry alone something like 500,000 gallons a day. Quite recently, the Directors of the Company had augmented their supply by purchasing 4 million gallons daily from the New River Company. But why, if reduced to such a predicament, had they not done this long before? for that was a source that had always been open to them. Then, throughout the period of scarcity, the supply of water for the roads and for the purposes of the large breweries, which was paid for by meter, was always abundant. As a matter of fact, all the figures that had been adduced went to show that the Company, by the exercise of ordinary care, could have easily provided for the needs of East London. The Vestries felt that in this matter the County Council had not done what they might; for the Act of 1871 distinctly conferred powers upon the Metropolitan Authority to recover penalties where a water company did not provide a sufficient supply. The deputation came there as delegates from a conference representing 1¼ million of people, and asked the Council, as the properly-constituted authority, to enforce the penalties.

The EARL of ONSLOW inquired if they in any way attributed the deficiency in the supply of water to the shortness of the rainfall.

Mr. KYFFIN replied that they did to a certain extent; but, inasmuch as the Company at one time drew only 5 million gallons from the Thames, instead of double that quantity, to which they were entitled, and whereas, too, most of the water from the Lea was derived from underground sources, they failed to see that the drought had much to do with the situation.

Mr. IDRIS: Could they have obtained any more from the New River Company? Have you any evidence to prove this?

Mr. KYFFIN: Yes.

Questioned by another member of the Committee, Mr. KYFFIN said that, during all the period of scarcity, the Company were supplying Tottenham, where no question of statutory liabilities arose, and starving the east of London. What the Vestries strongly recommended the Council to do was to proceed against the Company for penalties.

Mr. IDRIS: You know the penalties are rather limited?

Mr. KYFFIN: It is £200 for every offence; and in Hackney alone the penalties that could be successfully enforced would cost the Company £70,000.

Dr. BOND, M.P.: I am interested in some property in Spitalfields. I have caused inquiries to be made; and I do not hear of great privations being endured.

Mr. KYFFIN: They were selling water at 1d. a bucket in Spitalfields.

Mr. ROSE-INNES: Can you suggest any reason why the Company did not pump a larger supply from the Thames?

Mr. KYFFIN: I believe their reservoirs are too weak.

Mr. ROSE-INNES questioned Mr. Kyffin at length as to the manner in which he construed the sections of the Acts dealing with the subject.

Mr. CROOKS objected to this process of cross-examining gentlemen who had come there to lay their case before the Committee in a straightforward manner.

Mr. ROSE-INNES said he was fully in sympathy with the object of the deputation; but it had been asserted that the County Council were to blame for not having taken action in this matter.

The CHAIRMAN ruled that it was a point which could be argued with the deputation.

Further questions having been addressed to the deputation respecting the drawing up of detailed returns in the several districts represented by the Vestries,

The CHAIRMAN intimated that the Committee had been very pleased indeed to listen to the statements laid before them by the deputation. The Council were fully aware of the importance of this question; and Counsel's opinion had already been taken as to whether an action against the Company would lie under the Act of 1871. So far as it went, that opinion did not point to the successful issue of such an action; and it would be for the Committee to consider again whether they should be guided by Counsel, or seek for further information. One thing was certain—viz., that they would do all in their power to secure an efficient supply of water for the East-end of London.

The deputation then withdrew.

Deputation to the Local Government Board.

Last Friday, a numerous deputation, introduced by Sir Andrew Scoble, Q.C., M.P., waited upon Mr. Chaplin at the Local Government Board, in order to urge the necessity for an inquiry into the supply of water by the East London Company. The deputation was the outcome of the recent conference of Vestries and District Boards within the Company's district; and accompanying the representatives of these bodies were several local members of Parliament.

Sir A. SCOBLE, in introducing the deputation, said they were there to complain that the supply of water by the East London Company was deficient, and to ask the Local Government Board to institute an inquiry into the matter under the Metropolis Water Act, 1852.

Mr. J. B. KYFFIN said the district represented had suffered severely from scarcity of water; but, before taking any steps in the matter, they made careful inquiry as to whether or not the Water Company had been absolutely prevented by drought from supplying water. They were, however, now convinced that the imperfection was due to negligence. The Company had supplied the Tottenham Local Board with 3 million gallons, though they were under no statutory obligation to do so; while those whom they were bound to supply had suffered drought. The Company had not utilized to the full their statutory powers; and, instead of taking 10 million gallons from the Thames, they only took from 5 to 7½ millions. Action had been attempted by individuals under the Act of 1871; but it was encompassed with legal and technical difficulties. One case, however, was reserved for the consideration of the High Court, and was awaiting decision. Their complaint was that statutory obligations were neglected, and those which were not statutory were fulfilled. The public health had suffered; and mortality had increased in the district to a far greater extent than in other places.

Mr. SMITH (Limehouse) thanked Mr. Chaplin for the personal interest he had taken in the question of water supply. There was, he said, a diversity of opinion on this matter, and it was absolutely necessary that a searching inquiry should be made—not for vindictive purposes, but to prevent a recurrence of the dreadful evils which had been caused. The whole subject should be sifted to the bottom. It was only due to a marvellous Providence that there had not been a devastating epidemic in the East-end.

Other members of the deputation having spoken,

Mr. CHAPLIN said: I need hardly assure you that I have listened with the deepest interest, and with all the attention I could give, to the very serious and grave statements which you have put before me. I think I may say that, from the very earliest moment that this question was brought under my notice, very shortly after my appointment to the position I fill, I have recognized its extreme gravity. There was one fact alone which I think was sufficient to demand the earnest attention of any statesman who shares any responsibility in the matter—viz., that in a district which is one of the poorest parts of London, and contains a population of 1½ millions, we are confronted with the state of things that for a certain time during the hot weather the water supply was limited to two hours out of the twenty-four. I do not think, though much has been said to-day to reinforce the gravity of the situation, that anything further than that simple fact was required; and if I had wanted anything to confirm my opinion on this subject, I should have found it in the touching appeals made to me by Mr. Kyffin, Mr. Smith, and others. Though it is quite true that I may not have seen all there was to be seen when I visited that part of London myself, I was never so filled with anxiety by a question, and by the earnest desire to see what remedy could be applied in the future, as I was on the occasion of that visit. I need not tell you that you may put utterly on one side, as wholly unworthy of notice, any idea that I should refuse any redress, improvement, or relief which can possibly be afforded. Mr. Kyffin and Mr. Smith have both laid before me a great number of facts which I need not tell you will receive my most careful and serious consideration. It is not necessary for me to deal with them in any detail this afternoon. But my experience of life has always told me that there are generally two sides to a question; and, in common fairness to the East London Water Company, I ought not to omit to state what is their side, and the reasons which they allege to account for the deficiency of the supply. The first is the unusual drought, which Mr. Kyffin does not believe in. Secondly, the insufficient amount of storage, caused mainly, as they allege, by the action of Parliament in 1893. Thirdly, the considerable breakage which occurred in a large part of the consumers' pipes, owing to which there has been an enormous waste of water supply. As to how great that waste has been, gentlemen will form their own opinions. The Company put it down at 50,000 pipes of consumers alone. They have also supplied me with some figures as to the enormous waste caused by the breakage of each ½-inch pipe. I am, of course, expressing no opinion whatever on the correctness of these statements, or on yours. Then there is another serious question I have to consider—that is the legal one—as to the precise powers of this Department in instituting such a great inquiry as is demanded, especially with regard to the fact that the water supply has not been constant. That is a point about which I can inquire without a moment's unnecessary delay, and ascertain precisely what powers the Department possesses. But, after all, the real question is this: We want to avoid this condition of things in the future. I would rather reserve my final decision on that point. But thus much I am justified in saying to you—that I am not able myself to see any insuperable objections to the inquiry you demand. On the other hand, I think probably there may be considerable difficulties in such an inquiry. In any case, you may be sure that I thoroughly recognize the extreme gravity of the situation. There is no doubt that, a short time ago, we were within an ace of a great disaster; and I do not think Mr. Smith was going too far when he said that we had a providential escape. I approach this question animated by one feeling alone, and that is a real and impartial desire to do whatever is possible to avoid the recurrence of such a calamity as that through which that part of London has recently passed; and I will take the earliest opportunity of communicating my final decision on this question.

Mr. S. BUXTON, M.P., thanked Mr. Chaplin, and the deputation withdrew.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The accounts of the Aberdeen Corporation Gas Department for the year ending July 31 last have been issued. I expected them sooner; but I seem to have been mistaken as to the date upon which they close. Formerly it was on Sept. 30; and I thought that the date had been altered to May 15, so as to correspond with the date of closing of other municipal accounts. This has not been the case, which is very strange, as I understood they wished the accounts to all come in together. What is more peculiar is that, while the gas accounts close on July 31, those of the Electricity Department, which is managed by the same Committee of the Town Council, close on Dec. 31. This tends to confuse matters, and prevents an intelligible view being taken of how the businesses work.

For the past year, in the Gas Department the revenue amounted to £76,821; and the expenditure, to £64,944—leaving a gross surplus of £12,877. From this sum, however, annuities amounting to £5165, depreciation amounting to £4642, and charges for reserve and sinking funds, fire insurance, &c., had to be provided; and the loss on the electric lighting department, amounting to £217, had to be made good. The result is to bring out a deficit of £398. A year ago, it may be remembered, a reduction of 3d. per 1000 cubic feet of gas was made; so that the result comes out, considering the difficulties of the past year, quite satisfactory. Had it not been for the miners' strike in the summer of 1894, and the severity of last winter, I have no doubt but that there would have been a good surplus. As it is, the Gas Committee are not, to speak colloquially, out of funds, for they began the year with a surplus, carried forward from the previous year, of £6747; and they have now in hand £6349. Of the revenue for the past year, £65,456 was derived from the sale of gas; £11,010 from the sale of residual products; £246 from gas-stoves; and £103 from rents and feu duties. The manufacture of gas cost £47,634, of which coal amounted to £34,439; wages, £7461; maintenance of works and plant, £3000; distribution, £2092; rents, rates, and taxes, £4980; management, £1916; and discount and bad debts, £2503. The Gas Committee, in considering the accounts last Wednesday, were of opinion that the proposed reduction in the price of gas from 3s. 5d. to 3s. 3d. per 1000 cubic feet, would leave them, as estimated, at the close of the current year, a surplus of only £53, which would be insufficient to work upon; and they resolved to recommend that the reduction should be to 3s. 4d., which would leave an estimated surplus of £1719. The quantity of coal carbonized during the year was 42,698 tons—the average price of which was 16s. 1½d. per ton. The yield of gas was 430,569,000 cubic feet, or an average of 10,084 cubic feet per ton. Unaccounted-for gas amounted to 8·77 per cent., as compared with 7·64 per cent. in the preceding year, and 10·05 per cent. in the year before that. During the year, 129 annuities were redeemed, at a cost of £1117.

In the Electricity Department, the revenue from Jan. 1 to July 31 was £2975, of which £2704 was derived from the sale of current, and £154 was received for current supplied to ten public lamps. There was a deficit of £109 during the seven months. The quantity of electricity generated was 118,193 units. There was suppled to private consumers 98,122 units; and to public lamps, 8163 units—leaving 10,338 units, or 11 per cent., unaccounted for.

The Edinburgh and District Water Trustees have had plans prepared for a portion of the new works in connection with the augmentation of the water supply, which they are to take from the Talla, in the upper part of Peeblesshire. Tenders are being invited for the construction of the work. The works in immediate contemplation are a railway, 8½ miles in length, from the Caledonian Railway Company's branch line to Peebles, which it leaves about a mile to the east of Biggar station, up the valley to near the site of the proposed embankment of the Talla reservoir; a road near Tweedsmuir village, including a bridge over the Tweed; and a line of cast-iron pipes across the valley of the Tweed and partly along the new road. The Water Trust are to double the Caledonian Railway from Biggar to the junction where their service railway leaves it. The service railway, which, of course, is to be used for the conveyance of material, and of the contractors' plant and workmen up to the Talla reservoir, has a heavy gradient; the steepest portion being 1 in 50. The contract provides for offers being obtained for the permanent way in double-headed rails, equal to those on the Peebles branch of the Caledonian Railway, or alternatively flat-bottomed rails of a lighter weight suitable for the contractors' uses. The object of this is that, when the estimates are submitted, it should be determined whether the heavier or the lighter section of rail should be taken. The heavier would, of course, be preferable, in case the railway should ever be adopted permanently. The new road as agreed upon between the Trustees and the County Council is to be made 15 feet wide, branching off the main road about a mile above the Crook Inn. In room of an old narrow existing bridge at Tweedsmuir, there will be a bridge 15 feet wide between the parapets, 100 feet span, and with small arches for traffic on both sides of the river. This bridge will carry two lines of 36-inch cast-iron pipes below the roadway, capable of conveying 24 million gallons of water per day. It will accommodate the road traffic ultimately; but in the meantime will be used for the service railway, which runs up on the eastern side of the hill to the Talla embankment. This road willultimately be carried all the way up on the east side of the reservoir to Gameshope. The bridge is to be constructed of steel girders, with abutments faced with granite at the corners, and four polished granite slabs for inscriptions. It is provided by the contract that the works are to be completed within twelve months from Sept. 1. The whole arrangements are approved of by the County Council and Road Trustees.

Copious rains—rather too copious, I am afraid, to be agreeable to the holiday-maker, or profitable to the agriculturist—have fallen of late in Scotland. Still the quantity which has fallen this year is less than it was last year, a general average being 24½ inches, compared with 30 inches last year. There is a feeling that, for this season, water supplies are everywhere assured. There is this peculiarity about the present year, that nearly the whole of the rain which has fallen has been during the past three months. In January, there was a good deal of snow; but there was little "rainfall" in it. February and the greater part of March were frosty months, with little falling moisture in them; April gave a few showers; but in May, in some parts of Scotland, not a single drop of rain fell—a most unusual circumstance. It was only with the advent of June that anything like rainy weather began. August has been the wettest month of all. Till it came, there was much shortness of water, so much so that in one place—Airdrie Sheriff Court, I think—people who did not reside within the area of water supply were prosecuted for stealing water from a well within the area. With the quantity of rain which has fallen of late, there is no longer any cause for alarm as to gravitation supplies of water.

One effect of modern legislation, which I have before mentioned as likely to exercise no inconsiderable influence upon rural life, has become manifest this week. In the extension of the powers of local government which have been conferred by recent Acts of Parliament, there have been enactments which bring the powers of local authorities in rural districts up to almost the level, in many instances, which has been attained by urban communities in their Special Acts. These refer chiefly to matters of public health. But what I have more particularly in my mind are provisions with reference to water supply and public lighting. On these matters, County and Parish Councils are armed with very strong powers; and they are exercising them, very much to the disgust of old-fashioned people. One notable instance is the County Council for the Middle Ward of Lanarkshire, who are expending a very large sum in providing a supply of water for the different villages and hamlets in their district. This week I notice that in two places—one in Lanarkshire and the other in Stirlingshire—movements have been commenced for having the public lighting of the places taken over by the Parish Councils. Looked at financially, these local schemes are small; but their effect is far-reaching. Dwellers in cities enjoy the comforts and the advantages, from a health point of view, of many arrangements which have hitherto been unknown in country districts. Yet a very large proportion of the city populations are in the habit of finding their way, during summer, to rural retreats, in which to spend a holiday; and many of these places have hitherto been, in point of darkness, the extreme of unpleasantness, and in point of water supply and sanitation, veritable death-traps. Thanks to the general rise in the conditions of living, which has been characteristic particularly of the past quarter of a century, this is now a matter of the past; and in a few years we may expect that not only villages and hamlets, but even solitary residences in secluded parts, will compare well, in the matter of healthful surroundings, with dwellings in large and populous places. Meanwhile, the taxation to provide these improvements may be grudged by some people; but the effect on the health and well-being of the country at large cannot fail to be great.

An action of some interest relating to the use of destructors for the disposal of city refuse has been heard by Lord Stormonth Darling in the Court of Session; and his Lordship has given judgment in it. About two years ago the Edinburgh Corporation erected a destructor upon land in the outskirts of the city; and they have continued to work it. The pursuers in the action complained that its operation constituted a nuisance to them, because of the noxious smells which emanated from the place, and on account of dust and half-consumed paper and the like which the wind carried from it into their grounds. Evidence was led at great length in the case, in the course of which the Judge had more than once to remind the parties that he was not trying any question as to the capability of the particular destructor, but simply whether it had been worked so as to constitute a nuisance. In his judgment, he has found that a nuisance existed in the earlier stages of the working; but that the remedial measures adopted by the Corporation after the raising of the action had abated the nuisance to some extent, and that it was reasonable that time should be allowed for the effecting of still further improvements, so that if possible all cause for complaint should be removed. He accordingly remitted to Mr. B. H. Blyth, C.E., of Edinburgh, to visit the place from time to time, and, after consulting with Professor Odling, of Oxford, to report on the working of the apparatus. The result of the remit will be watched with some interest, because, if it should turn out that this particular destructor, which was selected with the utmost care by the advisers of the Corporation, cannot be worked without creating a nuisance, a great blow will be struck at a method of improving the sanitation of towns which has of late years become popular.

The Falkirk and Larbert Water Trustees last year had a revenue of £5662, which was £73 less than in the preceding year; but the decrease was due to a reduction of 2d. per pound of assessment. Otherwise there would have been, from an increased valuation and the extended use of water for trade purposes, an increase in the revenue. The expenditure amounted to £6056—an increase of £598 upon the amount in the preceding year, which was chiefly due to outlays in connection with the strengthening of the reservoir embankments and the extension of the distribution system.

Sale of Shares.—Last Wednesday, Mr. W. F. Bowden sold in Durham £10,000 of 4 per cent. preference stock (£5 nominal value) of the *Consett Water Company*; being part of the capital authorized to be issued under the provisions of the Consett Water Act of last year. The highest price realized per share was £6 10s.; the lowest, £6 2s.

The Hermite Process.—The War Office have instructed Messrs. Paterson and Cooper to proceed with the erection of the Hermite sanitation plant at Netley Hospital; and the Corporation of Cape Town have ordered plant to produce electrolized sea water, with a view to the Hermite process being applied to the sanitation of the town.

Incandescent Gas Lighting.—According to *Industries and Iron*, a new incandescent gas-light, to which the name "Excelsior" has been given, is being put upon the market by Messrs. Goltsepke and Co., of Berlin. Hitherto the sale of the Welsbach light in Switzerland has been controlled by the Austrian Auer Company through an agency located in Zurich. We learn from the above-named source that a company has been formed, with a capital of 500,000 frs. (£20,000), for the manufacture and sale of the light in Switzerland, to be known as the Swiss Incandescent Gas-Light Company.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Aug.* 31.

Sulphate of Ammonia.—There has been a fair amount of business doing; but, August contracts being now covered, the market closes quietly at £9 5s. f.o.b. at the ports. Now that London makers are meeting the market freely, there does not seem to be much prospect of immediate improvement in prices, notwithstanding that stocks in the North are understood to be greatly reduced. It would seem that, although sulphate has for some time been much the cheapest form of ammonia, this fact has, so far, not brought about any exceptional demand; but it cannot fail eventually to exercise a material influence upon prices. Dealers, however, are evidently trusting to the approaching season of increased production to keep prices in check, as they are offering over winter months at much under makers' ideas of value in that position.

Nitrate of Soda is quiet at 8s. 1½d. per cwt. for fine quality.

LONDON, *Aug.* 31.

Tar Products.—Benzols are firmer, especially the higher qualities, 90 per cent., and pure. Gas managers are recognizing that benzol is much the cheapest agent for enriching gas. It is now established that, good as acetylene is claimed to be, pure benzol possesses three times the illuminating power of acetylene. This might be expected from its molecular construction. The higher prices for petroleum spirit are also compelling those using it to fall back on benzol; but as this is three or four times more potent than spirit, gas producers will not have cause to regret the change. The pitch market keeps firm, and buyers will now pay pretty well quoted prices for next season's delivery. The creosote and common oil market is extremely dull; and this is all the more remarkable as the production of them just now is at its minimum. There is more inquiry for anthracene; and the reported better trade in alizarine, both in America and in the East, including Russia, is likely to firm this market. The expiration also of the alizarine blue patent is certain to extend the application of that most useful substitute for indigo, and will be bound to reflect itself in the consumption of anthracene. Several important tar contracts have been let during the week, at a remarkable disparity in price; showing that the old speculative spirit still survives among distillers. The following prices mark the week's business: Tar, 18s. 6d. to 22s. 6d. Pitch, west coast, 34s. 6d.; east coast, 37s. 6d. Benzol, 90's, 1s.; 50's, 11d. (country make, ½d. less). Solvent naphtha, 1s. Toluol, 11½d. Crude, 30 per cent., naphtha, 4½d. Liquid creosote, 1¼d. Naphthalene salts, 25s. Cresylic acid, refined, 1s. 1d.; brown, 10d. Carbolic acid, 60's, 1s. 6d. Anthracene, "A" quality, 1s.; "B" quality, 10d.

Sulphate of Ammonia is moving off pretty freely; but prices do not improve as was anticipated. The parity value with nitrate of soda should make sulphate much the cheapest fertilizer where nitrogen is required; indeed, sulphate, to be in parity with nitrate, should be at least £10 per ton. Considerable business has been done at the following rates: Beckton, £9 3s. 6d.; London, outside, £9 5s.; Leith, £9 7s. 6d.; west coast ports, £9 6s. 3d.; Hull and Tyne, £9 5s.—all, except Beckton, less 3½ per cent. Gas liquor, 6s. 6d. to 7s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No material change can be reported as regards the condition of the coal trade in this district. Only a very slow demand is coming forward generally, with pits still working short time; and supplies, even with this limited output, are in excess of requirements. For the better qualities of round coal, suitable for house-fire purposes, rather more inquiry is, in some quarters, reported; but generally the business put through continues only of the most limited dimensions. Colliery proprietors, however, who are expecting that the ensuing month may bring forward an increased demand for winter requirements, are holding to their quoted rates. The improvement in the iron trade and the other coal-using industries is not yet influencing to any appreciable extent the demand for the lower qualities of round coal, suitable for iron making, steam, and general manufacturing purposes; and these remain a drug upon the market, with prices weak and irregular where competition from outside districts has to be met. Engine fuel meets with a fair demand at about late rates; but supplies are plentiful, as notwithstanding the restricted output of slack, quantities are coming in from outside districts at very low figures. At the pit mouth, the average prices may be given as about 10s. to 10s. 6d. per ton for best Wigan Arley; 8s. to 8s. 6d., for Pemberton four-feet and seconds Arley; 7s. to 7s. 6d., for common house-coal. Steam and forge coals are readily obtainable at 6s. per ton, although some colliery proprietors hold to 6s. 6d.; and engine fuel ranges from 3s. to 3s. 6d. for common sorts, up to 4s. 6d. and 5s. for best qualities. Derbyshire slack is offering at 2s. per ton at the pit; and Yorkshire slack is also obtainable at very low figures. In the shipping trade, the only noticeable change is perhaps rather more doing in house-fire qualities, which are quoted 9s. 3d. to 9s. 6d. per ton; but steam coal continues excessively low in price—7s. 3d. to 7s. 6d. per ton, delivered Mersey ports, being about the average figures.

Northern Coal Trade.—A steady demand for best steam coals, and an increasing consumption of gas coals, are the chief features of the coal trade of this district during the last few days. There is now a natural desire to get away a large part of the shipments that have been contracted for to the Baltic; and this causes a pressure for the best kinds of coal, so that the producing collieries have a very brisk trade assured for some weeks to come, and can thus ask a relatively high price. For early delivery, 9s. 3d. per ton f.o.b. is the current rate for the best Northumbrian steam coals; whilst for second-class coals, with a less pressing demand, the price varies from 8s. 3d. to 8s. 6d. per ton. Steam small coals are plentiful, and can be had at from 3s. to 3s. 6d. per ton, according to quality; the large production of round coals necessitating a considerable output of small. In regard to gas coals, there is, as we have noted, an enlarging consumption; and thus the deliveries, both for shipment and for local use, have now been considerably increased from the lowest point, whilst every week will now add appreciably to the demand. Much of this fuller request is under contract; and odd cargoes are now quoted about 6s. 3d. to 6s. 9d. per ton f.o.b., according to quality and position of the collieries. As, however, many of the pits are still only working short time—though fuller than they were—there is ample facility for meeting the needs of the users, though a few weeks will see the pits better at work. Manufacturing coal is steady. Coke is also in very fair demand, with some enlargement of the exports, after a long depression. For best Durham coke, from 13s. to 13s. 6d. per ton f.o.b. is the current price. Gas coke is a little more plentiful; but it is finding a fair market at recent prices.

Scotch Coal Trade.—The outlook is more encouraging. There is a steady business doing in all classes of coal, and an improving demand, particularly for splint varieties. Forward orders are also coming in more freely. The improvement has not yet, however, reached so far as market prices, which are still quoted at: Main, 5s. 10d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. There is every indication that these rates will soon be exceeded. Shipments for the week amounted to 181,971 tons—an increase over the quantity in the preceding week of 8455 tons, and over the quantity in the corresponding week of last year of 175,565 tons. For the year to date, the total shipments have amounted to 4,738,926 tons—an increase compared with the corresponding period of last year of 989,991 tons. This increase is, of course, accounted for by the diminished volume of trade during the strike of last year.

The Kent Opposition to the London Water Bills.—The Parliamentary Committee of the Kent County Council report that the opposition to the Kent and Lambeth Water (Transfer) Bills promoted by the London Council has involved, up to the present, an outlay of £2000. Of this sum, the Kent County Council have resolved to pay £500 as a fair and equitable proportion of their share in the opposition; the remainder to be liquidated by the joint District Councils in West Kent.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 480.)

Issue.	Share	Whe ex. Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23½-24½	+½	4 5 8
100,000	10	,,	7½	Do. 7 p. c.	10	16—17	+½	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	106—108	..	4 12 7
200,000	5	10 May	6¼	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5¼	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	200—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125-130*	+2½	3 16 11
320,000	20	28 Mar.	11¼	British	20	54—56	..	4 0 4
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½-22½*	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½-17½*	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾—8¼	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	29—31	..	5 6 5
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	300—305	..	4 8 6
165,000	,,	,,	10½	Do. New	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	270—280	+5	4 12 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	203—208	..	4 16 2
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125-130*	+2¾	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	291—296	..	4 6 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	187—192	..	3 12 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	131—134	..	2 19 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	200—205	..	2 18 6
3,800,000	Stck.	10 May	12	Imperial Continental	100	248—253	−1	4 14 9
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	17½—18½	..	5 8 1
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	..	6 7 3
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	360-370*	+2¾	4 3 9
1,350,000	,,	,,	12	Do. B do.	100	302-307*	+1	3 18 2
308,685	,,	,,	13	Do. C do.	100	315-325*	+7	4 0 0
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	+1½	2 16 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	224—228	−4½	3 10 2
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303-308*	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	258—263	−1½	2 17 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Aug.	12⅞	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—145	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	153—158	−4½	2 10 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	290—295	−2	3 7 10

*Ex div.

New Water Reservoir at Rooden.—The Water Committee of the Oldham Corporation lately inspected the work now going forward in connection with the construction of the new reservoir at Rooden. They learned from the Engineers that an impervious bottom for the reservoir had at length been found, and that the work is now going on apace. Thousands of tons of peat have been removed since the first sod was cut; and a special embankment had to be made to prevent the tremendous mass of peat, which was daily moving with the slope of the land, going into one of the lower reservoirs.

The Effect of Reducing the Public Lighting Hours in Liverpool.—It has been frequently said that every public lamp is as good as a policeman; and, consequently, the advisability of keeping the policeman on the watch—in other words, keeping the lamps fully alight—as long as possible would appear to be self-evident. Not long ago, the lighting hours were curtailed in Liverpool, with the result, according to a correspondent to a local paper, that crime has increased in the city. He characterizes the decision to lower the gas as a direct encouragement to the criminal classes. There are some streets, he says, along which it is unsafe for a constable to go after dark; and even there the gas is lowered. It seems that the night-duty men are now provided with lanterns; for, when anyone meets with an injury from assault, a light has to be procured before the wounds can be dressed.

The Price of Gas in Dublin.—The *Freeman's Journal* understands that the Directors of the Alliance and Dublin Gas Company intend to recommend the shareholders to reduce the price of gas; and 2d. per 1000 cubic feet is the amount named—making it 3s. 5d. in the city, with a *pro ratâ* reduction in the suburban districts. "The 'Gas Question' in Dublin," says our contemporary, "has for a long time past been confined to the controversy between the Corporation and the Gas Company—a controversy which has been fought out in the Law Courts and before other tribunals at great cost, especially to the ratepayers. The important point whether the private consumer paid too highly was more or less lost sight of in the corporate dispute; but many were of opinion that the citizens were entitled to have their gas at a lower price than that charged. The step now advised by the Directors goes far to fix the soundness of this view, and to encourage the hope that, after a reasonable trial of the lowered scale, still further reduction may be ventured upon. It is certain that cheap gas leads to increased consumption."

Purifier Extensions at the New Wortley Gas-Works at Leeds.—The New Wortley Works Sub-Committee of the Gas Committee of the Leeds Corporation have decided to apply hydraulic power to the purifying-boxes now being constructed at those works by Messrs. Clayton, Son, and Co. The overhead crane and manual power system is in operation in connection with the old purifiers.

Reductions in Price.—The Directors of the Heckmondwike Gas Company have reduced the price of gas from 2s. 10d. to 2s. 6d. per 1000 cubic feet net, as from July 1; bringing it down to one uniform figure, whether used for lighting, cooking, or heating purposes. The price of gas at Bungay is to be reduced, as from the 1st prox., from 4s. 10d. to 4s. 7d. per 1000 cubic feet. Owing to the conclusion of exceptionally favourable coal contracts, the price of gas will be reduced by the Douglas (Isle of Man) Gas Company 2d. per 1000 cubic feet.

A New Reservoir for Totnes.—The Mayoress of Totnes (Mrs. A. Michelmore) recently laid the corner stone of the new reservoir at Bowden, the site for which had been obtained by the Town Council from the late Duke of Somerset. The reservoir will be 100 ft. long and 40 ft. wide, and have a depth of 8 ft. 6 in. The cost will be about £650. The Chairman of the Water Committee (Alderman Kellock) gave an account of the extensions carried out since he became a member of the Corporation in 1860; and said their new reservoir would contain from 160,000 to 190,000 gallons of water, which the Committee believed would be ample for the requirements of the town for some time to come. They hoped the rental from the improved supply would enable the Council to pay off the old debt, and reduce the improvement rate.

Increased Water Storage for Washington.—The Washington newspapers announce an important addition to the water-storage capacity of the system supplying the national capital in the completion of the improvements on the Dalecarlia reservoir. The work consisted of restoring the abandoned basin to the water-works system by preventing the drainage into it of polluting water. The work, which presented several difficult problems of engineering, has been done in two years; and the cost has been kept within 150,000 dols. Washington has now an additional reservoir capable of holding 170 million gallons of water. The Dalecarlia reservoir was built some 35 years ago by the late General Meigs, but was abandoned about 10 years ago. Its restoration was designed and carried out by Colonel George H. Elliot, of the Corps of Engineers.

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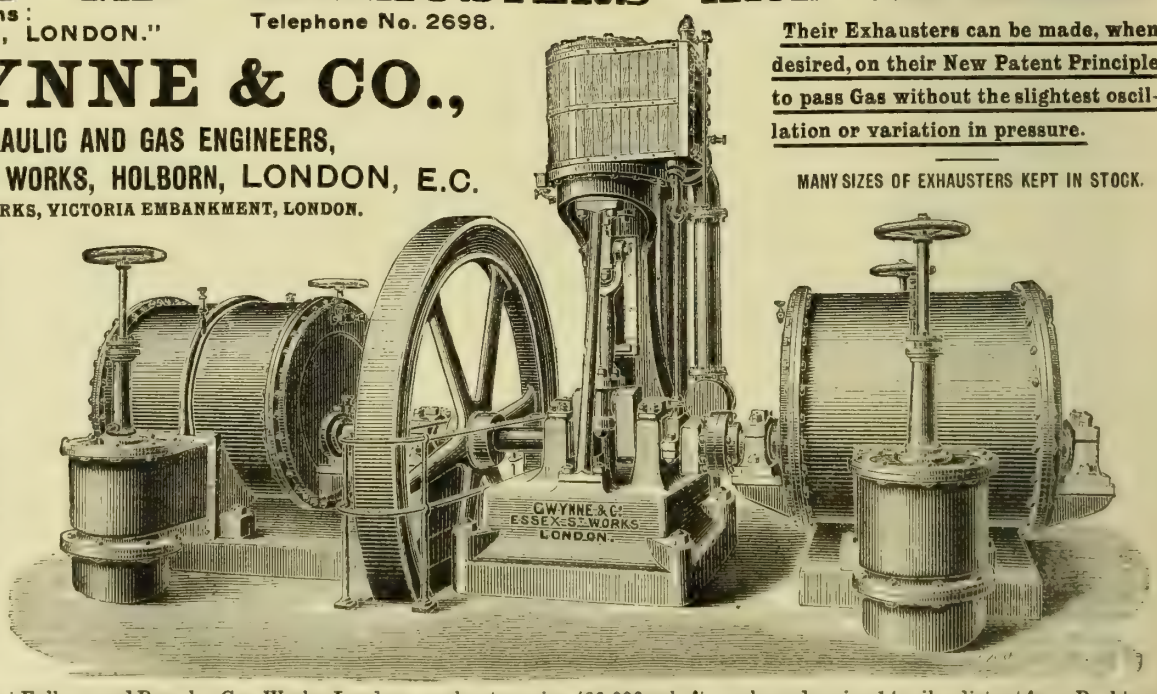

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Telegraphic Address: "GASKING LONDON."

Telephone Number; 2759.

EDITORIAL NOTES.

An Elementary Problem.

SEVERAL proposals for the transfer of gas undertakings from companies to local authorities were sanctioned by Parliament during the past session; some schemes being based upon agreements between the parties, and others involving the principle of compulsory purchase. We have no intention of discussing the details of any of these transactions, but desire to draw our readers' attention once more to the elementary facts of the position of gas capital when in private hands and under public control respectively. It is a commonplace of the gas industry of these kingdoms that private gas capital is irredeemable; while when such capital is raised on the security of local rates, it must be paid off within some period varying from the lifetime of one-and-a-half to two generations. At one period, the longer range for the process of redemption was the rule. But it is now many years ago that Sir Stafford Northcote became alarmed at the propensity of local authorities for incurring debts which were left over for posterity to pay; and he procured a general curtailment of the period for redemption. Whether the process of redemption for local loans is long or short, however, the essential point of such loans remains. They are always repayable, and necessitate the starting and maintenance of a sinking fund for this object. Gas stocks and shares, on the contrary, are perpetual. Now this is an age when all kinds of constants and coefficients are being overhauled and redetermined. The chemists are the great exemplars of this policy of revision; and once, as all the world knows, in the process of reinvestigating the composition of the atmosphere something was discovered that had previously been overlooked. In many other matters besides the data of chemical science, however, people nowadays ask themselves and others what is the foundation of, and continuing justification for, rules and working constants that have been handed down from our predecessors with more or less repute for validity. The ordinary man has to take without question a great number of these conventions; and it is the business of men of many professions, such as that of the law, to master as many "rules of procedure" as possible, in order that the transactions of civilized life may be facilitated by following precedents.

Now and again, however, the practitioner of business according to the usual forms is confronted by a searching inquiry from somebody who cannot be waved off or frowned down, as to the why and the wherefore of a convention; and then it often happens that the expert is nonplussed. The childlike innocence and ignorance of things which are mere commonplaces to "the man in the street" occasionally manifested by British Judges, have been made the subject of scornful remark by the fellows of the omniscient personality in question. But the thoughtful observer perceives easily enough the drift of the careful inquiries of the Court. It is that matters bearing upon the issue shall go upon the record with full explanation, so that future references shall be intelligible. It is very difficult for persons living actively in the present to make sure that what they may say or do will be as intelligible a generation hence as it is to-day. One of the peculiar advantages of a Parliamentary Committee as a means of investigating the merits of a project of legislation, consists in the preponderance in such a body of the ordinary lay mind. A member of such a Committee can (and not infrequently does) ask of Counsel or expert, questions which a lawyer or technically trained person would never think of putting; and he so gets right through many a fine old crusted convention. This year, somebody asked in Committee on a Gas Bill what was the justification for the customary addition of 10 per cent. to the value of an undertaking for compulsory purchase; and the question was somewhat of a "poser."

Suppose now it should be asked, in a similar way, why public gas capital is redeemable in a term of years, and private gas capital is an eternal investment—how is such a query to be best answered? If the JOURNAL were one of the new periodicals which are not meant to be read, still less to be kept and bound for reference, but are mere counters for thinly-disguised gambling, we might stimulate interest in this problem by offering a prize for the best solution forwarded to us in course of post. As it is, we shall be pleased to receive communications bearing upon

the subject from all who know or who would like to be informed as to the rights of it.

A Question of Nomenclature.

The study of words is always a fascinating mental exercise for everybody who happens to be sufficiently educated to begin with to appreciate the vital importance of precision in expression. One meets in the unlikeliest places with examples of men who have made words their study; for as men who are "practical" in the highest meaning of the term are fully aware, it is to the man of action and of affairs, rather than to the scholar or the arm-chair philosopher, that the proper use and comprehension of language is of prime importance. It matters little what value merely literary men attach to words intended only to amuse or to interest readers of "fine letters;" but the right use and understanding of words are matters of life and death, of fortune or ruin, of success or failure, to the soldier, the lawyer, the man of business and of industry. The great Duke it was who declared that there is nothing so valuable as an exact definition; and he was himself as careful in the employment of language as he was of all other concerns in his momentous career. So it is with peculiar pleasure that we have noticed in the recent public discussions of various forms of profit-sharing, a marked desire on the part of those who took part in them to be careful to distinguish the known varieties of the general plan by properly descriptive names. In connection with the International Co-operative Congress in London, and the National Co-operative Exhibition and Festival at the Crystal Palace, profit-sharing was discussed and applauded in principle; and several suggestive terms—such as "participation," "co-partnership," and other words of like (but not identical) meaning—were commended for consideration in this regard. Lastly, there has just been issued by the Labour Department of the Board of Trade a valuable report by Mr. D. F. Schloss, on "Gain-Sharing," which is an important contribution to the literature of the subject. The motive of this compilation is explained to be that of presenting in a collected form information concerning "certain systems "of industrial remuneration which, while they bear, at "first sight, a superficial resemblance [to profit-sharing] "are yet in fact essentially divergent in character from "any form" of this system. The fundamental distinction between the systems drawn by Mr. Schloss is that "while "under a scheme of profit-sharing the employee receives, "by way of bonus, in addition to his ordinary wages, a "share in the profits of the business in which he is "engaged," under the other systems "the employee "receives, as an incentive to the display of a special degree "of efficiency, a bonus, the amount of which is altogether "independent of the profits earned, or the losses incurred "in the business, and which is strictly proportionate to "the extra activity, carefulness, and intelligence exhibited "by him, measured by the reduction effected in the cost "of production as compared with certain standard costs." Any such system is consequently a sort of half-way house on the way to industrial co-partnership; and, as such, it is attainable under conditions which appear to preclude the complete plan. We may have another opportunity for discussing Mr. Schloss's report in detail, but for the present only desire to call attention to the evidence its appearance supplies of the diversity of the main subject, and the corresponding obligation to be careful as to the terms by which the various developments are described.

Gas-Testing Extraordinary.

Nothing has been heard of late as to the perambulating photometer that at one time threatened to make the lives of Metropolitan gas-works managers burdensome to them. But, according to a report of the proceedings of the Edinburgh Town Council this day week, a Liverpool Corporation Committee have "gone" considerably "better" than the London photometrist with the wheelbarrow, inasmuch as they have been taking a gas-tester and all his paraphernalia about with them upon a circular tour of English and Scotch cities, with the laudable desire to find out for themselves what quality of gas the aborigines were receiving. The Edinburgh people were made aware of what has been going on in this way by Mr. Councillor Mackenzie, who has recently travelled as far south as Liverpool, where he learnt that somebody enjoying local reputation as an expert, had had the temerity to test Edinburgh gas "in the Balmoral Hotel," with the result that the illuminating power was found to be only 20·65 candles with the standard burner, and 16·48 with what is described as the "ordinary" burner. Having escaped to Edinburgh, Mr. Mackenzie looked up the recorded tests of the local gas supply for the period of the Liverpool gentleman's invasion, and found the illuminating power entered as something between 24 and 25 candles. He asked, at the last meeting of the Town Council, why these things were so. But his interpellation was not at all well received; one of his colleagues even twitting him with entertaining a desire to puff the electric light, in which he is specially interested, to the disadvantage of the local gas supply. Apart from all such personal and local considerations, the prospect of inter-municipal spying opened out by Mr. Mackenzie's revelations, is not a pleasant one. The circular-of-inquiry nuisance was and is bad enough in all conscience; but it had at least the saving virtue that whosoever had an objection to reply to inquisitorial queries could always "basket" the paper. If, however, corporation deputations are to go about with photometrists in their train, testing on the sly the gas of foreign but friendly parts, with intent to make a note of the results—well, there will be no means of stopping them, so long as their own public are willing to pay the expenses; but one result of such photometrical peregrinations will be to bring gas-testing in general into contempt. The interchange of visits to one another's testing-stations by equally experienced and accredited gas-testers is one thing; this "snap-shot" testing of gas at hotels is another. If the latter is reliable, then the regulation testing-station is altogether superfluous, and ought to be done away with. If the regulations and conventions usually applied to the systematic testing of gas are worth anything at all, then the snap-shot operator is wasting his time on his enterprise, and those who pay him are squandering their money. If there is any middle way out of the difficulty, we should like to know of it.

Trade Unionists at Cardiff.

The Trade Union Congress has been having what might be colloquially styled "a high old time" at Cardiff during the past week. As was expected, the representatives of the Old and the New Trade Unionism had their pitched battle at the earliest possible moment over the question of the revised Standing Orders; and the latter were signally worsted. It was the lesson of the general election over again. Trade Unionism, like other human inventions, has its good and bad sides; but, whether good or bad, it seems hardly a subject for dispute that those who represent the institution before the world should be *bonâ fide* what they claim and are understood to be—followers of trades organized and combined for the furtherance of trade objects and the defence of trade interests. Yet—owing to a variety of circumstances which can hardly be explained, but are thoroughly understood by all who have taken any notice of the facts of recent industrial history—the representation of organized labour has to a great extent been usurped by a set of men who have not, and never had, any connection with the real or titular trades of which they posed as "leaders." The position of the older Trade Unions has never been quite so bad as that into which the newer ones were actually born. They have not been free from grave errors of policy; but, as a general rule, they have retained in office and in power men who are, or have been, real "tradesmen" in the proper sense of the term. The prestige and property of the best Trade Unions attracted the attention and excited the covetousness of several demagogues, such as those who climbed into notoriety as organizers of the unskilled "trades." But it was significant of much that not in the hey-day of their fame, with many newspapers ready to echo and acclaim their loud harangues, would the Amalgamated Society of Engineers, for example, have anything to do with Mr. Tom Mann, and very little with another noisy member, Mr. John Burns. These and other individuals of the same stamp, and of less repute, were accordingly driven to construct pedestals and find support for themselves and their "views" out of the complaisance—to say nothing of the ignorance—of the great reserve of unskilled labourers. The field was for some years a fruitful one, yielding abundantly to those who had the knack of cultivating it. New Unions sprang up on all sides; and as a Trade

Union is a Trade Union, the time came with great suddenness when the representatives of the established organizations of this order found themselves swamped in Congress, outvoted, brow-beaten, and dragged ignominiously at the tail of the once ragged regiment of Socialists who had had the address to seize upon New Unionism as a fresh and profitable branch of their old calling of agitation against a civilization that expects men to work for their living. There is on the face of it no more reason why a Trade Unionist should be a Socialist than there is for his being a Mormon. But, greatly to the disgust of many sober workmen with a little money in the savings bank, the majority in Trade Unionist representation was for several years composed of hare-brained "Collectivists," whose folly culminated in the passing of the Norwich nationalization resolution last year. That settled it—and them. It became the most immediate question of practical Trade Union politics whether such curious excrescences as the "Gasworker" Dr. Aveling should be permitted to stand before the community as embodying the essence of Trade Unionism, or that the Congress should be composed of representative workmen. The question has been answered in the latter sense by an overwhelming vote; and the parasites of Trade Unionism are ordered off. It is reported that these rejected ones held an indignation meeting all to themselves at Cardiff; and if they succeeded in carrying it off without laughing in one another's faces, they should be credited with great histrionic ability. Several of them must have been wondering, not that the game of "Labour "representation" was up at last, but that it should have been played so long. Meanwhile, this year's Congress has not displayed any remarkable improvement, in the matter of judgment and practical common sense, upon its predecessors. The members have been amusing themselves with resolutions in favour of a universal legal eight hours' day and other playthings. But, at any rate, the Congress has now been reconstructed upon its original basis; and better things may be in store for it in the future, when the best members of the associated trades shall have learnt that to belong to a Trade Society is not the whole duty of the workman.

The British Association Meeting.

The British Association for the Advancement of Science will meet at Ipswich to-morrow, under the presidency of Sir Douglas Galton, who succeeds the Marquis of Salisbury. The new President has for 25 years been General Secretary of the Association; and he is a man of very considerable ability in several branches of scientific research. Some interesting papers and discussions are promised for this year's meeting; and several of these will refer to subjects that have been mentioned and debated of late in the Journal. We shall, of course, take special note of these communications; but the principal interest of the meeting, as usual, will in all probability be centred in the presidential addresses and other summaries of the state of scientific knowledge of the period. Few workers in science nowadays reserve their most original productions for the British Association; and the notable exception of last year—the paper on Argon—is not likely to be paralleled on this occasion. The working men's lecture this year should be a good one. It has been entrusted to Professor Fison, who has chosen for his subject "Colour"—a topic capable of almost infinite expansion. The lists of papers in some of the sections, notably that of chemistry, are not particularly promising. But, by way of compensation, it is reported that the Association will try the experiment that has been found to answer so well at some other recent congresses of the kind, and will hold some formally-arranged discussions upon debateable points of general scientific interest. The proceedings in the section of Political Economy and Statistics are likely to be as important as any of the business of the meeting. The President, Mr. L. L. Price, is credited with a sound grasp of the subject; and several attractive papers are promised.

The Management of the Tonbridge and Cambuslang Gas Companies.—For the vacant position of Manager of the Tonbridge Gas Company recently advertised in the Journal, there were, we learn, 117 applications; and the successful candidate is Mr. James Donaldson, the Engineer of the Cambuslang (N.B.) Gas Company, Limited. The Directors of this Company entrusted to Mr. Donaldson the duty of selecting his successor; and he has chosen Mr. Robert Simpson, of the Tradeston (Glasgow) Gas-Works.

WATER AND SANITARY AFFAIRS.

The decision of the President of the Local Government Board to hold a departmental inquiry into the state of the water supply in the East of London, has met with general approval. The *Daily Chronicle* considers that Mr. Chaplin has "done the right thing;" and the *Pall Mall Gazette* says "now we are on the road to learn who and what were "to blame for the failure of the supply." At a meeting of the Directors of the East London Company, the Chairman (Mr. George Banbury) alluded to the determination of the Local Government Board to institute an inquiry into the recent events connected with the water supply of the East-end, as "a source of extreme gratification" to himself and his colleagues. We felt assured that such would be the feeling on the part of the Directors; and we are glad to find it so unequivocally expressed. The Secretary (Mr. I. A. Crookenden) has been directed to instruct the officers of the Company to furnish all possible information for the purposes of the inquiry, and to help forward the investigation to the best of their ability. Nothing will be wanting, therefore, on the part of the Company to render the proceedings effectual to the elucidation of the truth of the whole matter. The plan of the inquiry is well laid out. In the first place, it has reference to the circumstances which occasioned deficiency in the supply; in the next place, consideration is to be given to the effect of the deficient supply on the public health; and, finally, a conclusion is to be arrived at as to the means which should be adopted with a view to prevent a recurrence of any deficiency in the future supply of water to the district. As to this third element in the inquiry, the *Daily Chronicle* imagines that "most people have made up their minds by this time." The only way out of the difficulty is said to be "public con-"trol or acquisition." Mr. Chaplin's inquiry is accordingly made to appear somewhat superfluous; the main issue being already determined. Yet there may not be perfect identity between "control" and "acquisition." What Parliament has to say to the latter method, we shall learn in the session of 1896. "Control" is another matter, only there is a considerable amount of it already. But even "acquisition" is capable of a twofold interpretation. It may not be that the County Council should acquire the property of the Water Companies. Some better device is quite practicable; and we have again to urge upon the Corporation of the City that they should cut themselves adrift from the County Council, and seek a better haven than that of Spring Gardens. So far as the East London affair is concerned, it is important to get an official declaration as to the cause of the deficient supply. A lack of reservoir capacity is a ready answer; and it certainly appears that the shrinking of the water in the reservoirs was the fact which influenced the Directors in somewhat suddenly limiting the supply. The delivery now is a large one. But the season has changed; and the reservoirs are being replenished. The fact to which we alluded last week must not be lost sight of—that the East London Company have not the broad Thames at command, and require a larger amount of artificial storage than the other Companies. But these are points which we may expect to hear authoritatively dealt with ere long. With this inquiry pending, it is eminently absurd to find the County Council seeking for evidence on which to establish legal proceedings against the East London Company. If the latter are in fault, we shall soon learn it from the Government inquiry. But in the meantime, the Council, by means of a double Committee, are conducting an independent inquiry, with a view to the prosecution of the Company for failing to give a constant supply, while furnishing an ample supply to those consumers who took it by meter. Such are the allegations. But if the Council mean to say that the Company, during the drought which prevailed in July, were able to give a constant supply all round, we expect to find Mr. Chaplin's inquiry yielding sufficient proof that the assumption is ridiculous.

A return moved for by Sir Albert Rollit in respect to the relative presence of the constant and intermittent supply in the several parishes of the Metropolis, has the appearance of being singularly ornate and unnecessary. That it should be granted may be taken as signifying that the Government do not wish to appear desirous of withholding any information that may seem to at all bear upon

the Metropolitan Water Question. The organ which appears under the name of *London*, speaking for the County Council, says the return is to show the state of the supply in the Metropolitan "districts." But the phraseology is that of "parishes," which at once introduces a needless and troublesome detail. Is it not sufficient to know, as shown by General Scott's monthly report, what is the percentage of the constant supply in the "districts" served by the Companies; the broad result being that, if we take the Metropolis throughout, about 80 per cent. of the total number of services are on the constant system. In the East London district, 99 per cent. of the supplies are constant; and in the Grand Junction, 100 per cent. Yet *London* tells us that the return obtained by Sir A. Rollit "can but have the effect of emphasizing still further the "inadequacy of the London Water Supply, and the "danger which arises from having only a supply of water "for an hour or two a day." The same journal says that only the East London and the Grand Junction Companies give a constant supply. Yet surely the Southwark and Vauxhall Company deserve credit for having 93 per cent. of their supplies constant? The remark is made that, if the Grand Junction constant supply is of the same nature as that of the East London Company, "it is far from "adequate." The "if" breaks down; for the supply given by the Grand Junction Company in June last was within a small fraction of 56 gallons per head; the next in magnitude being Chelsea, with less than 48 gallons per head. The figures in *London* are described as taken from "the last report" by the Public Control Department of the County Council. But the statistics thus obtained are evidently not up to date. It is stated that, prior to the recent drought, nearly 120,000 houses in the East London Company's area obtained only an intermittent supply. Yet General Scott's report for March shows that the houses having an intermittent supply in the Company's district, both inside and outside the Metropolitan boundary, were only about 1000 in all. If our contemporary would knock off a couple of ciphers, they would come tolerably near the mark, and would perhaps be right for some period last year. We have observed on a previous occasion that, although General Scott's reports are sent to Spring Gardens, they do not appear to be read in that region.

Mr. Henry L. Cripps had a letter a column long in *The Times* of Saturday last, professedly on the subject of the East London water supply, but in reality directed against the Metropolitan Water Companies in general. Another letter is to follow, intended for the special demolition of the East London Company. Mr. Cripps is of opinion that it is time the London Water Question was settled. We venture to suggest that the really disturbing element is the London County Council. Mr. Cripps complains that, whereas he had the conduct of the Water Transfer Bills in the recent session of Parliament, he had "to "encounter the strongest possible opposition from the "Companies and their friends at every stage;" and he would have it appear that thus the settlement of the question has been delayed. But Mr. Cripps omits to explain that this opposition arose from the extraordinary conditions laid down in the Bills, by which the Companies were exposed to treatment of a most unfair description. Thus, as we have said on a former occasion, if the Companies are to be bought up, the way has been blocked by the County Council, in proposing impossible terms. As Mr. Cripps has not yet said his last word, we wait to hear it, before dealing at further length with his remarks.

Presentation to Mr. Cornish of Bridport.—The employees and workpeople of the Bridport Gas Company, on Thursday last, presented to Mr. J. H. Cornish, their Manager and Secretary, a very pretty dining-room timepiece, in commemoration of his marriage, which had recently taken place. After the presentation, Mr. Cornish entertained the employees at dinner, which was enlivened by music; a very pleasant evening being spent.

A Gas Manager's Son Drowned.—The sympathy of a large number of our readers will be extended to Mr. James Bailey, the Manager of the Middlewich Gas-Works, in the loss which has befallen him by the sudden death of his son Alfred, under sad circumstances. The boy was playing last Wednesday near the North Staffordshire Canal, at Middlewich, when he slipped into the water, and was drowned. Mr. Bailey was informed of the occurrence, and himself recovered his son's body in about ten minutes, but life was extinct. It is a curious coincidence that the former Manager at Middlewich (Mr. Peter Hancock) met his death by drowning in the same canal early in 1893.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 652.)

Business on the Stock Exchange last week was decidedly quieter; the spirit of activity which enlivened the previous week having almost entirely died away. Every now and then, there were signs of a little more animation being imparted to the markets; but they did not come to much. Even the South African market failed to keep up its usual buoyancy, and would have been almost tame, except for the big banking speculation recently launched upon it. But prices on the whole did not suffer; and perhaps balancing the losses on one side against the gains on another, a tolerable equilibrium was the result. The Money Market was as easy as ever, wanting even the mild stimulus of the fortnightly settlement. Business in Gas securities was very fair, when the time of year is taken into account; and transactions were quite up to the average of the dead season. It follows almost as a matter of course that there was no abatement of the continued firmness; and so long as the strong demand for good investment securities exists, so long may we expect that Gas stocks will hold their own. Changes in quotations are not numerous; but they are all in the upward direction. In Gaslights, the favourable signs apparent in the "A" stock a week ago were realized after a little hesitation, and a point in advance was scored. The other issues were in good demand, and strong generally, though the 6 per cent. debentures was the only one actually to advance. South Metropolitans were more active, and maintained (though they did not improve upon) their recent advance. Commercials were hardly touched. The Suburban and Provincial group were more than usually inactive, and not a quotation moved. The Continentals, on the other hand, were more brisk, and showed decided strength; Union and Cagliari making smart advances. Among the rest, there was no lack of business; but Australian debenture was the only one to move. Transactions in Water stocks showed a greater degree of activity; and prices were inclined to be steadier, although Southwark ordinary had a fall.

The daily operations were: Business in the Gas Market was rather more active on the opening day; and the general run of prices was very good. Continental Union preference advanced 4; and Australian debentures, 2. Transactions on Tuesday were much about the same; but the only change in price was a rise of 1 in Cagliari. Wednesday was perhaps the quietest day of the week; and there was no movement of any sort. Greater activity set in again on Thursday, especially in Gaslight "A," which promised to improve; but nothing moved on that day. In Water, Southwark ordinary fell 3. Things continued brisk and buoyant on Friday. Gaslight "A" rose 1; ditto 6 per cent. debenture, 2; and Cagliari, 1. Saturday's business was about the average; and quotations closed without further change.

ELECTRIC LIGHTING MEMORANDA.

Affairs Electrical in Liverpool—The Reward of Enterprise in Londonderry—The Prospects of Accumulator Traction.

There seems to be something peculiar, to judge from the reported proceedings of the Liverpool City Council which will be found in another column, about the arrangements for the transfer of the undertaking of the local Electric Light Company to the Corporation. We purposely refrain from expressing any opinion as to the merits of this transaction, and shall rest content to notice it as a matter of fact. The Corporation appear to regard the bargain as satisfactory, in the interests of the city; and the shareholders (unlike those of many other companies of the kind) ought to be glad to get their money back, with a premium on their venture. Of course, Liverpool wants electric light, just as it needs every other luxury of civilization; and there are many citizens who can afford to pay for it. Whether the Corporation, who were among the first municipal authorities in England to inquire into the new system of lighting, were well or ill advised in allowing a private company to undertake the exploitation of the new light in the city, instead of doing the work themselves, is now an idle question, which may well be left out of consideration. Whatever may be the prevailing tone of local opinion in this regard, it is at least open to be argued that, by acting as they did, the Corporation allowed the public to have the advantage of electric lighting at an earlier period than would have been practicable if the venture had been municipalized from the first. In this respect, Liverpool has been in agreement with Birmingham, and (as usual) out of harmony with Manchester, which has only tardily provided its citizens with electric light from a corporation station.

It is a proof of the possession by Mr. John Christie, the Electrical Engineer to the Corporation of Londonderry, of no small amount of courage, that he brought the story of the establishment of electric lighting in the city before the members of the Association of Municipal and County Engineers on the occasion of the recent meeting of the Association to the scene of so dismal an experience. Londonderry rushed in where Liverpool feared to tread, with consequences that have been reported in our columns on several occasions. The latest

information on this subject, as given to the world by Mr. Christie, is that Londonderry now pays £4000 a year for public lighting, as against the £2200 formerly paid for gas. The reflections uttered by the local newspapers upon this brilliant result of the enterprise of the Municipality, are not complimentary to those who were responsible for the venture. In discussing Mr. Christie's communication, several of the visitors to Londonderry ventured to ask why the new light was installed in such circumstances; and the local press, with brutal candour, has declared that "nobody had the hardihood to rise and explain that the light was introduced by means of the most disgraceful exhibition of false pretences that could well be imagined." It is further alleged that "outrageous figures, showing a profit as compared with gas, were concocted." We have seen a good many of such computations; but to Londonderry belongs the sad consolation of having been one of the first cities deluded by prophesying electricians to discover its error. "The scheme has reduced the Corporation finances to a condition bordering on bankruptcy;" and there is no other outlook for it but that "matters must drift from bad to worse until either the rates are raised or the electric light abandoned." Even so, the folly of the Corporation will continue to be visited on the ratepayers for many years to come.

Some interesting information concerning the results of the application of secondary electric batteries to tramway working was published at the recent meeting of the Birmingham Central Tramways Company. Among other points illustrated, was that of the necessity of caution in accepting an early provisional success in the use of electricity as an augury of continued triumph. Last year the then Chairman of the Company spoke of their accumulator car venture as one of "mingled difficulty and hope." Yet the cars had seemed to be through their initial difficulties, and were credited with having actually earned a profit of over £1200. This year the promise of success has given place to a loss of £1735, attributed by the official apologist for the Company to all sorts of unfavourable influences, rather than to the system of working. The fact remains, however, that accumulator traction is not doing so particularly well in Birmingham that the application is likely to be extended either in that city or elsewhere about England. Even the *Electrician* is disposed to give up the system as hopeless. It is acknowledged that "the Birmingham line is not an abnormally trying one; that several types of cell have been employed; and that these experiments on a commercial scale have now lasted several years." The moral drawn by our contemporary from this recital, with reference to the views of "individuals who affect to believe in electric omnibuses," is that "it would be as well to learn to walk before attempting to run." The observation applies with particular force to the competition for the *Engineer* prizes for mechanically-driven road carriages, which some people, without the smallest reason, have pretended to regard as safe to go to some combination of the electrician and the carriage builder. The truth is, as we have often had occasion to observe, that to the vast number of vague persons who air their notions about things in general in the newspapers and at corporation meetings, the word "electricity" is still as full of mysterious promise as "that blessed word, Mesopotamia," was of comfort to the old lady of the story. No amount of disillusionment, short of the loss of their own money in an electric speculation, seems to affect the childlike faith of these individuals in the pet fetish of latter-day sciolists; and so it happens that they are found again and again voting other people's money away in connection with schemes the hollowness of which prevents their being heard of otherwise than as indications of "municipal enterprise." It is a striking reflection that, in regard to this matter of the development of electric power, the keenest and most feeble intellects experience the same fascination with the subject, albeit the nature of the attraction differs.

Mr. J. W. Walker, the Manager of the Colnbrook Gas Company, has come to an arrangement with his Directors for leasing the works from Oct. 1 next.

A New Refractory Substance.—A correspondent of the *Colliery Guardian* says that, under the name of apyrite, Herren Schiffer and Kircher, of Grunstadt, in Rhenish Bavaria, work a mineral containing about 93 per cent. of silica, and consequently very refractory. When mixed with water, it forms a plastic and adhesive mass, which, after desiccation, becomes firm and resisting, while its volume does not change when exposed to the fire. Moreover, it is scarcely attacked by metals and scoria in fusion, which either do not stick to the surfaces made with it or are easily removed without the least detriment to the furnace. In the neighbourhood of the mines, apyrite, tempered with water, is used instead of lime mortar, and also for plastering. Slightly damped, this substance is punned so as to supersede fire-brick lining; and a large foundry cupola can thus be lined in a day by two men, while such a lining lasts longer than one of the same substance made up into bricks. For repairs to the fire-brick lining of furnaces, apyrite is also very useful, while its low price, and the fact that it is a good non-conductor of heat, recommend it in the case of blast-furnaces, puddling and heating furnaces, foundry cupolas, and crucible furnaces. The following is the composition of two qualities, the pure and the rich: SiO_2, 92·37 and 90·95; Al_2O_3, 5·1 and 9·45; Fe_2O_3, CaO, MgO, and K_2O together, 0·37 and 1·05; and H_2O, 1·73 and 2.

GAS ACTS FOR 1895.

Second Article.

THE Brighouse Corporation Act contains provisions for authorizing the sale of the undertaking of the Rastrick Gas Company to the Corporation. The district was incorporated as a municipal borough by Royal Charter in 1893, and the Company had an Act in 1865. It was during the negotiation of the Charter that an agreement to transfer the gas undertaking to the nascent Corporation was concluded between the Company and a Committee formed for promoting the incorporation of the town. The Company had a capital of £22,000, and had borrowed £2500 on mortgage. Part of the borough, moreover (known as Hove Edge), was partly included within the gas limits of the Halifax Corporation, who had agreed to sell and transfer their rights over this area to the Brighouse Corporation. The Act provides that the purchase money for the gas undertaking is to be £47,500, exclusive of the mortgage debt, which is to be taken over and paid by the Corporation. The Company retain their reserve fund of £1956, and receive the costs of the transfer. The price of gas is not to exceed 4s. per 1000 cubic feet; and interest at the rate of 3 per cent. is to be paid on consumers' deposits. The Hove Edge portion of the borough is taken out of the gas limits of the Halifax Corporation. Outlying portions of the undertaking are to be transferable to other local authorities, under a special condition as regards the value to be paid in the event of the transfer of any portion of the district situated within 300 yards of the boundary of the ancient hamlet of Brighouse. The sum of £52,000 is to be raised for the acquisition of the gas-works; and £29,000, for their extension and improvement.

The Clonmel Corporation Act provides for the transfer to the Corporation of the undertaking of the Clonmel Gas Consumers' Company, Limited. The transaction was agreed to between the Company and the Corporation on Nov. 16, 1894, in consideration of the payment of £13,000; and the agreement is confirmed by the Act. In addition to the payment to the Company, a sum of £3000 is required for the purchase of the interests in the undertaking formerly belonging to the British Gas Light Company; and a further sum of £2000 is to be raised for the improvement of the works. The gas limits under the Act are the borough and any places adjacent thereto situate within a radius of three miles from the town hall. The maximum price of gas is to be 6s. 6d. per 1000 cubic feet; and 5 per cent. interest is to be paid on consumers' deposits. Power is given for the formation of a Gas Committee of the Corporation, to consist of not more than five members. The gas-rents may be collected with the general rates.

The Hebden Bridge and Mytholmroyd Gas Board Act constitutes a Gas Board for the urban districts of Hebden Bridge and Mytholmroyd, in the West Riding of Yorkshire, and transfers to and vests in the Board the undertaking of the Hebden Bridge Gas Company. The capital of the Company consisted of £13,670 of 10 per cent. stock, and £16,424 of 7 per cent. shares, with no borrowed money. The Board is constituted of seven members from Hebden Bridge and two from Mytholmroyd—the Chairman to be elected by, and out of, the members of the Board, and three to form a quorum. The scheduled agreement for transfer of the undertaking is confirmed, by which the consideration for the purchase is stated to be the payment of a sum representing 27 years' purchase of the maximum dividends actually paid by the Company. The District Councils are declared to be interested in the undertaking; and are to share in profits or losses or deficiencies in revenue in proportion to the gas consumption of the respective areas for the preceding year. The maximum price of gas is 4s. 6d. per 1000 cubic feet, subject to discounts of from 2½ to 10 per cent. The sum of £103,000 is to be borrowed for the purchase and improvement of the plant; and £5000 for working capital.

The Ambleside Urban District Council (Gas and Water) Act sanctions the transfer of the undertaking of the local Gas and Water Company to the Council. The consideration for the transfer is to be agreed upon between the parties or ascertained by arbitration in accordance with the provisions of the Lands Clauses Act, upon compulsory terms; and in addition thereto the Council are to pay the costs of the Company and compensate their officers. The maximum price of gas is fixed at 5s. 6d. per 1000 cubic feet. Interest at the rate of 4 per cent. is to be paid on consumers' deposits. The money necessary for the purchase is to be borrowed, and also the additional sum of £9000 for the necessary extension of the works, to be repayable in 45 years.

The Chesterfield Gas and Water Board Act constitutes and incorporates a Gas and Water Board for the Borough of Chesterfield and the adjacent districts, in Derbyshire, and transfers to and vests in such Board the undertaking of the Chesterfield Water-Works and Gaslight Company. Associated with the Corporation in this matter are the Urban District Councils of Whittington, Newbold, and Dunston. The Company were first incorporated by an Act of 1855; and their last Act is dated 1876. The present area of supply comprises the borough and districts named, and also the adjacent districts and parishes of Brampton, Walton, Brimington, Hasland, and Tapton. The limits of the Act are stated to be the existing limits of the Company, subject to the proviso that it shall not

be lawful for the Board to extend the existing mains of the Company for the supply of gas in the parishes of Brimington and Whittington without the consent of the Whittington Gas Company, Limited. The Board is to consist of twelve members, of whom eight are to be elected from and by the Chesterfield Town Council. The quorum is to be six members. The sum to be paid for the Company's property is to be determined by agreement or arbitration; and the purchase is to be completed within six months after the publication of the award. Officers and servants of the Company (but not including the Directors or ordinary workmen) who shall have been at least five years in the Company's employment are to be compensated for any loss they may suffer in consequence of the transfer. The Company's mortgage debt is to continue a charge upon the undertaking; but all other debts are to be paid off by the Company. Four per cent. interest is to be paid on consumers' deposits. In addition to the purchase money and the costs of the transfer, the Board are authorized to borrow £30,000 for gas-works purposes. Gas capital is to be repaid in 40 years. In order to raise money for current annual expenditure, the Board are authorized to borrow an amount not exceeding one-half of the estimated revenue of their undertaking, from any bank or other person, upon such terms as may be agreed upon. Surplus gas revenue is to be applied to reduce the price of gas. Although the gas and water undertakings are to be kept separate, any deficiency of the revenue of the one may be made up by borrowing from the reserve fund of the other, subject to the payment of 3 per cent. interest on the amount so taken, and its repayment out of revenue.

NOTES.

Ewing's Extensometer.

The study of the action of parts of iron structures—such as gasholders and their framing—under stress, should be facilitated by the appliance described in a paper read by Professor J. A. Ewing before the Royal Society. The appliance is a new form of extensometer, or apparatus for measuring the elastic stretching of bars. It consists of two cross-pieces attached to the bar by means of a pair of diametrically opposed set-screws. Each piece is separately free to oscillate about the line joining its screw-points; since it does not touch the rod under test at any other place. But the two pieces are caused to engage with one another in such a way as to exhibit the amount of displacement corresponding to that of the extension of the bar under strain. The displacement is shown by one piece; and it is measured by means of a microscope attached to the other. The whole apparatus is self-contained. It is made in two forms, one for laboratory use, when the specimen under test stands vertically; and the other applicable to rods in any position—such as members of structures *in situ*. In the laboratory use of the instrument, the elastic properties of the material are examined by observing the strains under known loads; in the application to structures, the object is to determine experimentally what the stress on any member is from observation of the strain—the modulus of elasticity being assumed. The author described a number of observations made with the new instrument upon rods strained within, and in excess of, their elastic limit. In the latter condition, the elastic properties of a rod are materially different from its properties in a primitive state. On reloading the over-strained rod, it is found that the ratio of strain to stress no longer holds good, and further that the bar continues to stretch (even under light loads) if kept on for a few minutes. Over-strained rods, on the other hand, were observed to recover their elasticity after a few day's rest; the extent of recovery being apparently proportional to the softness of the metal.

Testing Lightning Conductors.

An interesting little instrument, designed to show when lightning conductors have been struck by a discharge, has been invented by Herr Zielinski, of Berlin, and is used by the German Imperial Post Office. It seems calculated to supply a decided want, since it must be a satisfaction to those who have gone to the expense of elaborate lightning protection, to know when this has been put to use, which cannot be ascertained without instrumental indication. Herr Zielinski's apparatus was recently illustrated in the *Electrician*. It consists of a kind of magnetic compass, provided with means of attachment to the lightning conductor. In a glass-covered brass case, a star-shaped compass needle swings upon a steel point. The magnetic star will set itself in the line of the magnetic meridian; and when first connected up for service, the red mark on the needle, or the point of the star opposite, is set towards the lightning conductor. The cover of the box is then put on, so that its pointer marks the same centre-line as the red mark of the needle. If, after this, the conductor is struck by lightning, the magnetism of the needle is disturbed, and the needle becomes newly magnetized in the direction of the lines of force of the discharge. Under the influence of the earth's magnetism, or that of the conductor if the latter is of iron, the star magnet will settle down into a new position. Any deflection of the needle, therefore, is taken as evidence that a lightning discharge has traversed the conductor. It can be easily re-adjusted to show a fresh discharge. Curiously enough, it is claimed that the instrument will only respond to lightning—even heavy discharges of artificially generated current failing to affect it.

Free Helium.

It is frequently observed that, whenever a discovery of something previously unsuspected is made—as that of argon and afterwards of helium in the atmosphere, by Rayleigh and Ramsay—the thing is speedily found in many other places and under familiar conditions; so that it becomes matter of wonder how it can have been overlooked. In the case of helium (hitherto only found in a few minerals, and in a state of combination of which nothing is known), it has recently been reported by Professor H. Kayser, of Bonn, that he has detected it in a free state in Nature, in no more occult a source than the springs of Wildbad, in the Black Forest. The bubbles of gas which these springs give off contain, according to an old analysis, as much as 96 per cent. of nitrogen. Thinking that this looked promising for argon, Professor Kayser submitted the gas to analysis, with the gratifying result of finding both argon and helium—the latter not in a small quantity, as its lines appeared very bright, and could be easily photographed. Thus, for the first time, a place has been discovered where the two gases included under the name helium are "on tap," so to speak, and stream freely out into the atmosphere. Where else helium may be found, and what office it fills where it is found, are wisely left as open questions by Professor Kayser.

The Upsetting of Tie-Rods.

Writing to the *Engineering Record* respecting the strength of tie bars with upset or plain screwed ends (as to which a question has been raised), Mr. G. C. Henning asserts that experiments made on small rods of iron and steel, with threads cut in the rolled end, always showed fracture in the threads, provided the holding nut was not screwed up to the end of the thread. When the nuts were screwed home, the fracture occurred sometimes in the thread and sometimes in the body of the bar. When the latter occurred, the material always showed a lower strength than that specified—proving that the break must have been due to some actual defect. Round bars with upset ends, as usually made, are sure to be weaker than those with threads cut in the solid rolled bar, because the upsetting is usually effected, says Mr. Henning, by heating up the end of the bar to a very high heat, and then producing the upset by hydraulic pressure—afterwards allowing the bar to cool. This leaves the metal in a much weaker condition than it is in the rolled bar, and in a coarsely crystalline state. Instead of this cheap and ready method of upsetting, the work should either be done at a lower heat, or else the end should be upset considerably more, and then worked down to the correct size (under the hammer or press) until the metal has cooled to a low red. In the case of long steel tie-rods with threads cut on the ends, Mr. Henning denies that the rods usually break in the body of the bar, unless the latter is defective. The fact that iron rods do occasionally so break is referred to the fact that long rods are always weaker than short ones—that is, defects will be found in long rods which are only accidentally found in short ones. Steel rods, being very much more uniform, and more free from accidents of manufacture, do not show this difference in so great a degree.

Death of the Town Clerk of Sheffield.—A heavy loss has been sustained by Sheffield through the death of its respected Town Clerk, Mr. J. W. Pye-Smith, on Monday morning of last week. He had only reached the age of 54 years; and the cause of his death was uræmia. Deceased, who was formerly a partner in a firm of solicitors, devoted himself early to municipal work. In 1872 he was elected to the Town Council; and in 1880, he was elevated to the Aldermen's bench. Five years later, he received the highest dignity the town could confer upon him in being appointed Mayor, which honourable position had been filled by his father nearly thirty years previously. In April, 1887, Mr. Pye-Smith was elected Town Clerk. It is curious to note that his appointment was on the very day of the third reading of the Sheffield Corporation Water Bill in the House of Lords—a consummation for which he had laboured hard for several months. Undoubtedly the most memorable piece of municipal work with which Mr. Pye-Smith was actively associated, was the acquisition by the Corporation of the water-works. It was during the year he was Mayor of the borough that this important transaction was formulated and settled; and his colleagues on the Council recognized his peculiar ability to deal with matters of this complicated character by electing him Chairman of the Committee appointed to superintend the parliamentary proceedings. He consequently took a prominent part in the delicate work which is inseparable from business of such magnitude; and it is freely acknowledged that the excellent bargain which the ratepayers secured—admittedly the best that could be obtained—was largely due to his foresight and wise counsel. Mr. Yeomans, the then Town Clerk, died just when the completion of the purchase was in sight; and his death was supposed to be the result of the draughts he encountered while attending the parliamentary proceedings in connection with the Bill. The cost of the undertaking amounted to £2,092,014. Mr. Pye-Smith continued Chairman of the Water Committee until his appointment as Town Clerk.

TECHNICAL RECORD.

MUNICIPAL ENGINEERS ON ELECTRIC LIGHTING.

At the Irish District Meeting of the Incorporated Association of Municipal and County Engineers, recently held in Londonderry, under the presidency of Mr. E. R. S. Escott, a paper descriptive of the electric lighting installation in the city was read by Mr. J. Christie, the Electrical Engineer to the Corporation, and one on the general subject of "Municipal Electricity," by Mr. J. Perry, the County Engineer of Galway.

After a few introductory remarks on the importance of the question of electric lighting to municipal engineers, Mr. Christie stated that in 1893 the Corporation of Londonderry decided to adopt a scheme for the public lighting of the city by means of arc lamps. The one prepared by Mr. Blake was submitted to Dr. John Hopkinson; and, on his approving of the specification, a grant was obtained from the Local Government Board to borrow the necessary estimated capital of £15,000. At present there were two boilers put down. They were of the Lancashire type, 26 feet long and 7 feet in diameter, constructed for a working pressure of 125 lbs. per square inch. The feed-water arrangements comprised two duplex direct-acting pumps, each capable of supplying 900 gallons per hour against the maximum working pressure. The economizer consisted of 96 4-inch tubes 9 feet long. The steam was conveyed to the engine-room by two lines of 9-inch wrought-iron pipes having 6-inch branch-pipes to each boiler. In the engine-room were placed along one side three vertical compound condensing-engines of 150 indicated horse power. The diameter of the high-pressure cylinders was 11 inches, and of the low-pressure ones 22 inches; and the stroke was 18 inches. The average speed at which they were run was 145 revolutions per minute. The distribution of steam was effected in the high-pressure cylinder by a piston valve admitting the steam in the middle and exhausting at the outer edges; and in the low-pressure cylinder by an ordinary trick slide-valve. By this arrangement the high-pressure piston gland was the only one which was subjected to the full working pressure.

Each engine drives two dynamos placed on sliding rails one behind the other. They are of the constant-current series type, made by Messrs. Siemens Bros. and Co., Limited. They were designed for an output of 10 ampères at 3000 volts at 750 revolutions per minute. The Corporation had had them running constantly for nearly 48 months, at 2500 volts, and often had them subjected to the most severe strains possible, and they had given no trouble whatever. To keep the current constant, a very ingenious regulator was provided, which automatically varied the voltage to suit the number of lamps on circuit, by rocking the brushes back or forward. With these regulators in gear, it was almost impossible to get more than 10 ampères for any time; and they gave the current just as well on short circuit as when the whole resistance of the circuit was on. From the dynamos the current was led to the switchboard by means of insulated cables laid in trenches under the engine-room floor. The switchboard was arranged for six dynamos, and four circuits; and it was provided with short-circuit field switches, double-pole fuses, and a Swinbourne electrostatic volt-meter, to each dynamo—each circuit having a Siemens ammeter double-pole fuses, and a Thomson-Houston lightning arrester on each end.

The author went on to explain that the lighting of the city is divided into two sections, each having two circuits with lamps arranged alternately on different circuits. The cables consist of $\frac{1}{16}$-inch copper strand, heavily insulated with vulcanized india-rubber with a covering of bituminized jute armoured with galvanized steel wires, the whole being covered with jute steeped in a preservative compound, and laid in the ground direct. The armouring is earthed at every lamp, and also at the station ends. There are 34 miles of this cable laid—the longest circuit being about nine miles round; and the area lighted is one of the largest in the country. During the first six months after the plant was taken over by the Corporation, they had a most unfortunate time of it, through failures of the lamps, cut cables, and other causes incidental to the starting of such a large scheme. For a long time, this made the electric light most unpopular with many; but Messrs. Siemens successfully surmounted all the many difficulties as they cropped up; and in the very depth of winter entirely relaid the whole of the cables without interrupting the lighting of the city. All these failures, said Mr. Christie, were happily a thing of the past; and now they rarely had even a single lamp failure reported. All the lamps are of the well-known Brockie-Pell double carbon 32-hour type, so that in winter they only require trimming every second day; while in summer once a week suffices. Each lamp has fitted within itself a cut-out, which, should the carbons burn out, or the rods hang up from any cause, automatically cuts the lamp out from the circuit and forms a bye-pass for the current to go on to the next lamp. The lamps are fixed on ornamental cast-iron pillars 25 feet high, and pitched from 75 to 250 yards apart. In the base of each pillar, inside a locked door, an isolating switch is provided, by means of which any separate lamp may be extinguished quite independently of any of the others on the same circuit. Daily insulation resistance tests of all the circuits are taken; and if any one shows below the normal, it is carefully watched, should it become dangerously low.

The cost of the whole scheme up to the present amounts to between £18,000 and £19,000. The financial year is not up till November, and the author regretted that he could not give the exact cost of the public lighting. In winter, during the long nights, the works cost per lamp-hour as low as 0·65d.; and in summer, when the runs are shortest, they reach as high as 1·70d. per lamp-hour. So far as could be judged, the total cost, including everything, should not much exceed £19 per annum, which, considering the number of hours they run, the author thought was by no means excessive. No attempt has yet been made by the Corporation to introduce private lighting; but as they have every facility on the site of the present station for the accommodation and working of all the necessary plant for it, and as the town is particularly well situated for the working up of a most lucrative electricity supply business, he said he had no doubt that before long they would be following the example set them by nearly all the other leading municipalities, and wisely keep the valuable monopoly of supplying electricity to the citizens in their own hands, by extending their present system, and laying down suitable machinery.

Mr. Perry, in introducing the subject of "Municipal Electricity," said that for six years, as part owner and occupier, he had been connected with the public and private supply of electricity in Galway. Electrical engineering was forced upon them, and they had to do their duty in regard to it, as they had done their duty by the other human refinements which had preceded it. There had been for some years in the public mind a confusion between electricians and electrical engineers, which would be paralleled by supposing mariners and astronomers to be the same. Electricians were doing good work for engineers; but a mere electrician was not an engineer. Electricity leaving a central station, passing round an external current, and returning to the station, might be compared to an endless rope driven by a pulley in the station. If they conceived of a rope of that kind passing round capstans and through tight places of one kind and another, they would see that when it was made to circulate it would turn the capstans and heat the tight places. Let them call the speed of the rope ampères, and the tightness of it volts. As many ampères returned to the central station as left it; but the volts varied from point to point. If they multiplied the tightness or pull by the speed, they had the power transmitted at any point. It was of no great consequence how the unit, ampère, and volt had been fixed. The volt meant pressure, or tightness of the rope; the ampère meant speed, or quantity per second. There they were on familiar ground, because 746 watts were a horse-power. When 1000 watts run for an hour, it was called a Board of Trade unit. A unit of electricity, for which they in Galway charged 3d. if used for printing or bottle-washing, or 5d. if used for lighting, was equal to $1\frac{1}{3}$-horse power for one hour. When, however, they had to compare the value of a unit of electricity for lighting purposes with that of 1000 cubic feet of gas, they had the elements of lamps and burners coming in in ways which allowed of a considerable field for discussion between gas conservatives and electric radicals. It was fair at this time of day to accept Gordon's estimate, made long ago, that 1000 cubic feet of gas were equal to 10 units of electricity, which would make electricity at 3d. equal to gas at 2s. 6d. With alternating currents electrical transformation was very simple. It was not so simple for continuous currents; and in this was a great point in favour of alternating currents for certain circumstances. There were disadvantages, and they had electricians who showed some partisanship both for continuous and alternating currents. The engineer would use what best suited his special conditions. Series dynamos were used for arc-lamp lighting, and compound dynamos for incandescent-lamp lighting, with accumulators. For five years he had every night run arc lamps off a shunt dynamo; and he had charged accumulators with both compound and shunt dynamos. With a turbine at an inefficient speed, he had also run incandescent lamps direct from a shunt dynamo without any injury; so that the above rules were in some respects flexible. The electrical arrangements at a central station were absolutely simple. The part in which there was any complication was the accumulator portion. Accumulators, if used for storing, were in first cost very expensive as compared with gasholders; and if used as regulators, they involved some little complexity in connections and switches. With proper arrangements on the premises for repairing defective plates, the maintenance of accumulators would give very little trouble. Accumulators were specially suitable for water power, because they allowed of the power being utilized during the whole 24 hours. There was a loss of about 24 per cent. of energy in accumulators.

In the discussion upon the papers, Mr. T. de Courcy Meade said the order of procedure with electric lighting in Londonderry had been the reverse of that adopted with most of the English towns. In England, the usual practice had been to adopt electricity for private lighting, and not to undertake public lighting. With regard to Mr. Perry's paper, he did not think any ordinary municipal engineer was likely to undertake an installation of electric lighting without the assistance and advice of an electrical engineer. Mr. Pritchard said it would be interesting to know why Londonderry had gone in for public

lighting alone. Mr. J. Lobley also thought the light should be supplied to private consumers. In the first six months' working at Hanley, they earned sufficient to meet all expenses, including interest on capital and sinking-fund charges. Mr. Christie, in reply, said he thought it would have been better for Londonderry to have worked up the public and private lighting together on a small scale, and extended them as it became necessary.

THE IRON INDUSTRIES AND MINERAL RESOURCES OF SOUTH STAFFORDSHIRE.

At the recent Annual Meeting of the Iron and Steel Institute in Birmingham, under the presidency of Sir D. Dale, the above subjects were dealt with in papers by Mr. D. Jones, F.G.S., and Mr. H. W. Hughes, F.G.S., respectively.

Mr. Jones began by pointing out that many of the inventions which have developed the iron trade to its present position had their home in South Staffordshire; and, after referring to the early history of the trade when iron was smelted with charcoal, and to subsequent inventions, he said that in 1796, there were in South Staffordshire 14 blast-furnaces; in 1806, 40 furnaces, of which 30 were blowing; in 1823, there were in blast 81; in 1826, 90; in 1830, 118; in 1840, 116 in blast. In 1857 this number had been increased to 153 in blast; and since that time a gradual decrease had taken place. On June 30, 1895, they had only 19 in blast. The Iron and Steel Institute visited the district in 1871, when 163 furnaces were built, and 108 in blast. Each furnace produced 6720 tons of iron per annum—the total production being 725,716 tons. Ten years later, the furnaces in blast numbered 48 only; the yield per annum being 7798 tons, and the total production 374,321 tons. In 1891, 31 furnaces were in blast; 11,525 tons was the yield per furnace; and the total production was 357,285 tons. The figures for the subsequent years were: 1892—furnaces built, 27; yield per furnace per annum, 11,956 tons; production, 346,725 tons; 1893—furnaces built, 24; yield per furnace per annum, 13,726 tons; production, 329,431 tons; 1894—furnaces built, 22; yield per furnace per annum, 14,360 tons; production, 315,924 tons.

Turning to manufactured iron, Mr. Jones gave some particulars as to its history, and mentioned that there are upwards of eighty firms in the district engaged in the manufacture of iron in various forms. This statement, however, gave no idea, he said, of the importance of the district in bygone years, when, with South Wales, it produced all the rails used in the world. The principal trade was that of sheet-iron making, associated with galvanizing. Galvanizers had become ironmasters, and ironmasters had become galvanizers. Marked bar iron had been to some extent superseded by steel. During the last ten years, great changes had taken place. Many of the iron-works had been broken up. Having given a list of the puddling and other furnaces and rolling-mills in operation or available in South Staffordshire and East Worcestershire on June 30, 1895, he said some idea of the gradual decrease in the number of furnaces might be formed when he stated that in 1871 there were 2037 erected; while in 1881 the production of puddled iron was 580,000 tons, as compared with 389,013 tons in 1894.

In viewing the district as a metallurgic centre, Mr. Jones said it was necessary to consider the production of steel together with that of iron. Referring to the exceptional position in which South Staffordshire stood in relation to a home market, he said that there was no ironmaking district in Great Britain so surrounded by what he might call the "allied trades." These had sprung into existence from very ancient times—attracted to the locality by the ready supply of fuel. There were generations of clever workers in iron living in the locality, well supplied with the native products of coal and iron. With the increasing needs of civilization, new branches of their industries were developed, and hung around this hive of busy workers. They had gone on extending to the present day. No casual visitor could form the slightest conception of the magnitude and variety of these operations. For many years to come there must of necessity remain for the district a fair future in iron and steel making, if it were only to supply this local hive of industries. He made no comparison between the great and past history of the district and the present for iron producing, nor with the gigantic undertakings in the North of England, South Wales, and Scotland. They had confidence in saying that South Staffordshire was by no means an exhausted district, taken as a whole, and that she had a future within moderate limits for generations to come, arising from her home trade, with which no other iron-making district could compare.

Mr. Hughes, who is the Mining Engineer to the Earl of Dudley, remarked, in his paper dealing with the mineral resources of South Staffordshire, that the coal-field of the district had been compared to an island of Palæozoic rocks surrounded by newer formations on all sides. The general form of the district was that of a rude, irregular, spindle-shaped band, bent so as to have both its sides convex to the west, and terminating in a point both to the north and south. The coal-field differed in its geological structure from the other coal fields of England, inasmuch as the coal measures reposed directly on the upper Silurian formation; the carboniferous limestone, millstone grit, and Devonian being absent. The Silurian rocks protruded through the overlying strata at Walsall, Dudley, and Sedgley; causing a very distinct line of division in the coal-field. This upheaval of Silurian rocks commenced at Parkfield, south of Wolverhampton; passed through Sedgley to Dudley; and thence to Leasowes by the basaltic Rowley Hills and a steep western slope that ran from them to the south. The line from Parkfield to Dudley formed a broad anticlinal ridge, round which all the coal measures cropped out and took a north-westerly direction, until they turned north of Bilston. For some distance they then ran somewhat parallel with the Bentley fault, until turned in a south-easterly direction by the Walsall Silurian district, against which the coal measures again cropped out, and the Silurian rocks appeared beneath. There was a second ridge of Silurian rocks, first revealed by the sinking of the Heath Pits at West Bromwich, which extended from that point for a distance of at least three miles to the south. In this case, the Silurian rocks did not reach the surface, but were concealed by coal measures. They probably formed an old Silurian bank of rising ground during the coal-measure period. This bank was the boundary of the coal-field until the sinking at Sandwell Park Colliery proved the existence of coal beyond. Recent explorations there had found the existence of a second concealed ridge of Silurian rocks lying at a distance of 1000 yards from the first bank. Its general direction was the same as the former; but its extent had not yet been proved. The author of the paper dealt chiefly with the geological aspect of the question, and described the position and qualities of the coal raised. There was, he said, in conclusion, considerable vitality in the Staffordshire coal-field. The older district, which the Institute visited twenty years ago, was getting worked out; and later developments round the boundaries had brought out a valuable supply of coal. Though the iron production had decreased very considerably, the coal production had practically remained constant for the last thirty years. He felt fairly confident that, given the existence of anything like decent trade, it would remain constant for a considerable time longer. A table was appended to the paper showing the output of coal and ironstone in South Staffordshire from 1873 to 1894. In 1873, the output of coal was 11,100,000 tons; and of ironstone, 346,644 tons. In 1894, the figures were 9,164,543 and 38,550 tons respectively.

THE RARE EARTHS USED IN THE MANTLES FOR INCANDESCENT LIGHTING.

A few months since, an article on "Thorium" was reproduced in the Journal (Vol. LXV., p. 1144) from a German source; and we are now able to present our readers with the substance of two papers that have recently appeared on that and the allied rare metals. One, by Dr. G. P. Drossbach, on the chemistry of the oxides, is from the *Journal für Gasbeleuchtung*; the other, referring more particularly to the sources of thorium, is by Dr. J. W. Ling, of New York, and is translated from the *Chemiker Zeitung*.

The manufacture of mantles according to the Welsbach patents really depends mainly on the admixture of the acid salts of zirconia and thoria with the stongly basic oxides of the cerium group. These latter oxides, of high light-emitting power attract carbonic acid and water from the air, except when in combination with the acid oxides. At the present time, only thorium compounds of the earths found in ytterite appear to be used in the Welsbach mantles. The minerals which for some time have been known to be rich in these earths are thorite, orangite, aeschinite, thorogummite, gadolinite, and ytterite; and as these have now been found more or less plentifully distributed, they have recently been again used for the production of the earths. The text-book analyses of these minerals are quite unreliable, probably because no satisfactory methods for the quantitative separation of the rare earths have been published.

Commercial thorite of the present time contains from 20 to 40 per cent. of thorium oxide; but a mineral passing by that name which contains only 5 to 6 per cent. also comes on the market. It is therefore customary for dealings to be made on the basis of the percentage of thoria it contains. Generally, aeschinite contains up to 16 per cent. of thorium oxide; gadolinite, 6 per cent.; ytterite, 2 to 5 per cent.; and orthite, only 0·6 to 2·0 per cent. Monazite is found in limited quantities in Norway, where it contains 4·9 per cent. of thoria; but rich stores of it have been discovered in Brazil and other places. The working up of it is, however, difficult, on account of its complex composition and small content of thoria. Brazilian monazite contains about 60 to 70 per cent. of oxides of the cerium group, from 0·5 to 1·5 per cent. of thoria, and a considerable amount of the oxides of the yttrium group of metals. But, as Gray has pointed out, nodules of richer monazite are found.

The Brazilian monazite appears to be almost exclusively used for the Welsbach mantles. The other varieties are worked up with difficulty, and the earths are obtained from them at greater cost. Recently, however, a large-grained Australian sand containing 4 to 8 per cent. of thoria, has been freely bought, as it is readily worked up. It contains orangite, which is easily extracted with hydrochloric acid. The Brazilian monazite is in

amber-coloured gravel-like grains, mixed with 10 to 20 per cent. of the original bed in which it was deposited. This consists of speckled gneiss, of which the portions detached by gradual disintegration form the material from which monazite is won. This material contains 0·5 to 2 per cent. of monazite, which is obtained by washing away the lighter particles. The greater portion of this monazite finds its way to the Welsbach factory at Atzgersdorf, near Vienna; only a small proportion being taken by other firms.

There is a prevalent notion that the Welsbach mantles consist wholly of thoria. In the first place, it may be said that those of the other Welsbach companies differ not inconsiderably from the Austrian. Apart from the suspension of the mantle from the side, the Vienna productions have a faint, but unmistakable, salmon colour when cold; while their radiation is incomparably more brilliant that that, for instance, of the Berlin mantles. In the latter, about half the mantle hangs down over the mouth of the burner, and is not raised to incandescence; while the support of the Vienna mantles by platinum wire enables them to be adjusted above the burner. It becomes necessary to strengthen the upper part of the mantle where it is supported by the platinum wire; and therefore only the lower part should be taken for analyses.

Thorium oxide is soluble in carbonates, and is not thrown down by dilution or by addition of ammonia. About 8 to 10 per cent. of a Vienna Welsbach mantle is insoluble in carbonates; and therefore at least this percentage is not thoria. But a number of oxides of the cerium group of metals are also soluble in like manner; and these oxides are found in considerable quantity in monazite. Therefore it is improbable that the 90 per cent. that is soluble is thoria; and terbium especially may be suspected to be present in some quantity. Pure thoria, on account of its absolute resistance to fire, and the absence of any tendency to frit, forms a very stiff mantle; but terbium oxide and other oxides of the group, when added to it, enhance the brilliancy of the incandescence, correct the tint, and give elasticity and durability to the mantle. According to Dr. Auer von Welsbach, there is no limit to the possible modifications of the tint. Mr. M'Kean states that the best result is obtained with 30 per cent. of the oxides of the erbium-yttrium group. This is the reason why a thorium nitrate containing terbium and yttrium is preferred to the pure substance, and is indeed taken for the latter by the uninitiated.

The thorium earth purified according to Bunsen's method by repeated crystallization and precipitation gives, according to him, neither an absorption nor emission spectrum; but Thalen ascribes lines of eight definite wave-lengths to it—some belonging to the known, and some to the, as yet, unisolated components of the group. A pure thorium earth, fulfilling Bunsen's requirements, can, according to Lecoq de Boisbaudran, only be obtained from the commercial earth by repeated recrystallization of the sulphate, and final precipitation with the oxide of one of the heavy metals. According to this method, the commercial substance has a percentage of only 80 to 85.

Thorium nitrate being now an article of commerce much in demand, a few hints for its valuation may be given here. The pure salt crystallizes colourless, and becomes white on drying. A faint yellow colour of it or its solution is unimportant if due to traces of organic bodies; but if iron oxide, uranium oxide, cerium oxide, &c., are the cause, the preparation is unsuitable for use. The pure nitrate should not give a coloration with sulphuretted hydrogen, nor with ammonium sulphide when in solution in alkaline carbonates. It is completely soluble in excess of carbonate, and is not thrown out of solution by ammonia or by dilution. On warming, the solution becomes cloudy through separation of the hydroxide, which, however, dissolves again on addition of ammonia. The nitrate crystallizing with 12 molecules of water gives on ignition 37·95 per cent. of thoria. The same salt dried at 100° C. contains 4 molecules of water, and yields on ignition 47·84 per cent. of pure white thoria. More water may be removed from the salt by drying at a higher temperature; but there is risk of the formation of difficultly soluble basic salts. If the salt with 4 molecules of water gives a residue of more than 47·8 on ignition, it may be concluded that it is contaminated with earths of lower molecular weight. A commercial product yielding 49·2 per cent. of residue on ignition contained 5 per cent. of yttrium and erbium nitrates. This might have been expected, as a mixture of equal quantities of these two salts gave 68 per cent. of residue on ignition. In default of any exact method of separation, the oxides of the yttrium group are estimated indirectly by a molecular weight determination.

The solubility of thorium hydrate in carbonates is not, in itself, a criterion of purity, as has already been pointed out, as the oxides of the yttrium group also have this property. The slightly basic character of thoria renders it easy of recognition qualitatively, though the quantitative analysis is not capable of being carried out very exactly. It is always possible to identify the products from different sources; and therefore it is surprising that, in a dispute, the expert should state that such analyses could not be made. The very dilute solution of thoria which is to be tested is fractionally precipitated with ammonia, so that only about eight-tenths of the oxides present are thrown down; and the precipitate is kept in contact with the liquid in the cold for about ten hours with constant agitation. The whole of the oxides of the yttrium group then remain in solution, if they do not exceed 10 per cent. of the mixed oxides. On concentrating the filtrate, the absorption lines of erbium and its allied metals usually may be found, and often also the broad band near D indicative of didymium. Erbium and the allied metals show distinctly a broad faint band between E and *b*, four fine sharp lines nearer *b*, two bands right and left of the solar line $\lambda = 4860$, and two broad sharp lines right and left of the solar line C. Yttrium, ytterbium, scandium, and terbium can be recognized in the flame spectrum. After the separation of thorium by Lecoq's method, and the precipitation of cerium by that of Popp, addition of ammonia to the residual solution throws down the whole of the oxides of the yttrium group. Zirconium is distinguished from all the other oxides of the group by the solubility of its hydrofluoride in water.

On analyzing mantles that have been in use for some time, the filtrate from the precipitation with ammonia often has a blue tint, from the presence of copper, which presumably is derived from the burner. In the methods of testing given above, no account is taken of contamination with the better-known oxides.

The sudden demand which arose a few years since for thorium nitrate, which hitherto had been merely a laboratory curiosity, seemed likely to be in excess of the supply; and the price rose to more than £45 per pound last year. It has, however, now fallen to a third of that price, owing to the discovery of more of the raw material and the rivalry of manufacturers. Of the raw materials, thorite, which contains thorium as silicate, and monazite sand in which it exists as phosphate, are the best available minerals. But, as already pointed out, thorite varies greatly in richness; and some almost valueless ores have reached the market. Monazite sand is rich in cerium and the allied earths; but it may be considered good if it contains 3 to 4 per cent. of thoria. Mr. R. J. Gray has already described the occurrence and properties of the sand.* But the analysis is attended with difficulties to the chemist who has not had special experience of it; and many comparatively valueless lots of ore have been purchased through misleading analyses. In reality, it is safer to rely on the results of the working up of 20 to 50 lbs. of the sand as carried out on the manufacturing scale, as some sand which is shown by analysis to be tolerably rich in thorium cannot be worked up profitably. The methods adopted by the manufacturers are, for the most part, kept secret, but are based on the solubility of thorium oxalate in boiling solution of ammonium oxalate, in which the oxalates of the cerium group of metals are insoluble. The oxalate is used as an intermediate product in the production of the nitrate, and is now made in America and exported to Europe for the manufacture of the nitrate. The oxalate is converted into the nitrate by forming the sulphate, and throwing down the hydrate, which is readily soluble in nitric acid.

The thorium preparations of commerce vary considerably as far as their content of thoria is concerned, owing to variations in the amount of water they contain. The anyhydrous nitrate contains 55 per cent. of thorium oxide; but the evaporation of a solution of the nitrate cannot be effected without partial decomposition of the salt to oxide before all the water of crystallization is removed. The commercial nitrate contains 47 to 49 per cent. of thoria, which is estimated by igniting the nitrate in a platinum crucible. It is necessary that thorium nitrate for incandescent mantles should be free from iron and alkali; the former affecting the quality of the light, and the latter the durability of the mantle. A mantle made from pure thorium nitrate gives a clear bluish, but feeble light; and other oxides must be mixed with it to give a high emitting power. The broken and discarded mantles have a certain value, on account of their content of thorium; and actually some are being again worked up. The future of the thorium market is obscure; and prices may again reach their former maximum when the demand increases during the winter months. With the rise of new companies, the consumption of thoria will increase; and though it seems doubtful if impregnating the filaments of electric glow lamps with this oxide will ever be successful, there is a prospect of a greatly increased demand setting in shortly.

Dr. G. P. Drossbach promises to give shortly some information on the composition of the mantles of the competing systems.

Gas Undertakings Parliamentary Returns.—In the House of Commons on Wednesday last, the usual annual returns were presented by Mr. Burt, as ordered last May, of gas undertakings in the hands of companies and corporations throughout the United Kingdom. The returns were ordered to be printed, and will be issued in due course; but this will not probably occur till quite late in the year.

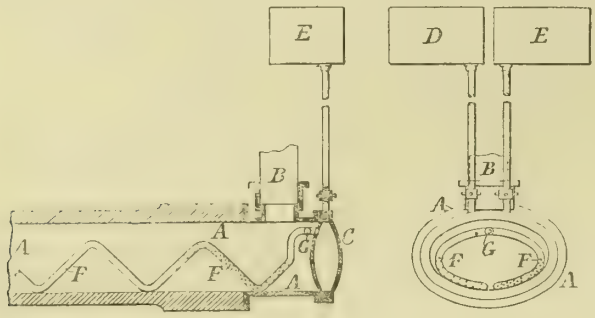
Private Bill Legislation.—Of the 168 Private Bills, apart from Provisional Orders, which were promoted during the past session, 103 successfully passed both Houses, and received the Royal Assent, 12 of them were withdrawn, 18 remain suspended till next session, and less than a dozen have been rejected by Committees of both Houses. Among the suspended Bills which will be taken up next session at the stage which they have now reached, are those of the London County Council for the transfer of the water undertakings.

* See JOURNAL, Vol. LXV., p. 1144.

REGISTER OF PATENTS.

Manufacture of Gas.—M'Ewen, T. G., of Leytonstone, Essex No. 8974; May 5, 1894.

According to this invention, water and petroleum or other oil or fat (or, it may be, tar) are exposed to heat together in a closed vessel so as to produce permanent gas. The proportion of water may be varied from one-sixth to one-half or more according to the quality of the oil employed—the former proportion for a very light oil, and the latter for fat or tar.



A longitudinal section of the retort, and a front view with the door removed, are shown in the illustration.

A is the retort; and B, the pipe leading gas from it (of any ordinary pattern). C is the door, made hollow, and secured in any usual way. D and E are tanks supplying water and oil through the pipes to the inside of the hollow door. Screw couplings connect the supply pipes to nozzles on the door, so that the latter can be opened to fill and empty the retort. F are perforated ziz-zag pipes in the retort, connected to a short horizontal pipe G, having a conical end fitting into a corresponding seat in the door. When the door has become hot, oil and water are together admitted to it from the tanks D E; and the resulting vapours pass by the pipe G into the perforated pipes F, where they are further heated. The gas produced escapes through perforations in the pipes F into the retort and pass away through the pipe B.

Prepayment Meters.—Sutherland, A. G., of Kennington Park, S.E. No. 8981; May 7, 1894.

In carrying out this invention in connection with (preferably) an ordinary type of dry gas-meter a barrel or drum is carried upon a crank spindle, and bears a scale upon its periphery visible through an opening in the case or gallery plate, so as to show the amount of gas to be consumed for one payment. The drum revolves during the whole time that the meter is working and gas passing. A toothed wheel, loose upon the crank spindle and concentric with the drum, is caused by frictional contact, obtained by a spring or cone, or its equivalent, to revolve with the drum. Upon the same spindle, or concentric therewith, there is a suitable arrangement of links terminating in inclined caliber points, which can be set nearer to, or farther from, one another so as to decrease or increase the space through which (or through part of which) an arm—also concentrically carried, and having a spring-controlled or weighted pawl to engage with the teeth of the wheel—reciprocates. The caliber links may be operated in any convenient manner—say, by toggle links and a screw and nut; the screw being arranged to be operated from outside the case or gallery plate by passing a screw-driver through a hole in the case and thus turning the grooved head of the screw.

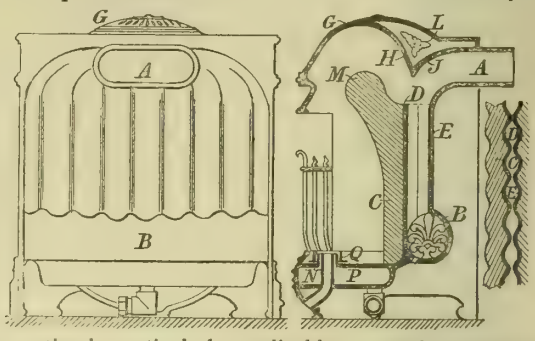
The coin is inserted through a slot in the case or gallery plate. It falls on to a cradle, hung pendulum-wise (but in a horizontal plane) within the case, and operated by a draw-bar or knob outside the case, so arranged as to cover the slot when in its normal position of disuse. When it is desired to obtain gas, the handle is pulled forward, uncovering the slot; and the coin inserted falls into the cradle. The knob is then pushed back, and the coin engages with a portion of the cradle-frame, which is thus caused to move by the coin. The cradle frame is by any suitable means—say, for instance, a pin and slot—connected with the pawl-carrying arm; and the pawl being in engagement with the toothed wheel as the cradle frame is moved, the pawl is moved and carries the wheel round with it, until the pawl is disengaged from the wheel by the operation of the caliber points. This movement of the wheel effects the opening of the gas-supply valve, so that the supply of gas is now on.

The valve-operating mechanism may be of any suitable construction; but the patentee says he has obtained satisfactory results by employing a bar connected with the valve-operating arm. This bar passes through a fixed guide, and carries on its end a projecting portion, which engages with a recess in the toothed wheel. When the projection is in the recess in the wheel, the valve is closed and no gas passes. But when the wheel is rotated by the pawl, the recess in the wheel with which the end of the arm is in engagement, turns with the wheel, drawing the arm with it, and thus opening the supply-valve. Ultimately it is moved from the end of the arm, which, having an inclined face (or the recess having an inclined face), the two parts disengage, and the arm is retained upon the face of the wheel, holding the valve in its open position. The arm is so shaped, or provided with a stop, that when drawn out to its full limit, and raised upon the face of the wheel, the stop prevents its returning until, upon the return of the wheel, the projection upon the arm entering the recess, the stop is released, and as the wheel turns back, the valve is closed.

After performing its function, the coin drops out of the cradle into the receptacle provided for it; and the cradle and frame being hung upon the same centre or axis, the coin operates the frame truly throughout its whole travel. Should a halfpenny (say) be inserted instead of a penny, it will engage with a portion of the frame, so arranged or placed that the movement of the draw-bar, or handle, will only move the pawl, and consequently the toothed wheel, through a distance one-half that which it would receive had a penny been inserted. Consequently, the wheel will return to its normal position in half the time that it would had a penny been inserted.

Gas Fires or Stoves.—Wilson, J. J., of Edinburgh. No. 18,382; Sept. 28, 1894.

The chief features of this invention consist in the construction and arrangement of a gas fireplace or stove, designed "to obviate or minimize the excessive loss of heat invariably carried off with the products of combustion or heated waste gases from gas-fires, so as to utilize most of the heat generated for the purpose of more effectually heating the apartment, without prejudicially affecting the passage or escape of the products of combustion into the flue or chimney."



The invention is particularly applicable to cast-iron stoves, having refractory incandescent fuel-lumps or fret-work, and an ordinary fire-clay back or slab. The flue nozzle A is, by preference, of a curved elongated shape, and cast integral with the back of the stove. In order to draw in a supply of air from the lower back part of the stove (near the floor), so as to control the excessive draught of the flue, the back C of the stove is formed with a number of corrugations integral with the casing, against which is placed a corrugated sheet of metal D, and a correspondingly corrugated sheet of metal E. The sheets are made with the ridges of both corrugated portions D and E impinging against each other, so as to form a series of vertical tubular air-passages which act as one passage. The passages are in communication with a horizontal air chamber B, arranged near the bottom of the stove, and extending from side to side; the ends of the air chamber being formed with openings or perforations, which may, if desired, be provided with regulating shutters.

The top ends of the passages are in communication with the flue nozzle A, which is located horizontally at the back of the stove. The top of the stove is provided with a canopy G, under the back of which, and above the flue nozzle A, are two curved baffle-plates H J, for the purpose of dividing the flue in a slightly descending manner into two passages—the one communicating directly with the induct passage, and the other indirectly with the combustion chamber or flue of the fire. The foregoing arrangement protects the fire and the Bunsen burners from any down-draught of the main flue or chimney.

The chief object of the lower induct passage is to cause an overpowering action on the draught of the flue or chimney, and to divert, by means of the baffle-plates H J, in a direct manner, the draught action of the flue or chimney up the induct passages, which become heated so as to induce a current action other than that of the main flue or chimney. Also from the action of this current passing the junction where the baffle-plates intersect, there is an extracting power exerted sufficient only to draw the heated waste gases of unconsumed carbon up the main flue or chimney, without carrying away the excessive heat.

The curved baffle-plates may be of sheet iron, bolted or screwed to the stove casing; but they are preferably cast integral with the top of the stove, in which case the space L between the underside of the top G of the stove and the tops of the baffle-plates is cored, so as to form a recessed air-heating chamber L, having perforations through the top of the stove, for the purpose of circulating heated air. The ends of the air chamber are also perforated, and have a cover or earlip (preferably of a semicircular shape) for preventing any direct or horizontal current, and to create an induct current of heated air from the chamber. The fire-brick slab M may be of a tubular form at the top, for the purpose of enabling a cylindrical air-heating chamber to be inserted so as to pass from side to side of the stove. The tail ends of the chamber extend downwards at the back of the slab, and so form an air-passage to circulate heated air.

There are a series of atmospheric burners to heat the incandescent fuel, connected to the central or inner air-tubes N, so as to form the series of burners through the bottom P of the mixing chamber. The tubes are secured in their proper positions by long screws with lock nuts; and the tubes are led, by a series of elbow-jointed air-tubes, under the mixing chamber and near to the front of the stove as shown. The op parts of the central tubes are formed with feathered ribs, divided so as to equalize an equal annular space, and by so doing form the Argand Bunsen jet.

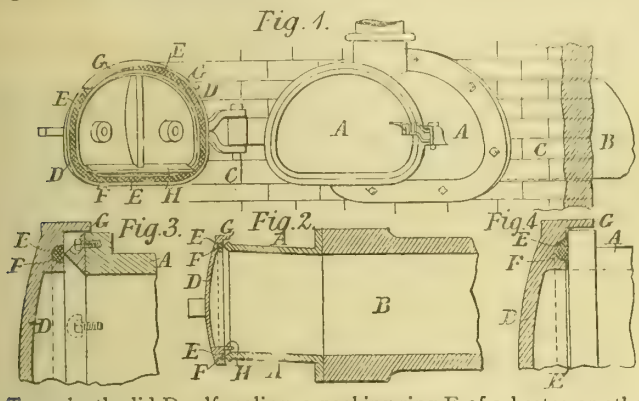
Retort Mouthpieces and Self-Sealing Lids.—Mitton, J. L. and T. J. L., of Longwood. No. 19,293; Oct. 11, 1894.

The object aimed at in this arrangement of retort mouthpiece and lid is "to prevent the tar passing out of the retort into the mouthpiece from getting to the joint between the mouthpiece and the lid, and to effectually seal such joint so that no gases can escape from the retort."

Fig. 1 is an elevation in perspective of a retort mouthpiece and self-sealing lid (the lid being shown open). Fig. 2 is a transverse section of the retort with the lid closed. Figs 3 and 4 are enlarged sectional details of a portion of the mouthpiece and lid, showing slight modifications.

In figs. 1 and 2, A represents the retort-mouthpiece secured in the ordinary manner to the retort B supported in the brick setting C. The body of the mouthpiece, or the lower portion of it, is constructed at an angle to the retort; so that it inclines downwards, as shown in fig. 2. This tends to prevent the tar which passes out of the retort into the mouthpiece from reaching the joint between it and the lid D, or

lodging in the mouthpiece—the tar on entering the mouthpiece being run back again into the retort, whereby very little, if any, is allowed to get as far as the lid.



To make the lid D self-sealing, a packing ring E of asbestos or other incombustible material is inserted tightly into a recess F formed all round the inner face of the lid. The asbestos may, if desired, be wrapped around a metal ring adapted to fit into the groove F, and be secured therein by screws; but, for ordinary purposes, the ring is dispensed with. The front end of the mouthpiece is provided with a V-shaped or tapered seating, the centre or tapered edge of which coincides with the centre of the asbestos ring, which, when the lid is closed against the mouthpiece and secured thereto, is slightly indented by the V-seating. The asbestos sealing bed gives and takes to the expansion and contraction of the metal lid and mouthpiece; and thus it is claimed that, under all conditions, it maintains a tight joint, and effectually prevents the escape of gases from the retort.

For existing mouthpieces, or those made with a straight or flat face, a V-shaped or knife-edged ring is employed, of the same size and shape as the mouthpiece, to which it is secured by bolts or screws as in fig. 3. If, however, the V-seating is not required, additional packing E is inserted into the groove F so that it projects beyond, and may be flattened against, the face of the lid, as in fig. 4; but the patentees prefer to employ the V-seating, "as there is less surface on which tar can lodge, and therefore less liability of an imperfect joint being made by an accumulation of tar on the seating."

In all cases where two or more retorts are set one above the other, there is attached on the top of the mouthpiece A, of the lower retorts, a protecting plate G, which, when the lid is closed, projects over the joint made between it and the mouthpiece, and shields it from the tar which may fall from the mouthpiece immediately above. A plate H is also formed on, or attached to, the inner face of the lid A, just above the joint made between it and the bottom of the mouthpiece, for the purpose of preventing the tar which boils up into the mouthpiece and against the lid from getting to this part of the joint.

Gas-Stove Flues.—Atkins, J., of Malvern. No. 20,866; Oct. 31, 1894.

The patentee states that the objects of his "invention" are to so construct and arrange the flues of stoves and fires burning coal gas that an upward draught may be set up in the chimneys prior to lighting the stove or fire; also to prevent or minimize the effect of down-draught in the flues of gas-stoves and gas-fires during windy weather.

He arranges in the chimney into which the flue of the gas-stove opens, and just above the level of the top of the stove, a chamber heated by a small gas-flame. This chamber is provided with a glazed door at front for gaining access to the burner for lighting. The pipe from the stove passes through the bottom of this chamber, and terminates near its top. An upper pipe, which virtually constitutes a continuation of the lower one, extends from the top of the chamber to a height of from 3 to 6 feet in the chimney. The top of the upper pipe is preferably provided with a cap for preventing the entrance of dirt and dust into the air-heating chamber. "By heating the small chamber in the chimney prior to lighting the gas stove or fire, a draught is set up in the flue and chimney, which ensures the passage up the chimney of the noxious gases or products of combustion of the gas stove or fire when lighted."

Device for Balancing Chandeliers.—Winfields Limited and Abbott, A., of Birmingham. No. 5686; March 19, 1895.

The object of this invention is to dispense with the ordinary suspending weights and chains of the usual centre-light or gasalier; and to provide a system of support for such a centre-light, so as "to allow the light to be raised and lowered at will, and left in any particular position, while also permitting the light to be moved around a considerable circle." The claims for the invention are: 1. A centre-light suspending and balancing device, in which the light is suspended from a tube attached to hinging arms; the arms being pivoted from a centre tube, and sustained by springs contained within pivoted telescopic tubular cases, connected at the top to the centre tube, and below to the hinging arms. 2. A centre-light suspending and balancing device, in which the light is suspended from a tube attached to hinging arms; the arms being pivoted from a centre tube, and sustained by a spring device attached to the centre tube—the spring device consisting of an enclosed spring (such as a circular spring) attached at one end to the outer tube, and at the other end to a rotating disc—having a curved cam surface cut upon it, upon which a wire, flat band, or chain operates, so as to equalize the pull of the spring, and produce a uniform effect on the arms to which the other end of the wire, band, or chain is attached.

Production of Gas from Oil.—Merichenski, M., of Forest Gate, Essex, and Moffat, J. D., of Victoria Street, S.W. No. 8120; April 24, 1895.

The object of this invention is to construct apparatus "for the production of inflammable gas from hydrocarbon oil, for lighting and heating purposes, with incandescent or other burners, and for use in motive power engines." The patentees propose to use one or more vessels, mounted one above the other; each vessel being preferably cylindrical, and divided by vertical internal walls or partitions, so as to form involute and evolute or spiral passages, channels, or chambers. These chambers are filled with absorbent material—such as pith, sponge, and the like—capable of receiving and holding in suspension, by capillary attraction or otherwise, a quantity of hydrocarbon oil. Air is caused to travel through the passages formed in the vessels, whereby it becomes saturated with inflammable vapour by contact with the oil in the absorbent material; and the charged air is afterwards carried to the burners, or other ordinary appliances for utilizing it.

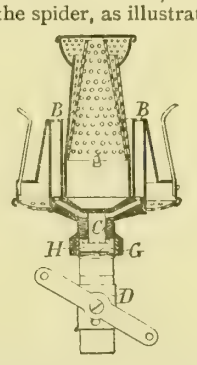
Radiant Tissue for Lamps.—Crocker, S. H., of Holborn. No. 9506; May 14, 1895.

The patentee proposes to take a quantity of paper pulp in a semi-liquid state, and mix therewith a sufficient quantity of zirconia or other rare metallic combination known to resist volatilization by heat. To the paper pulp may also be added a small quantity of starch, to facilitate its conversion into sheets, as hereafter referred to. The composition so formed is allowed to dry or harden to a suitable degree; and is then formed into sheets, which are perforated with holes of any desired shape or size, and thereby produce "a finely reticulated area of material, capable of being rendered radiant or incandescent by heat."

Perforated sheets are obtained from the composition by two methods—viz., firstly, by forming the composition into sheets, and then perforating them by mechanical appliances; or, secondly, by forming the sheet with the required number of holes or spaces throughout its area. To obtain the sheet in this latter form, the patentee first takes a piece of perforated water-proof paper, sheet metal, or other material, and coats the surface with the composition in its liquid state—preferably by pouring it upon the perforated sheet after the well-known method of paper making, and allowing it to drain and dry. When the coating applied is thin in substance and the perforations sufficiently large, the coating will not extend over the whole area of the perforated sheet; but some of the liquid composition will fall through the perforations. Hence the sheet will be formed of the composition resembling the perforated sheet on which it has been deposited. Sheets made from this composition of refractory and cellulose materials are consolidated by pressing, rolling, or other suitable means, and then cut into any required shape. They may be used either in a flat state, or curved and joined together so as to form hollow truncated cones, made up into hollow pyramids, or "in any other regular or irregular figure suitable for the economic application of heat for producing the required incandescence."

Gas-Burners.—Upton, C. S., of New York. No. 10,546; May 28, 1895.

The illustration shows a side view (partially in central vertical section) of an Argand gas-burner of this self-regulating form. The burner consists preferably of a circular chamber—provided at the top with the flame-orifices B—in communication at the bottom with the gas-passage C, by passages formed in the legs of an annular frame, on which rests the piece forming a circular chamber. The spider is so constructed as to leave free passage by the legs thereof into the central portion of the burner, so as to feed the inner mantle of the flame with air, which is distributed equally to all parts of the inner mantle of the flame, by being first compelled to pass through a perforated thimble or air-distributor supported within the central air-passage of the burner in any desired manner. The air to feed the outer mantle of the flame is equally distributed by passing through perforations in the chimney-gallery, and in the upward extension thereof, as well as through a perforated air-distributing bottom-plate, which closes the space lying between the outer edge of the downwardly extending outer flange of the chimney-gallery and the outer wall of the circular chamber, where such wall is secured to the annular portion of the spider, as illustrated.



The parts being in the position shown, and gas being admitted to the passage C by the stop-cock D, it will be found that the force of the stream of gas will in such case be just sufficient to lift the regulating disc G slightly away from the bottom of the disc-chamber H, so as to allow the gas to escape from underneath and around the edges between the studs, and up through the passage through the stud of the spider, and through the passages and annular chamber to the flame orifices B. If now the pressure of the gas be increased sufficiently to cause the flame of an ordinary burner to hiss, such increase of pressure will at once serve to instantly drive the mica disc G up tight against the top of the disc-chamber H, when the gas can only pass to the flame-orifices B through the grooves or perforations provided for it; and inasmuch as these perforations are of such size as to permit of only sufficient gas to keep the flame burning properly to pass to the orifices under the extremest of gas service pressures, blowing and hissing of the flame will be prevented.

Incandescent Tissue for Gas-Lamps.—Crocker, S. H., of Furnival Street, London. No. 13,111; July 6, 1895.

In making an incandescent gas-mantle according to this invention, the patentee proposes to first construct a truncated conical frame or

support consisting of an upper and a lower ring of thin iron wire connected together by straight wires or ribs disposed at equal distances all round. To these wires or ribs are attached short strips of the material from which the illuminating portion of the mantle is to be formed; the strips being arranged one above the other regularly from the bottom to the top of each rib, and at right angles or tranversely thereto—the strips of one rib being so disposed that they come opposite the spaces between those of the adjacent ribs, and the finished mantle having a polygonal form, the strips of each rib forming one side of the polygon. The mantle thus built up is then subjected to the burning operation; the heat being applied somewhat gradually at first, and free access of air being allowed in order that the iron wires of the frame may become converted into ferric oxide before the full heat is applied. They thus retain their shape, and serve to support the refractory illuminating material left by the burning of the strips cemented to them.

The cement employed for fastening the strips to the wire frame, or to each other, consists "of any adhesive substance which, when burnt, will leave a residue capable of holding together the parts to be connected without injuriously affecting them or impairing their refractory properties." This substance may be mixed with some of the compounds used for the illuminating portion of the mantle. The cement preferred consists "of a mixture of dextrin and nitrate of zirconium brought to a suitable consistency by water to allow it to be conveniently applied to the parts to be joined together."

The material employed for forming the incandescent portion of the mantle consists of a special paper, which during the process of manufacture has been "loaded" with oxide of zirconium or other refractory incandescent compounds such as are employed in incandescent mantles, in place of the kaolin or other substance generally used for loading paper. By this means the incandescent compound becomes incorporated with the substance of the paper; and the latter can be readily cut into strips for the purpose of building up the mantles.

APPLICATIONS FOR LETTERS PATENT.

15,991.—Gabe, H., "Automatical apparatus for decomposing carbide of calcium." Aug. 26.

16,007.—Ford, T., "Chandeliers, gaseliers, gas-pendants, and gas-brackets." Aug. 26.

16,036.—Perkins, A. B., "Water-service valves and other similar valves." Aug. 27.

16,060.—Paasch, H., "Liquid and gaseous meters; also applicable for other purposes." Aug. 27.

16,079.—Briggs, F. H., "Gas and oil engines or motors." Aug. 27.

16,110.—Vivian, F. G. "Carburetted water-gas plant." Aug. 28.

16,129.—Pointon, J., "An improved method of making illuminating gas; applicable also to the production of hydrocarbon oil and ammonia, and apparatus therefor." Aug. 28.

16,139.—Laycock, J., "Apparatus for washing and scrubbing gas." Aug. 28.

16,144.—Oldfield, J. K., "Water-waste preventers." Aug. 28.

16,178.—Fletcher, T., Russell, W., and Fletcher, Russell, and Co., Limited, "Reflector gas-stoves." Aug. 29.

16,183.—Salomons, Sir D. S., and Bailey, F., "Apparatus for straining water." Aug. 29.

16,255.—Tweeddale, J., "Apparatus for regulating the pressure of water in pipes." Aug. 30.

16,271.—Glover, R. T. and J. G., "Coin-freed gas-meters." Aug. 30.

16,272.—Perlich, A., "Lamp for the production of spirit-gas incandescent light, with lighting and extinguishing contrivance." Aug. 30.

16,295.—M'Laren, W. S. B., and Carrod, H., "Apparatus for purifying and softening water." Aug. 30.

16,308.—Sleen, N. V., and Schneller, A., "Apparatus for the sterilization and purification of water." Aug. 30.

16,323.—Butler, W. C., "Gas-stove for heating and cooking purposes." Aug. 31.

16,327.—Morton, J., and Shadbolt, R. G., "Kilns for burning fire-bricks, retorts, &c." Aug. 31.

16,370.—Smith, C., "Coin-freed gas and other fluid meters." A communication from L. P. V. Madsen. Aug. 31.

The Price of Gas for Public Purposes at Armagh.—The Directors of the Armagh Gas Company have notified to the Town Commissioners that they have resolved to allow them a reduction in the price of gas 2d. per 1000 cubic feet.

Carrickfergus Gas Supply.—The improvements commenced at the Carrickfergus Gas-Works a few weeks ago have now been completed; and the result will be a better supply of gas to the town. An important item was the re-sheeting of the gasholder, which was very much worn, and the strengthening of it by the addition of six columns. This work has been satisfactorily completed by Messrs. R. & J. Dempster, of Manchester. Recently the Directors of the Company have relaid large portions of the mains through the town; and it is the intention to carry the work still further. It is also intended to erect a number of new lamps in different parts of the town and suburbs, where more light is much required.

Sales of Shares.—Last Thursday, Mr. A. Gibson offered for sale by public auction at Sunderland, 1000 £5 shares in the *Sunderland Gas Company*, being part of the additional capital authorized to be issued by their Act of 1867, the maximum dividend on which is 8½ per cent. There was a numerous attendance of buyers. The prices produced ranged from £10 5s. to £10 10s. per share; but only 30 went at the former figure. The sale realized about £10,500.——On Tuesday, 33 shares in the *Spalding Water Company* realized £10 12s 6d. to £11 5s. each. The dividend last year was was 6 per cent.; and the shares were sold *cum* dividend, which is payable this month.——Twenty four £10 shares (£6 paid up) in the *Bridlington Quay Water Company* have recently been sold by auction at £17 5s. to £19 each.——At Preston last week, Mr. G. Wrightson sold by auction, £80 of consolidated "A" stock in the *Preston Gas Company* for £190.——Some fully paid £5 shares in the *Gotham Gas Company, Limited*, realized by auction last week, £6 16s 6d. and £5 17s.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Need for Regulation of Consumption in Incandescent Gas-Burners.

Sir,—Following the particulars you have been giving of incandescent lighting, you may like to make use of the enclosed tables of experiments made for this Company by Mr. Leicester Greville, which point the warning for gas companies that any excess consumption in an incandescent burner is to a large extent lost, as the light produced per cubic foot of gas burnt falls in an increasing ratio, more especially with the second type—viz., without transparent chimney.

Commercial Gas Company, Stepney, Sept. 6, 1895. H. E. Jones.

[Enclosures.]

Tests of Incandescent Gas-Burner.

Pattern—Without chimney, but with glass vase and metal upper chimney.

Pressure.	Cubic Feet per Hour.	Candle Light.	Candle Light per Cubic Foot of Gas.
7-10ths	3·30	42·0	12·7
10-10ths	3·80	53·0	14·0
15-10ths	4·75	41·0	8·6
20-10ths	5·55	34·4	6·2
25-10ths	6·25	30·5	4·8

These figures show that the best result is obtained at 10-10ths pressure with a gas consumption of 3·8 feet per hour. Also that beyond this limit *increased* gas consumption is accompanied with *diminished* light.

The difference at 10-10ths and 25-10ths pressure is an *increased* gas consumption of 64 per cent., and a *decreased* illumination of 66 per cent.

May, 1895. H. Leicester Greville, F.I.C., &c.

Tests of "C" Incandescent Burner.

Pattern—Ordinary type, with mica chimney.

Pressure.	Gas Consumption. Cubic Feet per Hour.	Light in Candles.	Light in Candles per Cubic Foot.
7-10ths	3·2	52·0	16·2
10-10ths	3·8	56·0	14·7
15-10ths	4·5	55·0	12·2
20-10ths	5·5	49·0	9·0
25-10ths	6·1	45·5	7·4

These results show an increase of 60 per cent. gas consumption, and a decrease of 49·7 per cent. light for an increased pressure of from 10-10ths to 25-10ths.

August, 1895. H. Leicester Greville, F.I.C., &c.

The Standard of Light Committee's Report.

Sir,—It cannot be said that the Commission has succeeded in simplifying the confusion that was said to exist in the measurement of light. While not wishing to disparage the services of a pentane lamp as a relative means of comparison, it seems to me that we are given only another to the two excellent instruments that we already have in general use—viz., the jet photometer and the Methven's screen.

Why does the Commission cling to the declaration of candle power, and then offer a standard which is two removes from what it standardizes? It is quite evident that if the Commission were able, by the use of candles, to obtain a standard figure of their value, the body of gas examiners in the country are able to use the candles as successfully in determining by them the value of the gas. So that a roundabout method is superfluous.

Why should not candles be made of an exact composition, and with a standard number and size of wicks; and why should they not be used in one general way? The conditions under which candles give variable results are now well known. No gas examiner of knowledge and experience is led into error by the candles *per se;* the faults arise mainly from inexperience and inattention. Such faults will affect results by any standard, however simple it may be made.

In my experience, I have always found that candles from one maker will give consistent results; but when another maker's candles are used, there is frequently a difference in the results. This brings me to the opinion that if rigorous care were taken by a central authority—such as the Board of Trade—in issuing candles for experimental purposes sealed and certified, much of the trouble of former days, which brought candles into disfavour, would be obviated.

I respectfully submit that further consideration be given to this important question before action is taken for London gas-testing, which will not prove useful or acceptable for the Provinces.

Manchester, Sept. 6, 1895. E. Williams, F.C.S.

"Cannon" Stoves.

Sir,—In your issue of the 27th ult., we notice your report of Mr. Siemens's paper on the subject of "Illuminating Gas for Heating Purposes;" and in two places reference is made in inverted commas to "Cannon" stoves. Of course, we are aware that this refers to the make of coal fires by slow combustion; but the word "Cannon" may be misunderstood as referring to ourselves. Our trade mark is the word "Cannon;" it has been in use for about 70 years, and is duly registered. It is our exclusive property, and is not in use by any other firm in our line of business, nor can it be so used.

We trust you will insert this explanation in your next issue.

Sept. 6, 1895. The "Cannon" Hollowware Co., Ltd.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS.

Monday, Sept. 2.

WATER SUPPLY IN THE METROPOLIS.

On the motion of Sir A. ROLLIT, a return was ordered showing, as regards each Water Company supplying water in the Metropolis, (*a*) the name of each Metropolitan parish where the supply throughout the parish is constant; (*b*) the name of each Metropolitan parish where the supply is constant only in part of the parish, and, in the case of each such parish, a description of the part of the parish where the supply is constant; (*c*) with respect to each parish, at whose instance the constant supply was ordered or given; (*d*) the name of each Metropolitan parish where the supply throughout the parish is intermittent; (*e*) the name of each Metropolitan parish where the supply is intermittent only in part of the parish, and, in the case of each such parish, a description of the part of the parish where the supply is intermittent; and (*f*) with respect to each parish or part of a parish where the supply is intermittent, the period during which water is supplied daily to the premises of consumers.

HOUSE OF LORDS COMMITTEE.

(*Before the Earl of* JERSEY, *Chairman; Earl* GREY, *the Earl of* DARTMOUTH, *Lord* CALTHORPE, *and Lord* KENRY.)

BARNSLEY CORPORATION WATER BILL.

The Bill promoted by the Barnsley Corporation in the last Parliament, for the purpose of obtaining power to procure a new source of water supply, was inquired into by the above Committee. The application was very vigorously opposed by parties interested in the watershed proposed to be acquired; but, as already announced in the JOURNAL, the Committee passed the Bill, which is now suspended, and stands for second reading in the House of Commons.

Mr. POPE, Q.C., Mr. PEMBER, Q.C., Mr. PAGE, and Sir G. MORRISON appeared for the promoters. The various opponents were represented as follows: The Corporation of Sheffield, by Mr. LITTLER, Q.C., Mr. BALFOUR BROWNE, Q.C., and Mr. G. FITZGERALD; the Corporation of Wakefield, by Mr. FREEMAN; the Duke of Norfolk, by Mr. POLLOCK, Q.C., and Mr. LEWIS COWARD; Messrs. S. Fox and Co, Limited, by Mr. WORSLEY TAYLOR, Q.C., and Mr. READER HARRIS, Q.C.; the Wakefield Rural District Council, by Mr. J. D. FITZGERALD; the Corporation of Doncaster, by Mr. WORSLEY TAYLOR, Q.C., and Mr. RAM; the Corporation of Rotherham, by Mr. BIDDER, Q.C., and Mr. BAGGALLAY; the owners, lessees, and occupiers of the mills and works on the Rivers Don and Little Don, by Mr. BAGGALLAY; the owners, lessees, and occupiers of steam-engine works and property on the River Don, by Mr. CRIPPS, Q.C., and Mr. J. D. FITZGERALD; and the West Riding County Council and the West Riding of Yorkshire Rivers Board, by Mr. PEMBROKE STEPHENS, Q.C., and Mr. MOON.

Mr. POPE, in opening the case, said the borough of Barnsley sought to construct additional water-works in order to supply the pressing needs of the borough for a further supply of good water. The increase of Barnsley in the last thirty years had been about 98 per cent. of the population; the town had, in fact, nearly doubled itself. With the exception of Rotherham, whose boundaries had been extended, the rate of increase in the other large towns in the neighbourhood had not been so large as in Barnsley—not even in Sheffield. Sheffield opposed the Bill rather on the principle that they wanted the water, or might in some remote future want it, for themselves. The works proposed to be constructed were on the Little Don River—a tributary of the larger River Don, which passed through Sheffield and Rotherham, and on to Doncaster. They hoped to give Barnsley an admirable supply to meet the necessities of the next fifteen or twenty years. Sheffield had existing reservoirs; and they had also certain authorized reservoirs which they had not yet constructed. His answer to the objection of Sheffield was that they would not require a further supply for a long time to come, because they had unexhausted powers to construct water-works which would serve them for at least as long as the works that Barnsley now sought power to carry out; and, further, that Barnsley was only going to do what practically Sheffield had already done—viz., ask for powers to carry them over the next fifteen or twenty years. Barnsley only wished to acquire 2000 acres of the ground, which would still leave 8000 acres to Sheffield. Dealing with the petition of the Corporation of that town, he pointed out that the population of Sheffield at the present time was 402,000, and the present works were sufficient to supply it. The Corporation's reserve power, added to their present resources, would give them a supply of 20 gallons per head for a population of 700,000, and 25 gallons per head for 600,000. They had consequently a sufficient supply for a population nearly 50 per cent. in excess of the present one. Sheffield was only increasing by 1½ per cent. a year; so that in truth they had water enough for at least twenty or thirty years to come. In their petition, Sheffield objected to the Barnsley Corporation taking water from the watershed of the River Don; and Counsel contended that Barnsley was as much within the drainage area of that river as, and was three or four miles nearer to it than, Sheffield. The petition also stated that below Sheffield, in the valley of the Don, there were the important towns of Rotherham, with a population of 46,000, and Doncaster, with a population of 26,000, and various mining and manufacturing centres and rural and urban districts. Both Sheffield and all those towns and districts were entitled to look to the sources of the Don for a further supply of water for drinking and other purposes, and would be injuriously affected if the waters of the Little Don were diverted from flowing into the River Don. Counsel, however, contended that Barnsley was as much in the valley of the Don as any of the other towns and districts mentioned in the petition, and was therefore entitled to as much regard, as far as its interests were concerned, as was Sheffield or Rotherham, or any of the other places. Barnsley had a rising and growing community; and they claimed a fair share of the water, which might, they acknowledged, be part of the source of supply of those various interests. Counsel then dealt with the other petitions against the Bill, which were mainly put in by riparian owners on the River Don, including the Duke of Norfolk, who sought compensation for any damage to their interests that might arise by the carrying out of the proposed works.

Evidence was then called in support of the Bill.

Alderman *E. Raley*, the Chairman of the Water Committee of the Barnsley Corporation, described the industries of the town, which, he said, was a growing one; the population having increased from 17,000 in 1861 to 40,000 now. The present works were designed by the late Mr. Hawksley in 1862 to supply a population of 50,000. The present daily consumption was about 1,014,000 gallons—nearly the limit, which was 1,080,000 gallons. The total population of Barnsley and of the out-townships now supplied by the Corporation was from 68,000 to 70,000. The out-townships at present served were too small to construct works for themselves. In exceptional droughts in 1884, 1887, and 1893, the supply ran very short; and the borough was subjected to great inconvenience and loss. The Corporation entered into an agreement with Dewsbury by which they obtained an increased supply of 46 million gallons, at a cost of £1400. Without this they could not have served their district. They also obtained the consent of the Sheffield millowners to forego their compensation water; and they entered into an agreement with Penistone for a supply of their water. This convinced them that it was necessary to obtain an additional source. They therefore consulted Mr. Charles Hawksley, who designed the present scheme, by which it was proposed to impound some 2000 acres of the Little Don drainage area, and to form a reservoir, as well as to extend the limit of supply to the places at present served—Ardsley, Monk Bretton, Worsborough, Stainborough, and Royston—as well as to Carleton, Hemsworth, Shafton, South Hiendley, South Kirkby, Notton, Woolley, and South Elmsall. The local authorities of all these places had repeatedly expressed their desire to be included in the Bill.

Mr. BIDDER cross-examined witness on behalf of Rotherham, to show that Barnsley was proposing, for purposes of profit, to include places with which it had no connection; and to take power to supply not merely sufficient for the wants of Barnsley, but for an unlimited district. Witness admitted that this practically was so. He said the Corporation sought to obtain a supply, and to make the best of it. It was also submitted that Barnsley proposed to do this at the expense of Rotherham and Sheffield, for the Don area was the natural gathering-ground to which they looked for an increased supply in the future. Witness, however, maintained that the Don was the natural supply of Barnsley.

In cross-examination on behalf of various opponents, witness stated that he was not aware that a number of authorities such as Wakefield had a good deal of water to sell; nor had he considered what injury the Barnsley scheme might do to the Sheffield district in the Don drainage area. Barnsley had no desire to supply water within the limits of the Wakefield district; but until he had consulted with Counsel, he would not consent to put a clause in the Bill to this effect, unless Wakefield would agree not to enter the Barnsley area of supply. Witness expressed the belief that there would soon be a scarcity of water in Barnsley alone, leaving aside the out-townships.

In re-examination, witness said Barnsley must have water from somewhere. Parliament had already sanctioned the taking of water from the Don; and the Corporation now sought a further supply. Barnsley did not sell to its needy neighbours until it was shown that they were in dire straits. It could not have supplied them had it not been for help from other than their own sources. The Local Authorities Barnsley was to supply under the powers of the Bill had agreed to pay 10d. per 1000 gallons, and were perfectly capable of looking after themselves without the motherly care of the West Riding Council. The enlargement of the Barnsley reservoir would have the same effect on the water obtained by the Sheffield millowners as the proposed works which the Bill would authorize.

Mr. *W. Battye*, of Darley Grove, near Barnsley, said the district was very badly off for water; and the Corporation had come to their rescue. The township had arranged to pay 1s. per 1000 gallons for the water. They had borrowed £5000 altogether for the purpose of paying for the supply, which, on the whole, had been satisfactory. They should regard it as a calamity to be without it.

Other witnesses gave evidence in support of the Bill. One of these—the Vice-Chairman of the Ardsley Urban District Council—was under cross-examination by Mr. Pembroke Stephens, when the learned Counsel was asked if his clients (the West Riding County Council) claimed a right to supervise agreements entered into between the Barnsley Corporation and the Local Authorities.

Mr. PEMBROKE STEPHENS said his contention was that the supply was not a suitable one at present; and supposing this objection were removed, the County Council claimed to put before their Lordships the view that, where a water supply of a district was to be absorbed, the absorption should take place on reasonable and proper terms. If some local districts had made provident arrangements with Barnsley, the Council desired to see that these arrangements were adhered to; but when improvident terms were proposed, they asked their Lordships not to sanction them.

Dr. *Sadler*, the Medical Officer of Health for Barnsley, said in 1893—a year of great drought—the supply of water was limited, and the result was an outbreak of typhoid fever. The water at present supplied was pure and soft; but not so soft as to be dangerous to health through its effect upon lead piping.

In cross-examination by Mr. PEMBROKE STEPHENS, witness said lead-poisoning was well known in the West Riding; but the number of cases had been decreasing of late. Soft water from the moors no doubt had a more or less solvent effect upon lead; but the Barnsley water was treated with lime.

Mr. *J. H. Taylor*, the Borough Surveyor of Barnsley, and the Manager of the water-works, in answer to questions by Sir G. MORRISON, gave particulars as to the source of supply, the charges made to the consumers, and the reasons for promoting the Bill. He said the total

population of the district proposed to be supplied was 94,692, including 10,000 persons outside, whom they were not desirous of serving, but whom they would supply because of their pipes being laid down through the districts containing this population of 10,000. There was, however, a supply for 7000 of these people already existing; and the actual population the promoters would be called upon to serve would be 87,000. The Midhope scheme would supply this population with 20 gallons per head per day, and would meet the wants of the district for the next 22 or 23 years. The Midhope water would be taken from a gathering-ground where there was only one house standing; while on the gathering-ground of the Ingbirchworth reservoir, some 160 persons resided. He thought the Midhope water was better than that obtained from Ingbirchworth. Any serious deterioration in the quality of the water would cause some manufacturers to send their work elsewhere. He might mention that a large bleacher and dyer had told him that any other water would have an injurious effect upon his printing, as the colours would not come out bright enough with hard water; and if there was any change, he would have to send his trade away. He described the filtering apparatus in use at the water-works, and stated that the last two filters erected by himself had been successful in neutralizing the tendency of the water to act upon lead. There was great necessity for an increased supply.

Mr. Bidder cross-examined witness with the view of showing that if the Corporation ceased to supply the out-townships, which they were under no obligation to serve, they would have plenty of water for their own purposes; and, further, that the rate they charged the out-districts left a large profit. In fact, he said his case to their Lordships would be that the Bill was promoted not for Barnsley's own necessities, but in order to carry on still further a speculation in the sale of water which had been found highly lucrative.

In reply to Mr. Balfour Browne, witness said the Barnsley Corporation at one time contemplated omitting the out-districts; but he denied that, if they had done this, the supply would be adequate for the wants of the area they were at present bound to supply, which comprised a population of 48,000.

Mr. Balfour Browne: But even at 20 gallons per head per day, your scheme would serve for a population of 180,000. Including the out-townships, you do not expect the population to increase to that extent?

Witness said they did not think Parliament would require them to throw overboard the out-townships. Practically, the population of their existing limit of supply was 87,000; and at the present rate of progress, they anticipated that in 1917 or 1918 Ingbirchworth and Midhope together would only be sufficient to supply 20 gallons per head per day.

In answer to Mr. Reader Harris, witness said he had tried to do his best; but he had reluctantly come to the conclusion that the Midhope scheme was the only available one. He scouted the idea of raising the height of the Ingbirchworth reservoir embankment. Such a thing, he said, had never entered his head. He was urged to add 12 inches to the height of the bye-wash. But the suggestion was a foolish one; and he declined to carry it out. It would endanger the embankment; and he did not think the watershed would supply water enough in a dry season. As to pumping from the sandstone, the water was fit for neither man nor beast.

Replying to Mr. Moon, witness said the Barnsley Corporation were quite willing to allow any of the out-townships they now supplied to avail themselves of another source of supply.

Mr. Moon: But are you not compelling Ingbirchworth to take your supply?

Witness: Yes; but there were exceptional circumstances.

Mr. Pope inquired what a County Council had to do with any bargain a District Council might make.

Mr. Pembroke Stephens, while admitting that the County Council had nothing to do with a bargain, said they could and ought to interfere generally to prevent such terms being imposed as would fetter other districts which had not at present made one.

After a long argument,

The Chairman said the question was: Which is the water authority of a district—the District Council or the County Council? Unless the learned Counsel could show any Act giving them a supervising control over the matter of the agreements, it was not worth while pursuing the cross-examination any farther.

Mr. *C. Hawksley*, M.Inst.C.E., the Engineer of the scheme, in answer to Mr. Pope, said the present water-works at Barnsley were completed in 1868. The drainage area at Ingbirchworth comprised 1857 acres. In estimating the requirements of the district, they ought not to calculate on less than 20 gallons per head per day. In Sheffield, the supply was from 19 to 20 gallons per head per day. The works proposed to be carried out under the Bill would supply the needs of a population of 135,000 persons. It would take five years from the present time to construct the works; and at the end of 22 years an additional supply would be necessary. By the Bill it was proposed to take water from the drainage area of the Little Don, which embraced the Hogg Brook and Thickwood's Brook, two tributaries of the river. The water would first be filtered in beds constructed in the neighbourhood of the reservoir, and would then be conveyed by pipes to a service reservoir at Wortley. Another line of pipes would take the water to Barnsley, and would supply on the way townships desiring to have the water. The drainage area it was proposed to take was 1922 acres. The total drainage area of the Little Don was about 11,000 acres.

Mr. Pope: What is the drainage area of the River Don above Sheffield?

Witness: About 85,000 acres. Up to the junction of the two boroughs of Sheffield and Rotherham, it is 102,000 acres.

So that it is a very small proportion of the drainage area of the Don that you propose to take?—Very small.

And on the Don you leave abundant drainage area and sites for the construction of reservoirs?—Certainly. There are on the Little Don 9000 acres of drainage area containing sites for reservoirs. Of this we only take 1922 acres.

What is the rainfall of the area you propose to take?—The total rainfall is 43½ inches, but the available rainfall is only 21 inches. The water obtained from the proposed works added to that from the present works would give a supply of 2,700,000 gallons a day.

In regard to the petition of Sheffield, What are the existing circumstances of that borough in reference to their water supply?—The works for their existing supply consist of three reservoirs known as the Redmires reservoirs, two others known as the Rivelin reservoirs, four others in the Loxley valley, the Strines reservoir, the Dale Dyke reservoir, the Agden reservoir, and the Damflask reservoir, the construction of which has just been completed. Other reservoirs have been authorized in the Ewden Valley; but these have not yet been commenced. The Corporation acquired the land for them; but they have not finished them because they have not been required by the needs of the borough. The Bill authorizing the construction of these reservoirs was obtained in 1867.

About what power have they now to supply the population of Sheffield with 25 gallons of water per head per day?—Allowing that quantity of water, they would need not only the reservoirs already in use, but also the Damflask reservoir. They are therefore now left with the Ewden watershed. That is capable of giving a supply to a further population of 200,000. The present population supplied is 402,000; and it is increasing at the rate of 1½ per cent. per annum.

That would give Sheffield a supply for 24 years in advance?—Yes. I do not think Sheffield will be in Parliament for new works for 20 years.

It is clear to you that the wants of Barnsley are immediately urgent; and it would be rather hard on her to say she shall not have what she needs because Sheffield will want some more water in 24 years?—I think it would.

With regard to Rotherham, Have they a Bill before Parliament?—Yes. It is for obtaining water by means of wells to be sunk in their own district.

Questioned as to the petition of Messrs. Fox and Co., witness said one-third of the available rainfall was a fair amount of compensation water, and was more beneficial to the millowners and others on the rivers than the whole rainfall descending irregularly—too little at one time, and far too much at another. There was no more danger of the proposed new reservoir bursting than there was of any other reservoir giving way; and there was a good deal less danger in this case than in that of some reservoirs. The foundation on which this reservoir would be placed was particularly well suited for the purpose. The water in the reservoir would be 100 feet deep; and the embankment would be 105 feet deep.

Mr. Cripps, on behalf of millowners and occupiers on the River Don, cross-examined witness as to the suggested alternative scheme of constructing additional reservoirs at Ingbirchworth.

Mr. Pope objected, on the ground that the matter was not raised in the petition.

Mr. Cripps said his object was to show that there was no necessity for Barnsley to go to the watershed of the Little Don.

The Committee overruled the objection.

Witness said his late father considered the possibility of keeping all the water in the Ingbirchworth reservoir for the purposes of supply, and sending the compensation water down from the Scout Dyke reservoir. Witness did not think it would be desirable to heighten the embankment of the Ingbirchworth reservoir. Barnsley was in the same watershed as Sheffield, if they took the whole watershed of the River Don; but they were in separate watersheds if they subdivided the watershed. He admitted that not one drop of water that flowed past Sheffield flowed past Barnsley also. The only available scheme for augmenting the water supply of Barnsley was the Midhope scheme. It only proposed to include some 2000 acres of the drainage area of the upper part of the Little Don; leaving nearly 100,000 acres of the drainage area of the Little Don and Don Rivers to Sheffield, with abundant sites for the formation of reservoirs.

In cross-examination by Mr. Bidder, witness said he was aware that Rotherham was in difficulties as to its water supply; but they had a Bill before Parliament which proposed to increase it by pumping from the wells in the neighbourhood. He had heard that a large portion of the existing supply on which the population depended had been condemned by a report of the Local Government Board.

Mr. Bidder: If we found ourselves face to face with a great and sudden necessity, owing to the report of the Local Government Board, it would be right that we should do everything we could to increase the supply temporarily until we could get something permanent.

Witness: Yes, no doubt; and that is what Barnsley is doing at the present time.

Do you suggest to their Lordships that in our Bill we are only taking pumping powers, and do not propose to go to the watershed of the Little Don?—I do.

Do you know the Bill contained a clause asking for powers expressly to make an investigation of the watershed of the Little Don, with a view to obtaining an additional supply of water? That clause was put in after it was known that the Barnsley Corporation were going to the watershed of the Little Don. The clause was struck out by the Standing Orders Committee.

Have you any ground for making the suggestion that it was because of your Bill that we developed that intention? It is a serious charge to make?—I believe that, if the dates of the proceedings are looked at, the suggestion will be borne out. Further, I think that the very form of the application to Parliament—the very unusual form, that the watershed might be shut out from everybody for a period of ten years while the Corporation of Rotherham are making up their minds what they shall do—is in itself *primâ facie* evidence that it was thought of at the last moment.

Do you know that the clause went out at the instance of the Sheffield Corporation, in consequence of negotiations with the Rotherham Corporation?—No. I am informed that it went out on the direction of the Standing Orders Committee.

Are you aware of the fact that, since this Bill has been deposited, the Sheffield, Rotherham, and Doncaster authorities have approached each other for a common scheme to go to the watershed of the Little Don, and that, in consequence, the application in the Rotherham Bill was withdrawn?—I am not aware of that. I did not know there had been such an arrangement. I am aware that the Corporation of Rotherham struggled very hard before the Examiners to retain the clause.

In answer to Mr. Balfour Browne, witness said that, as a matter of

principle, it was not fair for a town to go into another valley, so long as the valley it was in was still unexhausted—always provided that other things were equal; and therefore it became incumbent upon the Barnsley Corporation to show that they could not, from their own valley, get sufficient water of reasonable purity. A reservoir to hold 377 million gallons could be constructed on the Scout Dyke. With regard to Sheffield, he had already stated that the town would not require more water for a period of 27 years; and, to allow for contingencies, the Corporation ought to apply to Parliament seven years before the expiration of that time.

Mr. Balfour Browne: That gives us twenty years from now, even if we have no calls upon us. Where are we to go in twenty years?

Witness: That would be a consideration at the end of twenty years.

No; it is a consideration to-day.—There will be other sources. Sheffield will be a large place then, with 600,000 inhabitants; and I dare say it will have an ambition equal to that of Liverpool and Manchester, and go farther afield for water.

Why should we go farther afield when we have the watershed of the Little Don?—It is a question for the consideration of the Committee whether or not this valley is to lie idle for 27 years in order that Sheffield might go there if it thought proper at the end of that period. You must remember that we are leaving 7000 acres untouched.

Mr. *J. Mansergh*, M.Inst.C.E., next gave evidence in support of the Bill. He said he was familiar with both the Barnsley and the Sheffield Water-Works, and also with the watershed of the Little Don. With regard to the scheme in the present Bill, he could support it from an engineering point of view. The site for the reservoir was all that could be desired with a view to the safety of the bank. With respect to the opposition of the Sheffield Corporation, he pointed out that thirty years ago Sheffield obtained powers over the watershed of the Ewden Brook, from which source they could get something like five million gallons of water. This would be a supply for an additional 200,000 people, and for even a larger population if they did not use more water per head than they were doing now.

Mr. *G. J. Symons*, F.R.S., Secretary of the Royal Meteorological Society, was next called. He said the mean rainfall of the gathering-ground of the proposed new reservoir was 44 inches. He deducted one-fifth, in order to take exceptionally dry weather into account; and this made the rainfall 35·2 inches. From that they had to deduct between 14 and 14½ inches lost by evaporation and percolation. This left the total available rainfall of the gathering-ground at 21 inches, as near as possible. In manufacturing districts, where considerable water power was utilized, it had been the practice of Parliament to give one-third of the total available rainfall as compensation water. In this case, the one-third would amount to 7 inches, which he thought would be ample.

Mr. *R. Carter*, a former Mayor of Barnsley, expressed the opinion that the scheme in the Bill would furnish the town with a very satisfactory supply of water.

Mr. *H. Rofe*, M.Inst.C.E., also gave evidence in favour of the scheme. He said he did not think any responsible engineer would undertake to give Barnsley more water by means of the suggested augmentation of the supply from the Ingbirchworth reservoir.

Mr. *Hawksley*, recalled, stated that his figure of £150,000 as the cost of the proposed works did not include filter-beds, which would involve an additional outlay of £12,000; making a total of £162,000.

Mr. *Taylor* was also recalled, and said the population outside the existing area of supply, whether taking water or not, was 23,445. This was the actual population outside the area.

Professor *J. Dewar*, F.R.S., said he had on several occasions examined and analyzed the waters in the district from which the promoters of the Bill were proposing to take their additional supply. He had prosecuted his investigations on behalf of the Corporations of Sheffield and Bradford, mostly with regard to the effect of the water upon lead. His main inquiries for those two towns had reference to lead-poisoning, and to the remedial agents to be employed to prevent its effects. The whole of the waters in the district attracted lead more or less, according to the season and the condition of the supply. Sheffield experienced the same difficulty; but a remedy had been successfully applied there which could be employed at Barnsley and in other places. There was absolutely no difficulty in dealing with the action of the water upon lead. He considered the proposed Midhope watershed the most suitable one that could be selected in the district. It contained but a small proportion of arable land; and there was less land in cultivation—only 2 per cent.—whereas in the other districts the minimum was 20 per cent. Scout Dyke, for instance, contained 20 per cent. of land under cultivation; and, what was more objectionable, it was manured by night soil taken from Barnsley and the neighbourhood. No one would select a watershed that was highly polluted with manure; and no chemist would advise such a district to be used as a watershed. The district selected by the promoters was entirely free from impurities.

In cross-examination by Mr. Pembroke Stephens, witness said the waters in the district were of remarkable property. Anyone who introduced the water for the purposes of public supply must realize that it required to be specially dealt with—filtered or treated by some method. There was no filtration at Sheffield; but the water was passed through finely-divided chalk in running into the reservoir, and this diminished the action of the lead. Water of this kind, if filtered or treated by chalk, as at Sheffield, could be easily adapted for the purpose of a public supply.

Mr. Pembroke Stephens: If the water is sent down to the main in a perfectly harmless state, might it not be rendered dangerous by passing through lead pipes into the houses?

Witness: I cannot go the length of saying that. If the water were to lie in lead cisterns, it would be highly dangerous; but I will not go so far as to say that the short run through a lead pipe into a house would do any harm.

If there is to be treatment of the water, do you agree that a constant supply would be the safest on the whole?—Yes; that is my opinion.

Do you know that the Bill contemplates not a constant, but an intermittent supply?—I have not gone into that question.

Then your evidence is that the water is dangerous?—Not at all. It is perfectly harmless when treated as I suggest.

What is your remedy?—Filter it, if you cannot treat it with chalk, as at Sheffield.

But who is to filter it?—The Corporation.

Who is to make the Corporation filter the water?—I cannot conceive, after my experience of the Corporations of Sheffield and Bradford, any Corporation taking this water without providing for filtering it. Sheffield does not require to do this, for the reasons I have mentioned; but Barnsley would filter, if the conditions there were less favourable than those at Sheffield.

Mr. *Mammatt*, a mining engineer, said his opinion was that Barnsley would go on improving as a mining centre; there being in the neighbourhood coal-fields which would yield coal for fifty or sixty years. Under these circumstances, the importance of a proper water supply for the district must be obvious to everybody.

Mr. *A. H. Green*, examined by Mr. Pope, said he was Professor of Geology at Christ Church, Oxford, and had been acquainted for the past thirty years with the district from which the proposed water supply was to be taken. He had examined the site selected for the Midhope reservoir; and he could safely say that he had never seen one possessing so many favourable conditions.

Mr. Pope said he had several other witnesses; but their evidence would only go to corroborate what had already been put before their Lordships in support of the Bill.

The case for the promoters then closed. The further proceedings on the Bill will be reported in a subsequent issue.

LEGAL INTELLIGENCE.

Abstracting Money from Prepayment Meters.

At the Lambeth Police Court on Monday last week, John Dowling, aged 18, a labourer, was charged before Mr. Hopkins with attempting to steal money from an automatic prepayment gas-meter at No. 274, Camberwell New Road, the property of the South Metropolitan Gas Company. The occupiers of the house are supplied with gas by a prepayment meter; and just before four o'clock on Sunday morning a police-constable was passing along the road, when he heard a slight noise in the area of No. 274. He crept into the front garden, and found the prisoner in the area. When asked what he was doing there, the prisoner admitted that he was trying to open the gas-meter in order to get the money out. The meter had been wrenched away from the wall and the gas was escaping. Mr. Underwood, an official of the Company, informed his Worship that this class of offence was on the increase. There had been four cases within the previous few weeks. Mr. Hopkins remanded the prisoner for inquiries.

Public Lighting by Gas at Ainsdale.—By order of the Parish Council of Ainsdale, the streets in the district were illuminated for the first time by means of gas on the night of Saturday, the 31st ult. An agreement has been entered into with the Southport Corporation, the scheme to cost the ratepayers of Ainsdale £50 per annum, to meet which a rate of 3d. in the pound on houses and similar property, and 1d. in the pound on land will be levied. The inaugural ceremony of lighting the first lamp was performed by Mr. C. Nesbitt, the Chairman of the Parish Council.

The Water Question at Gomersal.—At last Wednesday's meeting of the Gomersal District Council, Mr. Brearley reported upon an interview with the Water Committee of the Bradford Corporation. He said they laid before the Committee the history of the negotiations with the Gomersal Water Company with a view to the purchase of the plant for the ratepayers, and stated that, while the sum of £10,000 was asked for the Company's plant and interest, the Corporation had themselves purchased the whole of the plant in Liversedge, which was three times as large as Gomersal, for a little above £3000. They also pointed out that the charges for water in Gomersal were something like twice as high, and in some cases three times as high, as in the neighbouring district. The deputation asked that the Committee should become mediators between the Company and the District Council; and if they could not do this, then that the Corporation should supply the district with water separately from the Company, or otherwise leave the ratepayers to "work out their own salvation" in their own way. The Committee expressed considerable sympathy with them; but as to what passed precisely, he thought it would not be wise to report further in public. The deputation suggested that the question should be adjourned for the present.

Trades Unionists and an Eight-Hour Day.—At the Trades Union Congress at Cardiff last Wednesday, Mr. W. Thorne, the General Secretary of the Gas Workers' and General Labourers' Union, moved the following resolution: "Seeing that the eight-hour working day is one of the most important preliminary steps toward the ultimate emancipation of the working class, and will lessen the number of unemployed, improve the quality of work, and increase the health, strength, and intelligence of the workers, this Congress declares that the time has arrived when the hours of labour should be limited to eight per day in all trades and occupations (miners excepted) in the United Kingdom, and that the Parliamentary Committee be instructed to draft a Bill on the lines of this resolution with a view of getting it passed through Parliament, and made a law of the country." In support of his motion, Mr. Thorne said that all ought to agree to a general eight-hour resolution; the time being fully ripe for such a step. Another reason why the delegates should be unanimous on this subject was the rapid increase of the use of machinery in all industries. More especially was this the case in the gas industry. There were only two ways of getting the hours of labour reduced—by an Act of Parliament, or by coming into conflict with their employers, and spending their money. He, for one, therefore did not see why they should contribute to their organizations, and then spend their money in a strike, when an easier way could be found. Some people advised a general strike. He thought that a general strike would only be entered upon by the workers for the purpose of obtaining complete control of the means and ways of production. The resolution raised a good deal of discussion; but it was carried by a substantial majority.

MISCELLANEOUS NEWS.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

The Gas Committee Recommend its Abandonment.

The members of the Gas and Electricity Supply Committee of the Bradford Corporation met last Wednesday afternoon to consider the supplementary report of Mr. Lewis T. Wright, the expert called in to advise that body as to the results obtained from the experiments in the oil enrichment of gas by the Dvorkovitz process which have been conducted at the Bradford Gas-Works for some time past. It will be generally known, says the *Bradford Observer*, that the Gas Committee have been divided in opinion on the merits of the system now being tried, both in comparison with the use of cannel for enrichment and with the value of the oxy-oil system which has been in use at Huddersfield. The Chairman of the Gas Committee consulted Mr. Lewis T. Wright some time ago on certain matters concerning the Dvorkovitz system; and afterwards the Committee resolved, in spite of the strong opposition of a minority, to employ Mr. Wright to prepare a report for its guidance. This document was presented to the Committee about a fortnight ago; and Mr. Wright was then asked to prepare a supplementary report dealing with certain matters upon which the first report was not sufficiently conclusive. The second document was circulated amongst the members of the Committee a few days since, and formed the basis of the discussion last week. In addition to this supplementary report, however, the Committee had before them a letter from Mr. William Wood, the Gas Engineer, adversely criticizing Mr. Wright's conclusions, and an offer from Mr. Isaac Smith—who has conducted the negotiations with the Corporation in regard to the Dvorkovitz system on behalf of a Syndicate—to allow the Corporation to work the system on terms which, he claimed, would ensure a very large saving, and without any risk. These three communications were discussed with strong feeling; and, upon the whole question, there was as keen a division of opinion as has formerly been the case. At an early stage of the proceedings, it was suggested by the advocates of a further trial of the Dvorkovitz system that Mr. Smith, who was in attendance at the Town Hall, should be brought into the room to make certain explanations. But, by the casting-vote of the Chairman (Mr. W. C. Dixon), it was decided not to take that course. Mr. Thomas Speight then moved that the oil-gas process be abandoned; it not having answered the expectations of the Committee. An amendment was moved, to the effect that the proposal from Mr. Smith which was then before the Committee should be accepted. But this was defeated; and, in the absence of several members of the Committee who were known to be favourable to the Dvorkovitz system, the resolution was put to the vote, and carried by 10 votes to 2.

The following are the documents which were before the Committee, the first being the supplementary report of Mr. Wright, the second Mr. Wood's comments thereon, and the third a letter containing the new offer made by Mr. Smith:—

No. 1.

1, *Victoria Street, S.W., Aug.* 28, 1895.

To the Chairman of the Gas and Electricity Supply Committee, Bradford.

Sir,—At the request of your Committee, as expressed at the meeting of the 21st inst., I have carefully studied the question of cannel enrichment under the conditions actually obtaining in Bradford; and, bearing in mind Mr. Wood's opinion, that the coke from cannels cannot be successfully employed in the retort-furnaces as now installed at Bradford, I have arrived at the conclusion that it is quite easy for the Bradford Corporation to procure ample supplies of cannels from the Yorkshire, Derbyshire, and Nottingham coalfields that will give enrichment at the figure I verbally made.

I append an estimate based upon actual working experience on a large scale—an estimate that brings out the cost of adding 1 candle to the standard illuminating power, as determined by consuming the gas at the rate of 5 cubic feet per hour, at 0·81 of a penny per 1000 cubic feet, by means of cannel yielding 10,000 cubic feet of gas of an enriching illuminating power of 23 candles per 5 cubic feet. I would call your attention to the fact that, in the estimate, the entire product of coke from the cannel is valued at 3s. 4d. per ton; and the coke employed for carbonizing the cannel is charged at 7s. 6d. per ton. This condition is not favourable to the utilization of cannel coal; and I would suggest that in future renewals of the retort-furnaces, they should be so arranged as to consume the cannel coke.

In order to calculate the saving arising on this basis from the use of the Dvorkovitz oil-gas process, I take the standard illuminating power to be supplied at 18¾ candles, and that of the unenriched coal gas at 15¾ candles, per 5 cubic feet respectively. The amount of enrichment required is therefore 3 candles per 5 cubic feet. The difference in cost is 0·81 − 0·76 = 0·05 of a penny per 1000 per candle per 5 cubic feet, or 0·05 × 3 = 0·15 of a penny for the total enrichment required. In the year ending March 31, 1894, the quantity of gas made at Bradford was 1,506,822 thousands; and the saving, therefore, on this basis will be the round sum of £942.

The question of the commercial value of an oil-gas process cannot be dismissed by a simple reference to a saving, whether it be large or small. There is another consideration that your Committee will not ignore; and that is the value of the possession of an alternative enrichment process. But for the introduction of oil gas processes in their various forms, in view of the foreign demand for the cannels of this country, it is not too much to say that there would be a very great scarcity of this article, with consequent high prices. In the experiment recently carried out at Bradford, the amount of the petroleum gasified was 65 per cent. of the original bulk; and in former trials the amount appears to have varied from as low as 40 per cent. up to 64 per cent. (*Vide* Mr. Charles Wood's report of Jan. 23, 1895.) With so low a proportion of the oil gasified in the retorting process, it is most essential that the residual products should be economically utilized. The oil-gas works in this country serving railway-carriage lighting, in some cases sell the oil-gas tar at from ½d. to ¾d. per gallon, and in other cases consume it as a fuel. This latter use is not generally practicable in towns, as at times it gives rise to smoke which may occasion nuisance. This is evidence that such oil-gas tars are not profitable to make for sale. To employ it in its crude state in a carburetter, as has been done at the Thornton Road works, is not desirable; but it appears to me that a method might be devised by which the same value I obtain—viz., 1·7d. per gallon—could be secured, and without the objections I have had occasion to note. Nor can I recommend your Committee to entertain the idea of attempting to utilize this oil-gas tar (bye-product) by distilling it, and selling the refined, or even partially refined, products. The quantity available, even in the case of the adoption of this oil-gas process to the exclusion of cannel, would not justify the Corporation entering upon such a business that requires special experience, and is attended with considerable expenses, not only for actual expenses in the refinery, but also for carriage of products and for casks.—I am, &c.,

(Signed) LEWIS T. WRIGHT.

Estimate of cost of enrichment at Bradford from cannel coal, yielding 10,000 cubic feet of gas of an enriching illuminating power of 23 candles per 5 cubic feet:—

Net cost of cannel per ton.

	Pence per Ton.		Pence per Ton.
Cannel at 13s. per ton . .	156·00	Tar, 19·5 gallons at 1·2d. per gallon	23·40
Fuel used in furnaces, 4 cwt. at 7s. 6d. per ton. . .	18·00	Ammoniacal liquor, 23·5 gallons at 0·84d. per gallon	19·74
		Coke, 11·6 cwt. at 3s. 4d. per ton	23·20
	174·00		66·34
	66·34		
Net cost of cannel per ton .	107·66		

Cost of gas per 10.0 cubic feet.

	Pence per Thousand.
Net coal as above	10·766
Purification, salaries, wages, repairs, and maintenance. Average of three years ending 1893.	6·171
Interest and sinking fund	1·918
	18·855
Less spent oxide	0·226
Cost per 1000 cubic feet into gasholders	18·629

Or 0·81d. per 1000 per candle per 5 cubic feet.

No. 2.

Gas Office, Bradford, Sept. 3, 1895.

To the Chairman and Members of the Gas Committee.

Gentlemen,—Before you come to a decision upon this question, I feel it my duty to submit to you the following statement, which I put as briefly as possible. Any details can be given afterwards.

Mr. Lewis T. Wright stated in a communication which was read to this Committee that the calculated cost of enrichment per candle-thousand in our report of the thirty-three days' test—viz., 0·42d. (page 3), was "incorrect," and that this result must be multiplied by 5, and should be 2·1d. When asked to explain this statement, Mr. Wright wrote declining to discuss the matter except upon payment of a fee. He has since admitted that the result referred to is correctly calculated. Mr. Frank Wright (brother to Mr. L. T. Wright), in an extraordinary report, for which he was paid ten guineas, made a similar misleading statement.

Mr. Wright refused to test the process if worked as it had been during the thirty-three days' test—viz., enriching with oil gas and bye-products at the same time. The difference between Mr. Wright's estimate of 0·76d. and the 0·42d. in the thirty-three days' test is due chiefly to the estimated values of the bye-products. As 6d. per gallon has been offered to the Corporation for these, we valued it at that figure. Mr. Wright's valuation of the bye-products (1·7d. per gallon) was based upon a carburetting experiment of three hours; although, in his opinion, this was not a satisfactory way of working. The photometer tests in this experiment were very conflicting. The bye-products were evaporated much faster than the gas could possibly retain them. Mr. Wright says that, for carburetting, the bye-products should first be distilled. This we recommended in March as being the best method of dealing with them. Mr. Wright's comparison of the bye-products with other oil-gas tars is misleading, as the bye-products obtained at Thornton Road do not at all resemble the tars from other oil-gas processes.

Again, in his first report, Mr. Wright advises distillation of the bye-products; in his second, he states that he cannot recommend this. Mr. Wright bases his estimate of the cost of cannel enrichment upon the use of cannel at 13s. per ton. Although we had half a million tons of cannel offered this year, we could not buy any at this price which would give the quantity and quality of gas, coke, tar, and liquor which Mr. Wright gives. Mr. Wright values the ammoniacal liquor from his cannel at 0·84d. per gallon (*i.e.*, 15s. 3d. per ton of 218½ gallons). The present average price of liquor, as quoted in the JOURNAL OF GAS LIGHTING, is 7s.; and the average price for the last three months is only 7s. 5d. per ton.

Mr. Wright calculates the cost of his cannel enrichment in quite a different way from his oil-gas enrichment when he assumes that the whole of the 23 candles would be available for enriching 15¾-candle coal gas. Taking Mr. Wright's values for the cannel and residuals, if the cost is reckoned out in exactly the same way as he reckons the cost of the oil gas enrichment, the result would be 0·08d., instead of 0·81d. Mr. Wright states that 17·73 candle gas is worth 13·66d. per 1000 cubic feet in the holders. Therefore, upon the same basis, 18¾ candle gas is worth—

$$13{\cdot}66\text{d.} \times \frac{18\tfrac{3}{4}}{17{\cdot}73} = 14{\cdot}44\text{d. per 1000 feet.}$$

Therefore, 1000 cubic feet of 23-candle gas cost (Mr. Wright) 18·629d.;

and if 1000 cubic feet of 18¾-candle gas are worth 14·44d., then the extra 4¼ candles cost 4·18d. per 1000 feet, or

$$\frac{4\cdot18}{4\frac{1}{4}} = 0\cdot98\text{d. per candle per 1000 feet.}$$

Repeated attempts have been made in Bradford to use the cannel coke for our retorts, but always without success; and I am convinced, for several reasons, it would be a great mistake to burn this coke.

In conclusion, I am of opinion that the Dvorkovitz process, in regular working, will cost less, and that cannel enrichment (at present prices) will cost more, than Mr. Wright's estimates; and that, therefore, by the adoption of the process, the saving to the Corporation would be considerably more than Mr. Wright's figures.—I am, &c.,

(Signed) W. Wood.

No. 3.

Bradford, Sept. 4, 1895.

Dear Mr. Town Clerk,—This subject will no doubt come up in Committee again to-day, upon consideration of the further report which I learn Mr. Wright has made; and as I have an offer to put forward, I want the Committee to have it before them at the same time.

You will remember that the agreement made with the Corporation at the outset (dated Aug. 7, 1894) empowers them to take over the plant at their own valuation; and on paying me £150 towards expenses, they have the right to use the process at all the gas-works in the borough. The offer I have to make, then, is as follows: On the Corporation agreeing to work the plant in Thornton Road for six months continuously, and to utilize the bye-products for the same length of time, under directions to be supplied by me, I will allow the £150 to be expended upon additional plant for treating the bye-products, and will guarantee, moreover, that the cost of enrichment shall not then exceed ½d. per candle for every 1000 cubic feet of gas supplied for consumption. Should the cost of enrichment not exceed that figure, then the Corporation to take over the plant at the end of the six months at cost prices.

The above offer means a clear saving at the Thornton Road Gas-Works alone at the rate of more than £1400 per annum on a capital outlay of less than half that amount. If extended to all the gas-works in the town, the saving would amount to more than £6000 per annum on a capital outlay of only £2000, without risk to the Corporation. —I am, &c.

(Signed) Isaac Smith.

The above reports and recommendation will be on the *agenda* of business at to-day's meeting of the Corporation; but it is quite possible that no definite decision will be arrived at. The *Bradford Observer*, writing on this subject last Friday, says: "What with the oil-gas question, the technical instruction grants, and one or two other matters of no less importance, though not causes of such keen controversy as is provoked by these two, there seems to be fair promise of a field-day for the Bradford Town Council next Tuesday. The present state of feeling between the two sections into which the Council is divided on one of these subjects is probably without parallel in the history of Bradford's corporate affairs, during the last twenty years at any rate. There are flat contradicitions in the evidence adduced, not only upon theories, but on the most elementary facts. The members of the Council who are not on the Gas Committee, and upon whose intelligence and judgment the result is to rest, have presumably got the task of, in three or four days, unravelling all this tangle, which is the work of months, so that they may be prepared to vote on Tuesday next. It is said that the voting on Tuesday will display practically a strict division of political parties. If that is so, of course, there is no need whatever for any effort to arrive at the actual and incontrovertible facts. If, on the other hand, the question of the value or uselessness of the oil-gas process is to be decided actually on its merits, would it not be only a reasonable thing that the general body of the councillors should now have all the documents put before them, and be allowed a month for the consideration of the matter? It is stated that amongst some members of the Council who have succeeded in keeping their heads cool during the controversy, there is a strong desire that this course should be taken." The full text of the decision of the Committee reads as follows: "That, after full trial of the apparatus and process patented by Dr. Dvorkovitz for the enrichment of gas by oil, and after careful consideration of reports by Mr. Lewis T. Wright, the expert called in to advise on the matter, the Committee find that the experiment has not proved a success to warrant the adoption of the system by the Corporation, and that the Council be accordingly recommended to abandon the scheme. The Committee, however, desire to acknowledge the kind services rendered by Mr. Isaac Smith in affording to the Corporation all possible assistance in the carrying out of the experiment."

BELFAST CORPORATION GAS SUPPLY.

The Past Year's Working.

At the Monthly Meeting of the Belfast Corporation on Monday last week—the Lord Mayor (Mr. W. M'Cammond, J.P.) presiding—the Gas Committte reported that the accounts for the past year (subject to audit) showed a very satisfactory result. The working of the carburetted water gas has proved most satisfactory; and having regard to the large expenditure going on in connection with the extension of the plant therefor, and for mains, also the money supplied for the electric light installation, the Committee have thought it prudent to charge the cost of the extensions made during the past year to revenue. After meeting such outlay, and adding £2000 to the insurance fund, there remains a balance of £3044 14s. 7d. to the credit of profit and loss, which the Committee recommended should be carried forward to the next account.

Alderman Dixon, in moving the adoption of the report, said the working of the gas department had been very satisfactory during the past year. The consumption of gas had increased by 5 per cent. The water-gas manufacture had been a great success; and the profits of the undertaking generally were more than in the previous year. Undoubtedly Mr. Stelfox, their able Manager, deserved great credit for the ability with which he had administered this important trust.

Mr. Harrison suggested that if the amount of profit from the gas department was so large, the Committee might consider the advisability of giving £1000 to the Library Committee.

Mr. Bell thought the Committee might seriously consider the advisability of lowering the price of gas, as it seemed they would be justified in doing so by the amount of profit realized. If water gas, as stated, were cheaper than ordinary coal gas, it must follow that a large profit was made, of which the consumer ought to get a portion of the direct benefit.

Alderman M'Connell wished to know, in the event of the Corporation going for a Bill in Parliament this year or next, whether the Gas Committee would obtain power to give a supply of gas to all consumers on equal terms, subject to the same rate of discount.

Alderman Haslett asked if the £25,000 lent to the Electric Committee was carried forward as a debt or not.

Alderman Dixon said the sum referred to stood as a debt in the books of the department.

Alderman Haslett said the Corporation had to face the difficulty that the borrowing powers under their Act of Parliament for the gas department were almost run out. At the same time, though he would be disposed to give the Committee every freedom to pay out from the working profits for many things in connection with the extension to the works, he thought the cost of the permanent buildings ought, if possible, to be made out of borrowed capital rather than out of profits. He would be glad also to see the mass of the people benefit by the success of the gas undertaking, and that it should not be solely the large consumers who obtained special advantages. Of course, the original idea was that mills and other places which gave employment to the working population, should be encouraged; but he thought they had arrived at a time when these special arrangements should be done away with. The difficulty was that, in giving a reduction in the price of gas, if they made the reduction, and gave also the rate of discount to those in receipt of it, they would reduce the charge for gas to under cost price, with, of course, disastrous results to the ratepayers. Again they must regard the gas undertaking to some extent as a fickle one; for they did not exactly know what its future might be. With regard to the electric light undertaking, they were glad to see that it competed so favourably with gas; but he was inclined to think that it had not made anything like the same advance as some of the newer forms of gas lighting. They saw, for instance, the incandescent gas-light very rapidly coming to the front; and he must say that some places lighted by this system compared favourably with others lighted by electricity. At the same time, in a sanitary sense, electric lighting was far ahead of any other form.

Mr. M'Cormick said the Corporation were not responsible for the system of discounts allowed consumers. This was an arrangement due to the old Gas Company, which they had to take over with all its "infirmities." He wished to know from the Town Clerk whether it would be necessary to obtain an Act of Parliament before they could do away with the present system of discounts.

The Town Clerk said the discounts were fixed by Act of Parliament; and the Corporation were obliged to allow them. It would thus be necessary to obtain an amending Act to do away with them; but if the Corporation were going for an Act for any other purpose, it would, of course, be easy to put in an amending clause dealing with the matter. He had anticipated the wishes of the Corporation in the matter; and had already brought the subject before the Gas Committee. He was sure it would be easy to make a uniform charge for gas, which would give private consumers the full benefit of the success of the gas development, and yet put millowners and other manufacturers in no worse position than they were at present.

Mr. M'Cormick said there were many manufacturers in town who did not come up to the high percentage required; and, therefore, they obtained no benefit from the discount system. As a fact, they were supplying gas to some people below first cost, and making the remainder supply the profit. This was very unsatisfactory; but he saw no way of meeting the difficulty save that proposed by the Town Clerk. He hoped the Chairman of the Gas Committee would see that a clause was put in the next Bill applied for by the Corporation dealing with this matter.

In reply to Mr. Barklie,

Alderman Dixon said the total amount set aside for insurance was now £9000; and the estimated value of the property was £350,000, irrespective of mains. He hoped they would be able in time to see their way to reduce the price of gas; but it was necessary for them to be very cautious. Oil last year was very cheap, which made a great difference to the price of their water gas; and then there was the electric light competition. He hoped whenever they went for a Bill in Parliament for the Gas Committee, they would take the opportunity of having a clause inserted dealing with the discounts.

The motion for the adoption of the report was then carried.

CARLISLE CORPORATION GAS AND WATER SUPPLY.

The Annual Reports.

Last Wednesday the Gas and Water Committee of the Carlisle Corporation agreed upon their report for the twelve months to June 30, to be submitted in due course to the Town Council.

It states that the consumption of gas during the year increased steadily; the total quantity made being 250,154,000 cubic feet, which, compared with the preceding year, shows an increase of 17,364,000 cubic feet, equal to 7·45 per cent. The gross profit for the year was £8455. It is mentioned that favourable contracts have been entered into for the supply of coal and sale of tar for the ensuing year; but that the market for sulphate of ammonia is very much depressed. The revenue from the sale of water continues to increase; the gross profit being £4706, compared with £4502 in the preceding year.

The Gas and Water Engineer (Mr. C. E. Newton), in his report

to the Committee, says the works under his charge are in excellent condition. The improvements and extensions of the chemical plant, already sanctioned, are to be put in hand immediately. The use of gas for purposes other than lighting—such as cooking, heating, and gas-engines—continues to increase. The coal and cannel carbonized during the year amounted to 23,372 tons; and the average quantity of gas produced per ton of coal, &c., carbonized was 10,703 cubic feet. The average illuminating power of the gas supplied during the year has been 19·36 sperm candles; while the impurities have been kept very low. The number of consumers, based on the number of accounts, is now 7347. The quantity of water supplied during the past two years (ending June 30) is as follows: Quantity pumped in 1894, 375 million gallons; 1895, 397 millions. Supplied for domestic purposes in 1894, 275 million gallons; 1895, 280 millions. Supplied for trade and other purposes in 1894, 100 million gallons; 1895, 116 millions. Average daily supply for all purposes per head of the population in 1894, 23·89 gallons; 1895, 25·32 gallons.

AUSTRALIAN GASLIGHT COMPANY.

Last week's mail from Australia brought particulars of the working of the Australian (Sydney) Gaslight Company for the half year ended June 30.

The Company's accounts are not set out so fully as is general throughout England; the total revenue during the six months, from "sales of gas, &c.," being given, in one amount, as £158,228. The total expenditure and charge is given in three items: Manufacture, distribution of gas, repairs and renewals of plant, management, &c., £92,124; lighting and repairing public lamps, £7001; miscellaneous charges, interest on debentures, bad debts, &c., £10,745. This total of £109,870 leaves an amount of £54,795 (subject to dividend) to be carried to the next account—due allowance having been made for the balance in hand after paying the dividend for the second half of the year 1894.

The general balance-sheet shows that the capital of the Company consists of 113,633 shares, £6 each paid up, or £681,798, with a reserve fund of £110,450. There are sundry creditors, temporary loans, debentures, &c., amounting to £348,000; suspense accounts, £121,415; consumers' deposits, £9098; and reserves for replacement of meters and cookers, £9735. On the assets side of the account, the Company's fixed investment—land, buildings and machinery at the various stations, mains and service pipes laid, implements, and furniture—represents an amount of £1,054,873; and the stores investment—coals, residual products, apparatus in store, meters, lamps, and pillars—a sum of £169,567.

The Directors in their report, submitted at the annual general meeting on July 29, recommended the payment of a dividend of 9s. per share—absorbing £51,135—and carrying forward £3660. It is mentioned that, consequent on the retirement of Mr. W. Johnston, the Directors have appointed Mr. R. J. Lukey (late of Falmouth) Secretary of the Company; and it is also noted that the Engineer, Mr. Thomas J. Bush, "reports that the whole of the Company's plant is in good working order." The Directors decided to reduce the price of gas, as from Aug. 1, by 3d. per 1000 cubic feet (making it 4s. 6d.), and the public lamps 2s. 6d. and 10s. per lamp per annum for the ordinary and eighty-candle power lights respectively. It was further mentioned that "the day consumption of gas is gradually increasing; and it is expected that the reduced price will further encourage this, as well as induce a greater demand for general lighting purposes."

TOTTENHAM AND EDMONTON GAS COMPANY.

The Ordinary General Meeting of this Company was held last Saturday week, at the Offices, Willoughby Lane, Tottenham—Mr. George Gripper in the chair.

The Secretary (Mr. James Randall) read the notice convening the meeting; and the Directors' report and the accounts, which were summarized in the Journal for the 27th ult., were then submitted.

The Chairman remarked that the Directors regarded the report as an eminently satisfactory one; and, considering all the difficulties that they had had to encounter during the last six months, he thought the outcome exceedingly gratifying. They had sold 16,755,300 cubic feet more gas than in the corresponding half of 1894, which represented an increase of 10·57 per cent. on the output. The number of consumers by ordinary meters continued to advance, and by automatic meters the increase was immense—in fact, they could not obtain these meters quickly enough. They had now 1825 prepayment meters in use by a class of consumers who would otherwise burn oil. The Company were in a good position with regard to coal, having made contracts to last two years on very favourable terms. The Directors now felt themselves in a position to safely announce their intention of reducing the price of gas by 1d. per 1000 cubic feet; bringing the charge down to 3s. The policy of the Company was to supply the public with gas at as low a price as possible; and they had accomplished much in this direction. When other companies round them raised their charges, they managed to keep to their price; and as coal had gone down, they had been able to reduce the price from 3s. 4d. to 3s. per 1000 cubic feet, which was a very gratifying fact. Unfortunately, residuals had, during the half year, been almost disastrous in regard to the price. Sulphate of ammonia had dropped to so low a figure that it had affected them to a considerable extent. As the proprietors were aware, £20,000 of "C" stock had been sold; and this had enabled the Directors to pay for the new carburetting apparatus. The stock had realized a premium of £76 10s. 9d. per cent., after paying the expenses of the sale. He concluded by moving the adoption of the report and accounts.

Mr. Corbet Woodall, in seconding the motion, said he did not think the present accounts called for very much special observation. They were thoroughly satisfactory; but there was nothing peculiarly striking in any of the items. Perhaps the most conspicuous feature was the falling off in the residuals. This was largely accounted for by the fact that they now made gas from the residuals as well as from coal. A considerable amount of coke had been used in the manufacture of carburetted water gas; and consequently they had a smaller quantity for sale. The introduction of this water-gas system had been eminently satisfactory. The results during the first complete half year had been such as to thoroughly satisfy the Directors and their Engineer (Mr. W. H. H. Broadberry); and they looked for still more advantage from it in time to come. One matter worthy of observation, which had been noticed by the Chairman, was that the Directors had determined upon a further reduction in the price of gas from Michaelmas next. He thought the consumers in the district would appreciate the fact that, while for the past half year, after paying the dividends and interest, there was a balance of only £183, the Directors had decided upon a reduction in the price which represented, in a half year, about £750. They were therefore giving evidence of their confidence in the future by making a reduction which the accounts before them did not appear to justify; but, with an increase of 10·57 per cent. in the consumption, the Directors might very well feel some courage in discounting the future. There was another matter which was worthy of notice—that was, that gas appeared to be obtaining an entrance into a new sphere (one might almost say a double sphere) at both ends of the social scale. By the introduction of the incandescent gas-burner—making it possible for those who had hitherto regarded gas as a hot and perhaps insanitary means of lighting—a beautiful effect was produced by the use of a comparatively small quantity of gas; and this made gas a very formidable rival to the petroleum lamps and candles which had been used in the better class houses up to the present time. At the other end of the scale, prepayment meters had brought gas within the reach of working men, to whom the quarterly account for gas had been absolutely prohibitive. Of course, the system involved a considerable amount of capital outlay, because the Company had not only to provide a meter, but had to fit up the houses. The success attending the prepayment system had been remarkable, and accounted for a large proportion of the extraordinary increase the Directors had to report this half year.

Mr. H. Moore said it seemed to him the Company were making extraordinary advance in obtaining new consumers. That they had fixed in eighteen months about 1800 prepayment gas-meters showed that one of the two "ends" referred to by Mr. Woodall was now burning gas to a large extent. A few weeks ago, he was making a survey in St. Luke's district; and he found there that The Gaslight and Coke Company, in addition to the meter and fittings, were giving a cooking-stove, which they fixed on a piece of artificial stone. They did not even ask the landlord to sign a paper. He might say that he had had to sign twenty or thirty papers, because the Directors of this Company said the fittings were liable to be distrained upon; and they wanted evidence that the landlord would not take a mean advantage, and raise a little money upon them. This, in his opinion, was not sensible, because fittings were worth very little, and the Act relating to the law of distress was an absurd one. He was sure there was no occasion to bother him or any other landlord to sign these papers. He suggested that the Company should also fix a stove in connection with the prepayment system.

The Chairman stated that they included a boiling-ring.

Mr. Broadberry remarked that cooking-stoves were put in with prepayment meters under certain conditions.

Sir H. Cartwright moved the declaration of dividends at the rate of 11½ per cent. per annum on the "A" stock and 8½ per cent. on the "B" and "C" stocks. He observed that no doubt, if a different policy had been pursued, they might have made a small addition to the dividend. But they were anxious to maintain the works in proper order; and, as would be seen from the present accounts, they had spent £1917 from the income of the half year for repairs and maintenance of works and plant. Under another course of policy, a large part of this would have been added to the dividends.

Mr. J. Warren seconded the motion, which was passed.

The Chairman proposed, and Mr. Magnus Ohren seconded, the re-election as a Director of Mr. H. Bailey. This was agreed to, as was also a resolution, moved by Sir H. Cartwright, and seconded by Mr. Moore, that the Chairman be re-elected.

The retiring Auditor (Mr. A. H. Baynes) was re-appointed on the motion of Mr. Magnus Ohren, seconded by Mr. W. B. Randall.

The usual votes of thanks were passed, and were acknowledged by the Chairman, the Secretary, and the Engineer.

Mr. Broadberry, in the course of his remarks, said he should like to make some reference to the statement by Mr. Moore that landlords would not be so petty as to distrain upon gas-stoves. This step had been taken in the case of one of the Company's stoves, and they had served a notice to the effect that an illegal distraint had been made. Then with regard to the pipes the Company put into houses, if they were fixed without the authority of the landlord, they could not remove them without his consent. They therefore thought it was better to obtain the consent of the landlord before fixing the pipes than have to get it afterwards. Then with respect to cooking-stoves, they always placed them on fire-tiles to protect wooden floors. The Company had supplied cookers with automatic meters for some time, under this arrangement: They spent a sum of rather more than £5 upon each house; and this included the meter, service-pipe, and fittings. But some people who required prepayment meters already had fittings in their houses; and it was thought that, as they did not require fittings, they ought to have some equivalent, and so they were allowed the use of a cooker. The Company had not gone so far as to supply both a cooker and fittings; but with the latter, they gave a boiling-ring. It was questionable whether it would be possible to include a cooker. He thought they were spending as much money on each house as they were justified in doing for the quantity of gas they were giving for a penny. He believed The Gaslight and Coke Company were supplying, in conjunction with the prepayment system, a cooker of the net value of £2 12s.; but he had not yet felt justified in recommending his Directors to go to that extent.

This concluded the proceedings.

HARROW AND STANMORE GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday last week, at the Albion Tavern, Aldersgate Street, E.C.—Mr. JAMES GLAISHER, F.R.S., in the chair.

The SECRETARY and ENGINEER (Mr. James L. Chapman, Assoc. M.Inst.C.E.) read the notice calling the meeting; and the Directors' report and accounts, to which allusion was made in the JOURNAL for the 27th ult., were presented.

The CHAIRMAN said the first paragraph in the Directors' report stated that "in pursuance of the powers of the Harrow and Stanmore Gas Act of 1894, since the 25th of March last, the Harrow District Gas Company and the Great Stanmore Gas Company have become one undertaking, under the title of the Harrow and Stanmore Gas Company." From this paragraph, it would be seen that up to March 25, they were separate Companies. The gas supply to Stanmore had been under an arrangement with the Lessee of that Company; but now they formed one undertaking. This rendered it rather difficult for him to make an analysis of the accounts; for they were in a state of transition. Therefore he could not give in the ordinary way a comparison of the expenditure. Turning to the receipts, comparing the Lady-day quarter with the corresponding period of 1894, the private gas-rental was £179 greater; but the public rental and under contracts was £452 more. But included under the latter heading was the money paid by the Lessee of the Stanmore Company in accordance with the arrangement to which he (the Chairman) had referred. The private rental in the Midsummer quarter was £297 in excess of the corresponding period of last year; and the public rental was £89 more. Coming to the residuals, they did very well by coke; but, in common with other gas companies, their failing point was sulphate of ammonia. The total receipts for the half year were £6209, as against £5056, which was an increase of £1153. This included the income from Stanmore, and the additional consumption of gas through the cold weather. On the other side of the revenue account, coal cost an additional £615; but this was for the most part due to the fact that they were paying for coal for Stanmore, as well as for Harrow. With regard to the other items, they included expenses which they had not had before, and which they would not have again. Expenses were incurred in applying for the luxury of an Act of Parliament; and they touched a small company very severely. The result was that the profit on the half-year's business was £1885, which was only £72 more than that of the corresponding half of last year. Feeling that this did not show the progress that was usually reported, and wanting to see what progress they had really made in Harrow lately, he had taken out the figures relating to the gas supplied in Lady-day quarter in the preceding five years. He found that in 1889, when gas was 4s. 9d., they supplied for private lighting at Harrow, within the inner circle, 7,250,000 cubic feet of gas; while in the same year in the outer circle, with gas at 5s., they supplied 1,039 000 cubic feet. In 1894, when gas was 4s. 6d. in the inner circle, the consumption was 8,739,000 cubic feet—being an increase of 1,489,000 in the five years; and in the outer circle, the increase was 455,000 cubic feet. Then in the Midsummer quarter, in the inner circle, they supplied in 1889, 3,525,000 cubic feet; and in 1894, 4,316,000 feet—being an increase of 791,000 feet. In the outer circle, in the Midsummer quarter, they supplied in 1889 573,000 cubic feet, and in 1894, 785,000 feet—being an increase of 212,000 feet. Adding the figures together, he found that in five years they had secured an increase of 2,947,000 cubic feet; but this did not include the public lighting which, compared in the same way, showed an increase of 330,000 cubic feet. He might remark upon this that both the inner and outer divisions had shown an almost proportionate increase; and that, although he had been complaining of the slow increase, there had been in the five years a total increase of 3,277,000 cubic feet. The gas made in the June half of 1889 was 12 million cubic feet; showing that the output was, at the time of the amalgamation, doubling in 20 years, which was satisfactory. Comparing the past half year with the June half of 1894, he found there had been an increase of 2,076,000 cubic feet, which was largely due to the great severity of the weather during January and February. It was gratifying to know that they had very few breakages of pipes during that period, and not a great loss of gas. The gas made in the half year was 26,119,000 cubic feet. Of this 6,369,000 feet had been disposed of under public lights and contracts. In the June half of 1894, the consumption under this head was only 1,826,000 cubic feet; but in the 6,369,000 feet was included the gas which had been supplied to Stanmore under contract—4,055,000 feet out of the 6,369,000 feet being due to Stanmore. The consumption for private lighting was 18,484,000 cubic feet, of which he calculated that 17,022,000 feet were consumed in Harrow and 1,462,000 feet in Stanmore. These figures worked out to this, that Harrow consumed in the six months for public and private purposes 19,336,000 cubic feet, and Stanmore 5,517,000 feet, which meant that, at the time of the amalgamation, Harrow was using about three-and-a-half times as much as Stanmore. They consumed on the works 240,000 cubic feet, which gave them a total of 25,093,000 feet accounted for out of the 26,119,000 feet manufactured, which left 1,026,000 feet unaccounted for. This was less than 4 per cent. on the make; so that they received money for 96 per cent., less that used on the works. It had always been "against the grain" with him to make gas and then lose it; and he could give great credit to their Engineer for having looked so well after the leakage. The coal carbonized amounted to 2559 tons, from which they produced an average of 10,207 cubic feet of gas per ton; and they obtained payment for 9800 feet, which was exceedingly satisfactory. There was one other matter to refer to. After the Board had looked over the expenses connected with their new Act, seeing they were already heavily capitalized before, they resolved to put £1500 to suspense account, in the hope that the future business would be such that they would be able to pay off out of the revenue this £1500. He thought it would be far better to do this than to put it down to capital. In conclusion, he moved the adoption of the report and accounts.

Mr. C. HORSLEY seconded the motion, which was unanimously carried.

The CHAIRMAN proposed the declaration of dividends at the rate of 7½ per cent. per annum on the original "A" capital, of 7 per cent. on the additional "B" capital, and 5¼ per cent. on the additional "C" capital, and for the three months ending June 30 at the rate of 6 per cent. on the guaranteed shares—the dividend for the first three months having already been paid by the Great Stanmore Company.

Mr. HORSLEY seconded the proposition, which was carried.

The CHAIRMAN moved a vote of thanks to the Secretary and Engineer, remarking upon the unusually arduous nature of the duties he had had to undertake during the half year. In addition to the difficulties caused by the severe weather, he had had six miles of pipe to lay from Stanmore to Harrow; and this he had successfully accomplished, without any appreciable loss of gas. They had now 22 incandescent lights fixed in the streets; but they had as yet very few applications for prepayment meters.

Mr. MAGNUS OHREN seconded the motion, which was agreed to.

On the motion of Mr. A. F. PHILLIPS, seconded by Mr. OHREN, the services of the Directors were also suitably acknowledged.

OTTOMAN GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Tuesday at the London Offices, 9, Queen Street Place, E.C.—Mr. A. J. DOVE in the chair.

The SECRETARY (Mr. T. Guyatt) read the notice convening the meeting; and the report and accounts, the main features of which were given in the JOURNAL for the 27th ult., were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, remarked that they were very much on all-fours with those for the corresponding period of last year. Some of the items were very favourable—for instance, although they had used an additional 158 tons of coal, it had cost them less by £72. The gas-rental had increased by £309.

Mr. CHARLES GANDON seconded the motion, which was unanimously carried.

The CHAIRMAN proposed a resolution adding £1000 to the reserve fund (making it £8000), and declaring a dividend at the rate of 7 per cent. per annum on both classes of shares.

Mr. GANDON seconded the proposition, which was agreed to.

The CHAIRMAN moved a vote of thanks to the Consulting Engineer (Mr. H. W. Andrews), the Engineer and Manager (Mr. John Gandon), the Secretary, and the staff at Smyrna.

Colonel J. LE GEYT DANIELL, in seconding the motion, mentioned that on this occasion they had with them their Engineer and Manager; and he must say, although in his presence, that he was much impressed by the result of the work that passed through Mr. Gandon's hands.

Each gentleman acknowledged the vote—Mr. GANDON remarking that all the staff in Smyrna did their best; and he thought the accounts showed that their endeavours bore good results.

On the motion of Mr. MAGNUS OHREN, seconded by Mr. R. L. ANDREWS, the Chairman and Directors were also thanked for their services.

PROVINCIAL GAS AND WATER COMPANIES.

Gas Companies.

The Directors of the British Gaslight Company recommend a dividend at the rate of 10 per cent. per annum, for the half year ending June 30 last, with a bonus of 2s. 6d. per share.

The East Ardsley Gas Company had a falling off of 500,000 cubic feet in their consumption during the six months ending June 30—from 7,000,000 to 6,500,000 cubic feet. This was due to the Great Northern Railway Company not consuming so much gas, and to the effects of the severe frost of last winter, which greatly affected the mains. The amount received for gas was £824, which was £74 less than in the June half of 1894. The profit was £318, which made the disposable balance £446, from which a dividend at the rate of 5 per cent. per annum has been declared.

The half-yearly meeting of the Lewes Gas Company was held on Wednesday last, under the chairmanship of Mr. James Broad. The accounts which were presented showed a profit for the six months of £1550. After providing for interest on mortgages, &c., the balance of net revenue was £1779. The Directors recommended that a dividend for the half year be declared at the rate of 5 per cent., which would amount to £1299. The Directors announced with much regret the death of their colleague, Mr. George Lenny; and stated that they had appointed Alderman E. Hillman to fill the position. The Chairman, in moving the adoption of the report, said, as a consequence of the vacancy caused by the death of Mr. Lenny, they thought it was only due to their worthy Secretary, who had occupied that post for 35 years, to offer him a seat on the Board; and in doing so they considered that he would make a most valuable Director. Alderman Hillman had accepted the offer. This appointment caused a vacancy in the post of Secretary, Collector, and Solicitor; and the Directors considered they could not do better than elect Mr. H. J. Hillman, who they hoped would prove as valuable a servant as his father had been. The balance-sheet and report were highly satisfactory. The production of gas was very gratifying, as notwithstanding an increase of less than 7 tons of coal, they had produced nearly 2 million cubic feet more gas in the six months than in the corresponding period of 1894. They had had an additional 259½ chaldrons of coke for sale, and disposed of 2480 gallons more tar, and an extra 51 cwt. of sulphate of ammonia. The increased amount of gas which had been sold amounted to a little more than 5½ per cent., which was exceedingly good, as when they incurred a very heavy expenditure on gasholders, Mr. Paddon told them they would want to increase their make of gas 5 per cent., adding that, if they did so, they would go on well. He was glad to say it had increased by 5½ per cent.; while they had paid only about £10 more for coals. In return, they had received an increase of £242 for

gas, £64 for coke, and £55 for tar. There had been a decrease of £45 in the amount received for sulphate of ammonia; but this was more than made up by the larger stock, which represented £51. The motion was passed; and, among the other business transacted, the Directors were authorized to raise a sum of £5000 of the additional 7 per cent. capital for general purposes. Before the meeting terminated, the shareholders heartily thanked their Manager (Mr. Levi Monk); the Chairman remarking that the Directors were delighted with the way in which he discharged his duties.

The Chairman of the Richmond Gas Company (Mr. T. J. Carless) was able to congratulate the shareholders, at their recent meeting, upon the result of the half-year's work, which had been very successful. There was a considerable increase in the consumption of gas, in spite of the competition of the electric light. He was glad to say favourable contracts had been entered into for the supply of coal; and the Directors were enabled to reduce the price of gas 2d. per 1000 cubic feet, which made the charge 2s. 10d., comparing favourably with their neighbours, whose price was 2s. 11d. The Richmond Company had to supply gas of an illuminating power of 15 candles; while their neighbours had only to furnish gas of 14-candle power. They had now several hundred penny-in-the-slot meters in use; and more of them were on the point of being fixed. Turning to financial matters, he said that, on the expenditure side of the revenue account, there was an increase in the consumption of coal, amounting to 900 tons, at a cost of £478. There was a decrease of £570 in the repairs and maintenance account, due to the fact that some heavy charges fell under this head in the corresponding half of 1894. There was also a considerable decrease in the cost of distribution of gas, owing to the extensive renewals of mains undertaken the former half year. On the other side of the account, was shown an increase of 10 per cent. in the consumption of gas, which he believed was the largest the Company had ever known. This was due to the cold weather in the early part of the year; and the receipts were thus increased by £1000. The stove-rents were increasing by leaps and bounds; and from this source alone, they received nearly £400. The price of the residual products had been low; and the amount remained about the same. The profit and loss account showed a balance of net profit £9106, of which, when the half-year's dividends (£3980) had been paid, a balance of £5126 would be carried to the next account; and this very satisfactory statement justified them in reducing the price of gas. The report was adopted; and dividends were declared of 5 per cent. on the "A" and "B" stocks, and 3½ per cent. on the "C" stock. The shareholders testified to their appreciation of the work of the Directors by increasing their fees to £250. The usual votes of thanks were passed to the Chairman and his colleagues, and to the Engineer and Secretary (Mr. T. May).

The half-yearly meeting of the Rugby Gas Company was held on the 30th ult. The Directors' report showed the receipts for the half year ended June 30 to have been £6595; and the expenditure, £3934—leaving a balance of £2661 to be carried to the profit and loss account. A dividend at the rate of 11½ per cent. per annum, free of income-tax, was declared. This will absorb £1719.

The annual report and accounts of the Sunderland Gas Company (which were noticed last week) were presented to the shareholders at their meeting on Thursday. The Chairman (Mr. James Stokoe), in moving the adoption of the report, referred to the new retort-house that was being erected, and said it could produce 2 million cubic feet of gas in 24 hours; this being an increase of 66 per cent. The new gas-holder would contain 1½ million cubic feet, giving an increased storage capacity of 75 per cent. He added that since the last holder was erected in 1885, the make of gas had increased 285 millions, or a rise of 61 per cent. during the ten years. The revenue from gas and residuals had risen from £54,000 to £84,000—an advance of £30,000, or a percentage of 55. Some 42 years ago, there were two Gas Companies in the town. It would, however, be unfair to give contrasts with figures relating to that period; but he would deal with the time when they became amalgamated. The revenue in 1855 was £16,000; whereas in 1895 it was £84,000—a difference, therefore, of £68,000, or 425 per cent. The report was adopted; and dividends were declared of 5 per cent. on the original stock and 4½ per cent. on the additional stock for the half year ending June 30.

Water Companies.

The Brymbo Water Company report that the total number of houses now supplied by them is 3206—an addition of 67 having been made during the past year. The balance on the net revenue account is £1435, deducting from which the interim dividend and the interest on debentures leaves only £292. In order to pay a dividend at the rate of 4 per cent. for the second half of the year (making 4½ per cent. for the year), the Directors have withdrawn £150 from the reserve fund, and have carried over to next year's accounts £253 of the exceptional expense caused by the frost. The cost incurred by the Company in obtaining their new Act was £665—a sum considerably higher than it would have been but for opposition by Sir W. Grenville-Williams.

The annual accounts of the Drogheda Water Company show a net balance of £804 available for dividend, out of which a dividend of 3½ per cent. has been declared. There was an increase in the water-rental of close upon £100.

The report submitted at the ordinary meeting of the South Essex Water Company last Saturday week showed a profit of £5637 for the half year. Dividends of 5 per cent. on the preference stock, £4 15s. on the ordinary 1891 stock, and £3 6s. 6d. on the 1882 stock were recommended. The Chairman (Mr. Cracroft Fooks), in moving the adoption of the report, said 207 new services had been added during the half year, yielding an increase in the revenue of £326 per annum. A 12-inch main, connecting the low-service main with Ilford, had been laid, and was now in use. Additional pumping machinery had been erected at Romford; and the Directors were making arrangements to construct the second section of the Hog Hill reservoir during 1896. Mr. J. C. Amos seconded the motion, which was agreed to.

A New Reservoir for Redcar. The Redcar District Council last week accepted a tender, submitted by Mr Atkinson, of Stockton, for the construction of a new reservoir for the sum of £1405.

THE LIVERPOOL CORPORATION AND THEIR ELECTRIC LIGHTING PURCHASE.

A "Consequential" Provisional Order to be Applied for.

A Special Meeting of the Liverpool City Council was held last Wednesday—the Lord Mayor presiding—for the purpose of considering a resolution asking "the authority and approval of the Council for the intention to make application to the Board of Trade for the purposes of the Electric Lighting Acts, 1882 and 1888, for a Provisional Order to supply electricity for public and private purposes, under the provisions of the said Acts, within the area of the City of Liverpool, as the same may exist at the time of granting the said Order."

Alderman Smith, the Chairman of the Special Lighting Committee, in moving the resolution, said he thought it very undesirable that the Corporation should allow any portion of the extended city area to be dealt with by another company who might desire to come in and supply electric light to the new districts. This resolution was merely intended to give the Corporation power to apply for a Provisional Order, which would enable them to supply electricity throughout the whole of the city, and not allow any other company to interfere with them.

Mr. Brownbill seconded the motion.

Sir Arthur B. Forwood said that at a recent meeting of the Council it was stated that a special meeting would be required to give effect to the proposed purchase of the Electric Company's undertaking.

The Town Clerk said the Provisional Order referred to in the resolution just moved in no way related to the purchase of the Electric Light Supply Company's undertaking. That would have to be dealt with in a separate Bill.

Sir A. B. Forwood: Then the proposal is to advertise that we are going for a Provisional Order which will enable the Corporation to become purveyors of electric lighting independently, and that we do not commit ourselves to the purchase of the Electric Supply Company's undertaking? If that is so, I have nothing whatever to add.

The Town Clerk: The purchase of the Electric Supply Company's undertaking has been already arranged, and has received the sanction of the Council. The Bill to confirm the purchase was before Parliament; but it had not time to pass.

Sir A. B. Forwood said he understood that Parliament required that a majority of two-thirds of the members present should vote for the motion to apply for a Provisional Order.

The Town Clerk said the procedure in this instance did not require any stated majority of the Council to vote for an application for a Provisional Order.

Alderman Smith: As I understand it, what Sir Arthur Forwood wants is to discuss the purchase of the Electric Supply Company's undertaking.

Sir A. B. Forwood: Quite so.

Alderman Smith: Then I do not think there is any disposition on the part of any member of the Council to impede a discussion of the matter. I have not seen the Bill brought in by the Company; and I think we might have copies of it before us.

Sir A. B. Forwood: I can see that this matter is surrounded with great difficulties. The Council will find itself committed to the purchase without an opportunity of discussing the same. We are escaping the precautions which Parliament gives to the general public; and we, by a bare majority, consent to this Company promoting a Bill. If that is so, then we are being done.

Alderman Smith objected to the assertion that the Council was "being done." There was no earthly reason why the Council should not discuss the matter; and the more it was discussed, the better would it be for the city.

Sir A. B. Forwood said he was afraid the Council had drifted into a position by which they were precluded from discussing the matter before purchasing the works. If the limit of the present proposal was to advertise that a Provisional Order be applied for, he would say no more; but he would endeavour to find an opportunity of bringing the question forward at some future time.

Mr. Petrie, as a member of the Lighting Committee, said he wished to inform Sir Arthur Forwood that the Council had passed a resolution authorizing the purchase of the Electric Supply Company's undertaking. The Committee made the best bargain they could with the Company. It transpired at the last moment that Lord Morley objected to the Company handing over their works without a special Bill being promoted; and such a Bill was promoted by the Company. The Provisional Order now in question was for the purpose of enabling the Council to extend their lighting powers to the districts about to be included in Greater Liverpool. They had heard that very recently application had been made to the local authorities of West Derby and the other districts by a Syndicate in the South of London, who wanted to acquire these areas for the purpose of supplying electric light. The Committee thought that the Syndicate ought not to be allowed to come in and establish new works. He (Mr. Petrie) felt convinced that if Sir A. B. Forwood understood the position of affairs, he would not oppose this motion.

Sir A. B. Forwood read the portion of the report concerning the procedure to be adopted, and said that it would have been better if the Council had been fully informed that, by taking the course they had taken, they were losing the safeguards as to the statutory majorities laid down by Parliament.

The Town Clerk said it was impossible for the Corporation to have introduced a Bill to carry out the agreement with the Company. As a matter of procedure, they found it necessary for the Company to promote a Bill; and whether a Bill was promoted or a Provisional Order was obtained, the Council were in exactly the same position—no majority being required in either case.

Mr. Taylor said that the Committee had practically unlimited powers; and there could be no suspicion of the Committee having resorted to any tactics in order to evade examination. If the transaction with the Company was not through by the 31st of December, it was open to either party to be "off;" and the Council should understand that they were applying to the Board of Trade for a Provisional

Order which was consequential upon the purchase by the Corporation of the Electric Supply Company.

Sir A. B. Forwood: In which way consequential?

Mr. Taylor: I say morally consequential. Proceeding, he said the Corporation had made a bargain with the Company for the purchase of their undertaking, by virtue of which the Corporation could supply electric light over the city, including the area now supplied by the Company. But it would be a breach of faith if application was made to the Board of Trade after the bargain had not been carried out.

Alderman Smith opposed this view. Whether the bargain was carried out or not, he hoped the Council would make an application, at any rate, for the area outside the area of the Company. His personal view was that they ought to have gone into competition with the Electric Company.

The motion was then passed; and the ordinary business of the Council was proceeded with.

ELECTRIC LIGHTING NOTES.

The Exeter City and County Council recently considered, at a meeting specially convened for the purpose, the advisability of negotiating with the Exeter Electric Light Company for the acquisition of their undertaking. The Mayor (Alderman Perkins) presided. The Town Clerk (Mr. G. R. Shorts) said he had received a letter from the Solicitors to the Electric Light Company, who stated that they understood a meeting of the Council was to be called to consider this question. It was no doubt known that the Company had had an offer of £7000 for their undertaking from a large London firm, and there was a Syndicate of local gentlemen who would be prepared to give upwards of £8000 for it. The critical condition of the Company rendered it necessary that an immediate decision should be come to; and if the Council were willing to purchase for £10,000, the Directors would recommend the proprietors to accept this amount. A memorial, signed by all the principal tradesmen in High Street, Fore Street, and Queen Street, had also been received in favour of the acquisition of the works by the Council. The Deputy-Mayor (Dr. E. J. Domville), who had called the meeting in response to a requisition he had received, remarked that the step he had taken did not pledge the authority to take any action in the matter; it simply gave them an opportunity of considering the question, and hearing what their legal position was. Under the Provisional Order, if the Company became insolvent, the Board of Trade could transfer the powers granted; and certain conditions were laid down under which the undertaking could be purchased. The matters involved required careful consideration. The less one said about the management of the Company, the better. It was evident that misfortune had dogged its footsteps from the beginning; and the expenditure of a capital of £23,000 had not resulted in any profit to the shareholders. A large portion of this capital was now worthless to a purchaser; and what they had to think of was the present value of the undertaking, the possibility of the Company carrying out their obligations, and the further demands that would be likely to be made on any purchaser in extending the works. They had also to consider whether it would be wise for them to wait the 17, 18, or 19 years that must expire before they could acquire the works under the Provisional Order, or whether they should seize the opportunity which now offered itself of purchasing them. He thought it would be best to refer the whole subject to a Special Committee, and he moved that this should be done. Mr. Ward seconded the motion, which, after some discussion, was withdrawn. Mr. W. Wreford then moved a resolution declaring it to be expedient that the control and supply of the electric light in the city should be in the hands of the Council. By doing this they would, he said, only be reaffirming what they did three or four years ago, when they promoted a Provisional Order in opposition to one applied for by the Company. Mr. E. C. Penny seconded the motion. He said he had always held that such an important element of civilization as light should be in the hands of the municipality. He thought the city made a great mistake in not purchasing the gas-works when they had the opportunity some years ago; and if they let the present chance slip, they would be making another mistake. Mr. Force said three-fourths of the Council were in favour of the purchase of the gas-works on the occasion referred to; but their resolution was overruled by the ratepayers. Might not the same thing occur again now? He should like to see the feeling of the ratepayers expressed before they considered the matter thoroughly. The Town Clerk said in this case it would not be necessary to take a poll of the ratepayers. The motion was carried—29 voting for, and none against it. Mr. Wreford then proposed that it was desirable to enter into negotiations with the Electric Light Company, with a view to acquiring their undertaking. The Company had, he said, come to the conclusion to transfer their shares and debentures to a London firm for £7000; and they had no reason assigned yet why the Council should go further and offer £10,000. But this was a matter of detail which could be threshed out in Committee. Was this a favourable opportunity for purchasing? Under the Provisional Order, they could at the end of 26 years take over the works by paying the value of the plant and an equivalent to the previous five years' profits; and only at the end of 42 years could they acquire the property without paying anything for profits. They had now a chance of getting the undertaking on much better terms; and he believed they could effect the purchase without inflicting any pecuniary burden on the ratepayers. The motion was carried; and the further consideration of the matter was referred to the Council in Committee, with power to appoint a Special Committee to decide points of detail.

A Local Government Board Inquiry was recently held at Oldham, by Mr. W. J. B. Clerke, M.Inst.C.E., one of their Inspectors, in regard to an application by the Oldham Corporation for power to borrow £15,000 for electric lighting purposes. The Town Clerk (Mr. A. Nicholson) explained that in 1890 the Corporation obtained a Provisional Order authorizing them to supply electricity within the municipal borough. In due course, a scheme was prepared by Professor Kennedy, and application was made for power to borrow £40,000 to enable the Corporation to carry it out. The scheme was approved of—borrowing powers to the extent of £27,000 being sanctioned. Plant was provided sufficient to supply simultaneous lighting for about 2500 glow lamps of 8-candle power each, which is equivalent to 5000 incandescent lamps of similar power. The works were completed, and commenced to supply electricity on March 15, 1894. There were then only seven consumers, who took energy to supply 979 lamps of 8-candle power. The increase in the consumption of electricity developed so quickly, that in January, 1895, the whole capacity of the plant provided had been brought into use. The Corporation therefore consulted Professor Kennedy on the matter; and he advised them as to the proposed extensions. Hence the application for further borrowing powers. The position of the Corporation on March 25, 1895, the end of the first year's working, was as follows: They had then expended on the erection, fitting up, and completion of the station, mains, and services, meters, &c., in round figures, £25,000. The gross revenue for the year amounted to £1916; and the gross expenditure, to £1272—leaving a balance of £644. The interest on loans and the payments to the sinking fund came to £796—leaving a deficiency of only £152. This result was attained notwithstanding that the Corporation had charged at the rate of 6d. per unit only, whereas in most towns the charge had been 7d. or 8d. On the 25th of March last, the number of consumers was 55; and the number of units sold 68,998. On the same date, 99 arc and 1946 incandescent lamps were being supplied—together equivalent to 6940 incandescent lights of 8-candle power. During the five months intervening between the 25th of March and the 24th of August, the expenditure on capital account had increased to (in round figures) £26,400; thus practically exhausting the £27,000 borrowing powers. The number of consumers rose from 55 to 85—an increase of 30, or 64·7 per cent., in the last five months. The number of lights equivalent to 8-candle power went up from 6940 to 9334—an increase of 2394, or 34·5 per cent. Now there were places being wired and fitted up for lighting, and would shortly be complete, which would require 1200 more lights of 8-candle power. The Engineer had told him that the station had its full load on; and if the general consumption went on as it had done from day to day, these 1200 lamps could not be supplied until further plant was obtained. The proposed extensions would, according to the Engineer's estimate, cost (in round figures) £11,000. The contemplated expenditure would increase the power to supply electric energy 136·3 per cent., at a cost equivalent to 48·1 per cent. on the outlay up to date. This reduced cost was accounted for by the fact that the conduits laid in the streets were made specially to allow of their being used for the three-wire system when necessary, without having to expend additional moneys on street works, and the electric station having been constructed with the view of placing additional plant therein. Mr. H. Burstall, the Chief Engineer to Professor Kennedy, was then called, and answered a few inquiries relative to details of the scheme. He stated that on March 25 last there were 4576 yards of electric mains. The Inspector asked how they found the electric light affected the gas-works. The Town Clerk replied that at the present time it had practically made no difference. The increase in the consumption of gas during the past year had been at an equal ratio to previous years. The Inspector asked if there was any depreciation in the value of the gas undertaking. The Town Clerk said not at all. No opposition was offered to the application; and at the close of the inquiry the Inspector visited the station.

The Salford Town Council having applied to the Local Government Board for sanction to borrow £18,000 for electric lighting purposes, an inquiry into the matter was held on the 30th ult., at the Town Hall, by Mr. W. J. B. Clerke, M.Inst.C.E. There was no opposition to the application. The Town Clerk (Mr. S. Brown) explained that there had already been an inquiry into an application to borrow £50,000 for electric lighting purposes; but on that occasion sanction was granted for the raising of £32,000 only, in respect of which estimates were submitted. The £18,000 now applied for was the balance of the £50,000. It was proposed to spend something approaching half of the sum asked for in accordance with estimates submitted; and the Council hoped it would not be necessary for another inquiry to be held with regard to the balance. The Inspector remarked that, though he could not pledge the Local Government Board to anything, he saw no reason why another inquiry should be held for the remainder. Of course, at present, sanction could not be expected for a greater amount than that for which definite proposals were submitted. Mr. E. Manville, the Electric Lighting Engineer of the Corporation, said the works already carried out were in accordance with the plans originally submitted. In regard to the present application, they could simply show an estimate of expenditure amounting to £7770. With the exception of £1500 to be laid out on premises, this sum was entirely for extension of mains and to provide the necessary apparatus for the utilization of the current passing through the mains. The extensions were outside the compulsory area. This was all the evidence submitted.

The Cheltenham Town Council had before them yesterday week proposals, submitted by the Lighting Committee, for lighting the principal parts of the town by electricity, for which some 50 arc lamps would be required to replace 59 one-light, 4 three-light, and 60 four-light gas-lamps. An alternating current system, with a separate and independent transformer for each lamp, was recommended, the capital cost of which was estimated at £3100; and with 30 all-night arcs and 30 switched off at midnight the total annual cost would be £957, against £550 for gas. The adoption of the recommendation having been moved by Alderman Norman, Mr. Margrett proposed an amendment, with a view to extending the lighting beyond that recommended by the Committee; and this was carried with the original motion.

The main topic of debate at the meeting of the Blackpool Town Council last Tuesday was the proposal to spend £30,000 in extending the electricity works. It was stated on behalf of the Committee in charge of the department, that the present capacity of the works is 590 kilowatts, and so great had been the demand for current that the plant was now working at 580 kilowatts, which meant that there was no reserve plant to fall back upon in case of breakdown. Statistics were produced to show that the department was being worked at a profit, and that the applications for current were already so numerous that additional plant, equal to 600 kilowatts, should be provided. Exception was taken both to the extension of the works and the appointment of

Mr. Robert Hammond as Consulting Electrical Engineer. It was contended that the works were not being conducted on a business-like method; and it was especially urged that a Consulting Engineer was not necessary, and that the extensions could be supervised by the Resident Engineer. Ultimately it was decided that no extension of the department should be permitted for twelve months, and that the services of Mr. Robert Hammond should be dispensed with.

It would seem that the St. Pancras Vestry are already repenting their ill-advised boycott of the London Hydraulic Power Company; for on Wednesday last Mr. M'Gregor gave notice that, at the next meeting, he would reopen the question. The reason appears to be that the landlords of the premises affected have asked the Vestry to sanction the laying of a service-pipe—not a main—only seven yards over the parish-boundary; and the Chairman of the Vestry announced that, at the next meeting, he would be prepared to rule how long a period must elapse, according to the new bye-laws, before a rescinding vote may be taken. Mr. M'Gregor said the leading members of the Electricity Committee had now changed their minds on this question; but Dr. Bell challenged the statement, which he thought ought not to be made public. While noticing this matter, it may be mentioned that, contrary to the terms of his appointment, the new Chief Electrical Engineer of the Vestry has taken up his residence—inadvertently, it is said—a short distance outside the parish; and the Chairman of the Vestry has ruled that this officer will not be entitled to any salary until he moves within the parish boundary. Some of the outspoken criticisms of the members must have sounded rather harsh to this recently-appointed gentleman; but it is to be hoped that his remuneration of £600 a year will tend to salve his feelings.

WIGAN CORPORATION WATER SUPPLY.

An Augmentation of Supply Needed—Proposed New Reservoir.

Ample evidence was supplied by Mr. Alderman Richards, at the monthly meeting of the Wigan County Borough Council last Wednesday, that, for safety, it is necessary that immediate steps be taken to provide for an additional supply of water. Recognizing this, the Water Committee, on the 29th ult., passed resolutions instructing the Borough Engineer to make a survey of land at Worthington, to prepare plans and estimates of the cost of constructing a new reservoir there, and to report as to the probable amount of water that could be impounded. They also directed that information be obtained from the Liverpool and Manchester Corporations respectively as to the price at which a daily supply of 500,000 gallons of water could be obtained. The confirmation of these resolutions was moved by Alderman Richards, who pointed out that the Council could safely adopt them, because they did not bind them to anything. All they had to do was to look round and see what was the best mode of obtaining an extra supply of water. The town continued increasing while the means of supply remained the same; and he was sorry to say that at the present time the reservoir was some 20 feet below the overflow mark. This must be more or less alarming to those who had the care and management of the water supply. He found on referring to the reports of Mr. Hunter, the late Surveyor to the Corporation, that, as far back as 20 years ago, the supply was regarded as needing augmentation, and if that was so then, what must be the need now, when the population was 20,000 more than it was in 1871? The reason the supply had continued sufficient was due to several causes, the first of which was that ten years ago the railway companies, who had been paying £1200 a year for water, ceased to take a supply from the town. This, of course, was a large loss of revenue; but it was a saving of 24 million gallons of water per annum, or equal to 24 days' supply. Then the fixing of water-meters had been the means of both increasing the revenue and preventing waste; while a more strict system of supervising fixtures had resulted in an additional saving. Further, the acquisition of the Whitley reservoir had been of great use to the town—in fact, he might say, during several summers, it had been their salvation. These various precautions had been the means of postponing the necessity for an additional supply up to the present time. But how much longer they would be able to go on, he could not possibly say; and it was the duty of the Water Committee to bestir themselves if they did not wish to be blamed in case of scarcity of water. Since 1875, the customers had increased by 5417; while the number of houses in the town had risen by no less than 2843. During the same period, the population had gone up by 19,000; and the total quantity of water consumed had advanced from 287 million gallons, or a daily consumption of 786,000 gallons, to 346 million gallons, or a daily consumption of 950,000 gallons. The storage capacity, with the exception of the little reservoir at Whitley, was, as already remarked, the same now as then; and he thought he had said sufficient to justify the action of the Committee, as set forth in the resolutions which appeared in the minutes. In answer to a question, Alderman Richards said the plan most favoured by the Committee at present was the erection of a new reservoir on the present gathering-ground, so as to impound an increased quantity of water. It was not intended to obtain water from either the Liverpool or Manchester Corporation unless it was absolutely necessary, because buying water in this way was very expensive indeed. Mr. Johnson mentioned that he had already made inquiries on the subject; and he was told emphatically that additional water could be impounded on the present gathering-ground. The minutes were confirmed.

The New Water Scheme for Shrewsbury.—The proposal to obtain a new supply of water by pumping from the Severn, at a cost of £48,000, is meeting with some opposition from the owners of property and the ratepayers of Shrewsbury, whose vote on the question has been solicited by the Water Committee of the Town Council. The Ratepayers' Water Committee have passed a resolution to the effect that the Corporation should deal with the drainage question before proceeding with the water scheme, and the Committee pledge themselves to use all legitimate means to compel them to do so. In a circular which has been issued, the supply is condemned on sanitary grounds.

THE RECENT SCARCITY OF WATER AT THE EAST-END.

A Local Government Board Inquiry to be Held—Action by the County Council—Investigation Welcomed by the Company.

With reference to the deputation which waited upon the President of the Local Government Board on the 30th ult., in order to urge upon him the necessity for an inquiry into the supply of water in the district of the East London Water Company, the Permanent Secretary of the Board (Sir Hugh Owen) has addressed a letter to Mr. G. Grocott, the Clerk to the Vestry of St. John, Hackney, stating that Mr. Chaplin "has given directions for the holding of an inquiry as to the circumstances which occasioned the deficiency of water supply in the Metropolitan area comprised in the district of the East London Water-Works Company, the effects of the deficient water supply as regards the public health, and the means which should be adopted with the view of preventing a recurrence of any such deficiency." The arrangements for the inquiry have not yet been settled; but Mr. Grocott has intimated to Sir Hugh Owen that he will be prepared to adduce the evidence on which the complainants rely, and has offered to place the Hackney Town Hall at the disposal of the Board for the inquiry.

The Water and Public Control Committee of the London County Council, after considering the representations made by the deputation of representatives from Vestries and District Boards who waited upon them on the 27th inst., have resolved to instruct the Solicitor to the Council to collect evidence with a view to taking proceedings against the East London Water Company under the Metropolis Water Act of 1871, and to submit a further case to Counsel with regard to certain points which have been raised.

At the ordinary meeting of the Directors of the East London Water Company last Thursday, the Secretary (Mr. I. A. Crookenden) reported that he had received a communication from the President of the Local Government Board, announcing his intention to hold a departmental inquiry into the state of the water supply in the East of London. The Chairman (Mr. George Banbury) remarked that this intimation of the determination of the Local Government Board to institute an inquiry into recent events connected with the water supply of the East-end was a source of extreme gratification to himself and his fellow-Directors; for they were prepared to face, with the utmost confidence, the fullest examination that could be devised into the Company's affairs, and the efficiency of the supply of water which they gave to their customers. Such an inquiry, if made thoroughly exhaustive, would, he felt sure, have a strong tendency in the direction of removing many erroneous impressions which now undoubtedly existed in the public mind. Several other Directors present took a similar view of the situation, and expressed their satisfaction at Mr. Chaplin's decision, as well as the readiness of the Company to meet all the charges formulated by the Vestries. It was incidentally stated by the Secretary, in the course of the discussion, that the Company were now pumping into their district no less than 47 million gallons of water per day, after allowing for "pump slip." This supply, he added, was equal to 36 gallons per head per day. At the close of the discussion, Mr. Crookenden was directed to instruct the officers of the Company to furnish all possible information that could be made available for the purposes of the forthcoming inquiry, and to help forward the proceedings to the best of their ability, with a view to eliciting the real truth of the whole matter.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

The Chief Engineer's Report on Available Sources of Water Supply.

(*Concluded from p.* 498.)

IX.—*Estimated Cost of Works.*

This is a subject which has engaged my most careful attention; and, assisted as I have been by Mr. R. Hassard, M.Inst.C.E., and Mr. G. F. Deacon, M.Inst.C.E., the Engineer of the Liverpool Water-Works (Vyrnwy supply), I believe I have arrived at figures which can be relied upon. They have been based upon prices actually paid for recent work of a similar nature; and when it is considered that, after making full allowance for actual construction, I have provided a sum exceeding £5,000,000 to cover unforeseen contingencies and parliamentary and professional charges, I believe that, if anything, the cost, on further working out, or in actual construction, would be reduced in amount.

As a total for the gross supply of 415 million gallons a day to provide for all contingencies for a period of fifty or sixty years hence, the summary of my estimate would be as follows:—

Head works at Llangorse, Yrfon, Edw, Ithon, and Wye, with their collecting and communicating conduits and compensation reservoirs	£8,135,000
Aqueduct from Llangorse to Elstree	7,100,000
Aqueduct from the Yrfon reservoir to Banstead	8,070,000
Terminal works at Elstree, filters, and connection with existing distribution-pipes	4,850,000
Terminal works at Banstead, filters, and connection with existing distribution-pipes	5,500,000
	£33,715,000
Contingencies, 10 per cent.	3,371,500
	£37,086,500
Professional and parliamentary expenses	1,685,750
Total	£38,772,250

Say £38,800,000 for 415 million gallons a day, or at the rate of £93,494 per million gallons.

But, as before pointed out, it is not necessary that the whole of this expenditure should be incurred in the immediate future. It will be sufficient if, in the first instance, the supply afforded by the Usk from the Llangorse reservoir, of 182 million gallons a day, be brought into

the Elstree reservoir. This would cost, as per estimate below, say £17,500,000, or at a rate of £96,000 per million gallons per day.

First instalment, Llangorse and Usk reservoirs, 182 million gallons a day	£3,175,000
Aqueduct from Llangorse to Elstree	7,160,000
Terminal works at Elstree, including filters and distribution	4,850,000
	£15,185,000
Contingencies, 10 per cent.	1,518,500
	£16,703,500
Professional and parliamentary expenses	759,250
Total	£17,462,750

£17,462,750 for 182 million gallons a day, or at the rate of £95,949 per million gallons.

Following this, an additional supply of 18 million gallons a day could be obtained from the Edw, at a further cost of £625,500, which would bring the total volume up to 200 million gallons a day, at a total cost of £18,095,250, or £90,476 per million gallons delivered.

Previous expenditure		£17,462,750
Edw supply, including reservoir and conduit to main aqueduct, 18 millions gallons a day	£550,000	
Contingencies, 10 per cent.	55,000	
	£605,000	
Professional and parliamentary expenses	27,500	
Total for the Edw supply		632,500
Total for a supply of 200 million gallons a day		£18,095,250

Or at the rate of £90,476 per million gallons.

It is obvious that the remaining supplies which can be derived from the Yrfon, the Towy, the Ithon, and the Upper Wye, can be brought in one by one at a future date; but they would involve the construction of the second line of aqueduct from the Yrfon to Banstead.

From the whole of the above figures, I am not only confident that this scheme of works is the best for the supply of London, but I believe it to be the cheapest that could be introduced. If we assume that the present supply of London, as afforded by the eight Companies, is at the rate of 192 million gallons a day, as in 1893, and that it cost £93,500 per million gallons, the Companies' works should be worth £17,952,000—a sum far below that which the Companies claim for the transfer of their united undertakings to the Council.

X.—*Other Sources which have been Proposed for London.*

I feel that I must not quit the consideration of this subject without glancing at some of the schemes previously proposed for the supply of the Metropolis, so that the Committee may understand my reasons for not taking them in preference to the one described.

Cumberland Lakes.—Mr. R. Hassard, M.Inst.C.E., the gentleman who has been associated with me in the preparation of this report, in conjunction with the late Mr. Hemans, M.Inst.C.E., laid before the Duke of Richmond's Commission in 1869 a scheme for obtaining water from the Cumberland lakes. The total supply proposed from that source was 287 million gallons a day. The length of the aqueduct was 270 miles, and it delivered the water near Edgware, at an altitude of 232½ feet above Ordnance datum. A portion of this scheme has since been appropriated for the supply of Manchester. The length of its conduit, and the circumstance that it delivered its water 80 feet below the proposed reservoir at Elstree renders it in every way a less desirable scheme than that which I have laid before you.

River Severn.—It may be remembered that the late Mr. Bateman, F.R.S., proposed a supply of water from the upper basins of the Severn. He calculated that 230 million gallons a day could be obtained; that the aqueduct would be 180 miles in length, terminating at Stanmore, at an altitude of 270 feet above the sea, or more than 42 feet lower than the suggested Elstree reservoir. The possibility of carrying out the project as designed by Mr. Bateman has been rendered impossible by the fact that Liverpool has appropriated the supply from the Vyrnwy, which circumstance, taken in connection with the long aqueduct and the low altitude of delivery, makes it clear to my mind that it is less advantageous than the scheme now laid before you.

Bala Lake Scheme.—During the time I have been engaged in writing this report, Mr. Price Williams, M.Inst.C.E., has laid before me a project originally designed for the purpose of supplying certain large towns in the midland districts from Bala Lake, with an ultimate extension to London. Seeing that the altitude of Bala Lake is only 530 feet above sea-level, and that its distance from London would involve a conduit about 200 miles in length, I do not consider that it could be economically constructed, even were the quantity of water available sufficient; and I am sure it could not be delivered at the same altitude as that proposed in the scheme which is the subject of this report.

Dartmoor.—Since writing my report of October, 1890, I have looked somewhat carefully into the possibility of obtaining a supply of water from Dartmoor. I find, however, that though possibly the altitude might be sufficient, yet the nature of the country does not afford those facilities for storing water which are to be found in Wales; and certainly its distance from the Metropolis would be much greater than from the valley of the Wye.

From this brief summary of schemes which have been proposed in the past, the Committee will, I think, gather my reasons for not adopting any of them on the present occasion. But the fact that they have been proposed, and that portions of them have been appropriated by other large towns, teaches that the valuable watersheds of the country suitable for the supply of the Metropolis are gradually being acquired by other municipalities.

Conclusion.

In conclusion, I hope that my endeavours to lay before the Committee a scheme of water supply suitable for the Metropolis outside the Thames basin will meet with their approval. I can assure them that during the four months which have elapsed since the issue of their order on the 16th of February last I have spared no time nor trouble to place the matter before them in a concise and reliable form. The work has required much designing and calculation, both as to the yield of the ground and the proper disposition of the reservoirs to economically store the water obtained; and the working out of long lines of aqueduct to London has been a subject involving much detailed consideration.

In this work I have been zealously assisted by Mr. Seymour Rumble and the staff of the Water Department engaged under him; and it would have been impossible for me to comply with the request of the Committee had I not been so fortunate as to have associated with me Mr. Hassard, M.Inst.C.E., who has placed at my disposal many sections and much valuable information accumulated during the past 25 years, over which period he has been continually at work on London Water Supply. To Mr. G. F. Deacon, M.Inst.C.E., I am also indebted for the care and attention with which he has checked many of my most important calculations; but neither of these gentlemen must be held responsible should any errors have crept into the work on which we have been engaged.

Following the Chief Engineer's report is one by the Chemist (Mr. W. J. Dibdin, F.I.C., F.C.S.) on the quality of the waters proposed to be taken, accompanied by tabulated analytical details.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. Mackenzie, a member of the Edinburgh Corporation, has just raised a question regarding the illuminating power of the gas supplied from the Edinburgh Corporation Gas-Works, of which more will be heard. At a meeting of the Town Council on Tuesday, he stated that he was in Liverpool on the previous Friday, and that, in the Corporation Buildings there, he was informed that a deputation from the Liverpool Corporation had paid visits to a number of towns for the purpose of testing the gas in those places. Edinburgh was visited on Aug. 4 and 5; and tests were made in the Balmoral Hotel, by an expert who accompanied the deputation. He was shown a sheet which indicated that the illuminating power of the Edinburgh gas was, with a standard burner, 20·65 candles; and with an ordinary burner, 16·48 candles. He found that the result of tests by the Official Gas Examiner in Edinburgh (Mr. J. Falconer King) on Aug. 7, was 24·90 candles. He was not alleging that Mr. Falconer King's figures were wrong; but he wished to point out the discrepancy. At present, he said, Mr. King had to give twenty-four hours' notice to the Gas Commission when he was about to test the gas; and he (Mr. Mackenzie) thought that if the Examiner could test it when and where he pleased, the public would have more confidence. Bailie Kinloch Anderson, who is Convener of the Works Committee of the Gas Commission, said the statement was a most alarming one; but he entirely discredited it. They had analysts in the works at Edinburgh and at Leith, besides the City Analyst; and he asked if it was to be supposed that the whole three were wrong. He did not know whether the Liverpool specialist made his test before or after dinner; but it was an entire falsehood. Mr. Mitchell Thomson condemned the practice of giving notice of proposed testings to the Gas Commission. Mr. John Jamieson said it seemed to him that Mr. Mackenzie always tried to get a better market for his electric light by decrying the quality of the gas. This Mr. Mackenzie indignantly denied. The Lord Provost said he would have the subject looked into by the Gas Commission, and the conversation ended.

Now, to begin with Mr. Jamieson's remark, it is the case that Mr. Mackenzie is the Convener of the Electric Lighting Committee of the Corporation; and in that capacity, as these "Notes" have before shown, he has displayed an enthusiasm on behalf of the subject under his charge which would have done him credit if he had been pushing it for pecuniary advantage to himself, and not merely as a duty laid upon him as a public representative. It does look as if the raising of this question about the gas would have been better in the hands of some other member of the Corporation. But then Mr. Mackenzie is a conscientious man; and the information having come into his hands, the responsibility lay upon him of bringing it forward. I should say that so important a subject having been introduced to his notice, it was his duty to call attention to it. At the same time, I quite believe that he experienced more joy than any other feeling at being able to have a dig at the Gas Commission.

But while Mr. Mackenzie must be held to have acted quite straightforwardly, what is to be said of the action of the Liverpool Corporation? There was, morally, nothing wrong, or even admitting of objection, in their endeavouring to satisfy themselves as to the quality of gas supplied in different towns. To come into a town, however, and begin on a Sunday (for Aug. 4 was a Sunday) to make tests of the gas, and to depart with the results in their pocket, having in their minds the knowledge that something was wrong somewhere, but not seeking to find out what it was—making a sort of snap-shot test, and regarding the result of it, notwithstanding its divergence from other tests made in a careful manner by competent men, as being sufficient, and seeking no information which might explain the discrepancy—was not what was to be expected from a body of English gentlemen. But to do all this, and without giving the Edinburgh and Leith Gas Commissioners an opportunity to furnish what explanation might be possible, to disclose the result in the way they did, was, I must say, as huge a piece of "sneaking" as ever came under my notice. It is difficult to understand what could have been the motive for the secrecy of the test; it is still more difficult to understand why, if secrecy was necessary, the result should have been published at all, or, if published, why it should have been made surreptitiously to one member of the Edinburgh Corporation, and not honourably to the Gas Commission. Surely all the people in Liverpool are not as the members of this deputation. The deputation must have started on their tour with the suspicion that the published results of official testings were not accurate; else why leave home at all. Their suspicions must, in fact, have extended to the gas,

the instruments for testing it, and the Official Examiners, for they took an examiner and a photometer with them. To minds so constituted, the Edinburgh results surely must have brought happiness. If the whole Corporation are to share in the happiness, they must shut their eyes to a great deal. For instance, they must not recognize, or acknowledge to themselves, that all this clandestine testing of gas is of no avail in any sense whatever. They cannot use the figures they have obtained, because Parliament has prescribed that gas shall be tested in a certain manner, at certain places, and by particular persons, and that the results are to be taken as evidence. No tribunal, therefore, would accept the figures of the Liverpool expert. Even in private negotiation, they would not be accepted, in face of the overwhelming testimony of the regular Examiners.

On other grounds, the movement was a piece of folly. It is common knowledge to everyone acquainted with gas matters that the testing of the illuminating power of gas must be performed under very strict conditions. In Edinburgh it has to take place at 25, Waterloo Place, and is to be conducted with a union-jet burner, and with the gas at 5-10ths pressure. It is extremely doubtful if these conditions could be complied with in a hotel, with temporary appliances. The pressure, for one thing, in the mains, is, from sunset to midnight, 8-10ths, and for the rest of the 24 hours, 6-10ths. I presume that the pressure was not what is prescribed, and that the prescribed burner was not used; and these two things would quite account for the difference in the illuminating power. But, on this point, it may be better to wait till it be seen whether any explanation is to be given regarding the conditions under which the tests were made.

Returning to what took place in the Edinburgh Town Council, it is the fact that notice is given by the Examiner of the time when he proposes to test the gas. Two members of the Corporation condemned the practice; and a local newspaper writer waxed wroth over it, and asked the question whether, if notice were to be given to milk-sellers, any would be found watering. On the face of it, it does look strange that notice should be given before the arrival of the Examiner; but it is better not to speak too rashly. The testing of gas is a statutory proceeding; and though no mention is made in the statute (the Gas-Works Clauses Act, 1871) of notice being given, that Act provides that the owners of the gas undertaking may, if they think fit, be represented by some officer, at the testing; and, how are they to be represented, unless they get notice to attend? Without compliance with the statute, the test would be void; and therefore notice must be given. If the Town Council wish to act the part of detective, there is nothing to prevent their obtaining an independent test from another examiner. But such a proceeding would imply distrust of the Official Examiner; it would, in fact, be based on the reasons which led to the Liverpool expedition, and would, among honourable men, be altogether out of the question. That the Gas Examiner should make his tests at any time, and at any place he may choose, is a fine sounding phrase; but it is impracticable. Happily, in these islands, a person is held to be upright until something to the contrary is proved against him; and that doctrine applies to the makers and sellers of gas. There are some, however—and these Liverpool deputationists seem to be among them—who think that those who supply gas should be held to be rogues until it can be established that they are honest men. In this instance, I look with confidence to their discomfiture.

The annual accounts of the Aberdeen Corporation Gas Department, to which I referred last week, were submitted to a meeting of the Town Council on Monday, and were adopted unanimously. Mr. Johnston, the Convener of the Gas and Electric Lighting Committee, in presenting them, said that as last year's report was only for a period of ten months, a comparison could not be made. The year had, however, been a most successful one. The new gasholder at Gallowhill was now completed, and was at present being filled with gas. The holder was the second largest in Scotland. Its construction had, from the very commencement, gone on without a single hitch; and the work was, in every way, a credit to all concerned. They had purchased coal for the current year on about as favourable terms as last year; and the price of gas was the cheapest they had ever had. Mr. Johnston entered into a comparison with the Dundee Corporation Gas Department, pointing, with satisfaction, to the circumstance that, although, from the longer carriage, they paid 2s. 7d. per ton more for their coal, and had no meter-rents (which in Dundee realized £3000 a year), they were able to sell gas at the same price as in that town. If they had meter-rents in Aberdeen, it would mean another 2d. per 1000 cubic feet upon the price of gas. He would like to call the attention of the Council to the financial position of the gas undertaking, as compared with what it was when they acquired it in 1871. The value then was £114,933; and since then there had been added works at the cost of £164,600, making a total of £279,500. Of this sum, however, no less than £126,300 had been repaid, leaving as the present book value £153,000, or only £39,000 more than in 1871; while the works produced now three times the quantity of gas they were capable of manufacturing then. The figures he had given (£153,000) as being the present value of the gas-works represented, of course, the book value only. As a quarter of a century nearly had elapsed since the Council became owners of the works, he considered it would be well to have a new valuation; and he should bring the matter under the notice of the Gas Committee with the view of submitting a proposal to that effect. They had last year contributed to the reserve fund £957. It stood now at £17,395; and it would, in less than three years, amount to £20,000. This, he thought, would be quite large enough; and when it had been reached, they might call a halt. I may say that I had the pleasure, this week, of meeting Mr. Alex. Smith, the Gas Engineer to the Corporation; and I learned from him that during the past year the output of gas increased by 20 million cubic feet. This is most satisfactory. Mr. Smith is in a most cheerful frame of mind, and with good reason, seeing he has just seen the end of his labours in connection with the large new gasholder on the Links, which he has engineered from start to finish, and which is turning out such a success. I had a glimpse of the holder; and it is a masterpiece of work. It has also the great merit of being, if I am not mistaken, the lowest in point of cost of construction of all the large gasholders in the United Kingdom, which says a great deal for Mr. Smith's capabilities as an Engineer.

It is with pleasure that I record the circumstance, which has just come under my observation, that the adoption of the patent regenerative settings invented by Mr. G. R. Hislop, of Paisley, is extending rapidly, both in England and Scotland. The following installations have just been completed: A bench of 48 retorts at Kidderminster; of 28 retorts at Beverley; of 64 retorts at Falkirk; of 32 retorts at Helensburgh; of 28 retorts at Selkirk; and of six retorts each at Largs and Nantwich; while an extension of the system is being made at Waltham Cross.

I am sorry to see that the Dundee Corporation Gas Committee are coquetting with a proposal to let their street lamp pillars for advertising purposes. The Company who have approached the Committee make the curious offer of 3d. per head of the population per annum, which would amount to £1983. I regard the system as objectionable. It is not altogether legitimate gas business.

The shareholders of the Carnoustie Gaslight Company held their annual meeting on Wednesday. It was reported that the net profit for the year was £424, out of which a dividend at the rate of 7½ per cent. was paid, which absorbed £375; and the balance was added to the contingency fund. This fund will require some assistance, as, it will be remembered, the works were all but destroyed by a gale at the end of 1893. The Chairman of the meeting stated that a new chimney had been erected, and that the retort-house had been enlarged and improved. The price of gas was reduced from 5s. 5d. to 5s. per 1000 cubic feet.

The Montrose Gaslight Company have this week reduced the price of gas for lighting purposes from 4s. 7d. to 4s. 5d. per 1000 cubic feet; and for cooking and heating, to 4s. 2d. The charge for public lighting has also been lowered from 11s. to 10s. 6d. per lamp per annum.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept. 7.*

Sulphate of Ammonia.—September has opened quietly; buyers for the most part holding off, and there being no great pressure on the part of makers to sell. The only firmness apparent is at Leith, on the strength of a threatened strike at the shale works—the source of the bulk of the Scotch production. The question between masters and men is still pending. Failing an amicable settlement, some temporary improvement in sulphate may be looked for. Meantime, the quotation, f.o.b. at the ports, is £9 5s. per ton. Forward business is still being done by speculators, who are offering £9 15s. for delivery in the early months of 1896.

Nitrate of Soda is quiet, at 8s. per cwt. for fine quality on spot.

LONDON, *Sept. 7.*

Tar Products.—Pitch is firm; and the improved value looks as if it will be maintained, at any rate for the coming season. There is not much new business being done in benzol; but the value continues firm. The production of benzol has not realized the anticipation of some of the "bear" operators of this article. Indeed, there are no stocks of benzol in this country anywhere; and, if report is true, it is stated that Continental buyers have allowed their stocks to become inordinately small, in the expectation of being able to replace them at very low prices. Compared with this time last year, the price is now much lower; but there can be little doubt that the bottom value has been reached, and any movement will be in an upward direction. Great dulness characterizes the market for creosote and oils. Solvent naphtha is more sought after; and toluol, which is now being largely used for solvent purposes, is also in fair request. Carbolic acid and cresylic acid are both firm; and, with little being produced, values may quite easily be increased. Anthracene is said to be weak; and undoubtedly some outside parcels have been sold below the Committee prices. The following values have obtained during the week: Tar, 18s. to 23s. Pitch, west coast, 35s. 6d.; east coast, 38s. Benzols, 90's and 50's, 11¼d. Solvent naphtha, 1s. 0½d. Toluol, 1s Crude, 30 per cent. naphtha, 4⅝d. Liquid creosote, 1¼d. Naphthalene salts, 24s. Cresylic acid, refined, 1s. 1½d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d.; 75's, 1s. 9d. Anthracene, nominal "A," 1s.; "B," 9½d.

Sulphate of Ammonia does not improve in price; but the market is very steady, and considerable business is being done. It is reported that a large reduction in stocks, which have been held for a rise, has taken place. There is a healthy tone about this market, which is likely to develop into considerable strength. Transactions during the week have realized: London, £9 2s. 6d. to £9 5s. Liverpool, £9 3s. 9d. to £9 6s. 3d. Hull, £9 2s. 6d. Leith, to £9 5s. Tyne, £9 2s. 6d.—all, excepting "Beckton terms," less 3½ per cent. f.o.b., bags included. Nitrate of soda is reported weak; and this is undoubtedly the disturbing influence that prevents sulphate realizing a better price, notwithstanding the fact that sulphate, from a nitrogen point of view, is still much cheaper than nitrate at to-day's values. Gas liquor is quoted at 6s. 6d. to 7s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—What further particulars I can gather with regard to the Salford gas-coal contract, bear out what I have previously stated—that the bulk of the coal has been secured at exceptionally low figures. One of the leading Manchester collieries has, however, obtained a fair proportion of the contract at what they consider a satisfactory price—certainly considerably above what it is reported other collieries have accepted. But they are in the position of being in close proximity to the works, and under very small cost as regards delivery. The prices they obtained for gas nuts, delivered by cart, was equal to 8s. 6d. per ton at the works, which is about 2s. per ton above the prices reported to have been taken for Arley nuts delivered by rail at Regent Road. But in the latter case the price, of course, was exclusive of carting; and this to some extent may account for the higher figure obtained by the Manchester firm for a similar class of coal. With regard to other descriptions of fuel, the position remains much as last reported; there being still an absence of any

development of the usual winter demand for house-fire purposes. The better qualities of round coal meet with only a very slow sale, with pits not working more than three to four days per week. Prices which are usually expected to show some upward move at this time of the year, are not more than maintained at late rates. They average 10s. to 10s. 6d., per ton for best Wigan Arley; 8s. 6d. to 9s., for Pemberton four-feet and seconds Arley; and 7s. to 7s. 6d., for common house coal at the pit mouth. The lower qualities of round coals, suitable for steam and forge purposes, are in but limited demand, and continue quite a drug upon the market, with prices weak and irregular. Ordinary steam and forge coals do not fetch more than about 6s. to 6s. 6d. per ton at the pit mouth. Engine fuel meets with only an indifferent inquiry; the holiday stoppages in the surrounding manufacturing districts still considerably interfering with requirements for this class of fuel. Prices remain at about 3s. and 3s. 6d. for common to 4s. 6d. and 5s. for best qualities, at the pit, with contracts for some of the inferior descriptions taken at 6d. to 1s. less, and slack offering from other districts at very low prices. A moderate business is being done for shipment, in house-fire qualities—chiefly for Ireland and the west coast; and about 9s. 6d. is being obtained for good seconds qualities, delivered either at the ports on the Mersey or the Manchester ports. There is still, however, only a small demand for steam coals, which (for delivery at the High Level, Liverpool, or the Garston Docks) are not fetching more than 7s. to 7s. 6d. per ton.

Northern Coal Trade.—An irregular increase in the demand for coal has developed during the last week or so; and in one or two cases, collieries have been able to ask rather higher prices. But, generally speaking, the better demand has been readily met by working fuller time at some of the pits; so that the maintenance of prices is the utmost that can be expected. Best Northumbrian steam coals have been in demand for shipment, as the exporting season becomes shorter now; and the price may be quoted as about 9s. per ton, f.o.b. Second-class steam is obtainable at from 8s. to 8s. 3d. per ton; and small steam coal is in fairly good demand at from 3s. 3d. to 3s. 6d. There has been a better demand for bunker coals during the last few days; and in one or two cases a rather higher price has been asked. But good unscreened qualities may be had at 6s. 3d. per ton, f.o.b.; and from that up to 8s. 6d. per ton, f.o.b., for the best screened bunkers is asked. Manufacturing coal generally is quiet; but there is a better demand for coking coal. Household coal is naturally in limited demand; and the price is very weak, except for shipment, where the unaltered figures of 10s. per ton, f.o.b., are still current. In regard to gas coals, there is a decided increase in the amount sent out both for shipment and for local consumption; and there is a considerable enlargement of the quantities supplied under the contracts with the great gas companies. Prices do not show very much alteration in this kind of coal; for the great bulk of the deliveries are under contract. For odd cargoes, the quotations vary from 6s. 3d. to 6s. 9d. per ton, f.o.b.; but for forward delivery the disposition is to ask higher prices. The improvement in the local iron-trade is enlarging the demand for coke, and causing a stiffening in the price, which, if continued, will affect the future quotations for several kinds of Durham fuel. Best coke is quoted 13s. to 14s. per ton, f.o.b., with higher rates for future delivery, as there is a desire on the part of users to anticipate their demands as much as possible. Gas coke is in a little fuller supply, and is well taken up for local use and export. The price shows no alteration this week.

Scotch Coal Trade.—There is at present a good demand for coal, particularly in the west of Scotland, where the miners are getting full work. In Fifeshire, the demand is not so good; the Baltic connection having been lost last year, and not quite returned. This is keeping down prices, which otherwise would be better. As it is, there is little variation in the quoted prices, though, in some instances, splint is spoken of as 2d. per ton dearer. The miners are likely soon to be asking for an increase of wages; but, it is reported, the masters will refuse it, which may lead to trouble. The shale miners are agitating for a rise of wages, which the masters are declining to give; and a strike is threatened, but is not likely to take place. Taken all round, the market for coal is improving. The prices quoted are: Main, 6s. to 6s. 3d.; ell, 6s. 9d. to 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 6d. to 7s. 9d., f.o.b., Glasgow. The shipments for the week amounted to 171,878 tons—a decrease of 10,093 tons, compared with the previous week; but an increase of 163,319 tons, compared with the corresponding week of last year. For the year to date, the total shipments have amounted to 4,804,726 tons—an increase of 1,337,294 tons, compared with the same period of last year.

Hiring and Sale of Gas-Stoves, &c., in Glasgow.—According to the last report made to the Glasgow Corporation Gas Committee on the hiring and sale of gas-stoves, kitchen range fittings, &c., the total number of hired goods at the close of July was 12,496; and the sales of stoves, range fittings, gas-fires, burners, &c., from the commencement of the stove-hiring scheme, amounted to 18,056.

The Large Loan for the Leeds Corporation Water Department.—A resolution was proposed by Alderman Cooke at last Wednesday's meeting of the Leeds City Council, empowering the Water Committee to make application to the Local Government Board for sanction to borrow £100,000 for water-works purposes. He said that this money was required to meet the demands of the city in relation to the water supply. The extensions needed comprised a new 30-inch main from Swinsty to Eccup, the new pumping-engines at Headingley for the high-level supply, and the new service reservoirs at Harehills and Beeston for low-level supplies. The estimated expenditure for the three years ending March, 1898, were as follows: Eccup reservoir, completion of No. 2 contract, £16,000; completion of No. 3 contract, £22,000; pipe-line from Arthington to Swinsty, £34,000; the new engines for the Headingley pumping-station, £10,000; and ordinary extensions, £18,000. Alderman Cooke also mentioned that during the year eleven miles of new mains and service-pipes had been laid, principally to new property; and that the new supplies of water in 1894 numbered 5687. The net profit for last year amounted to £7365; and those for the past seven years, to £50,198. The resolution was adopted.

Fenton District Council Gas Department.—The annual report of the Gas Committee of the Fenton District Council was submitted at the last meeting by Mr. G. Hallam. It showed an increase of £466 in the gas-rental, which was attributable chiefly to prepayment meters. The total increase in the receipts was £650. The gross profits amounted to £3715, or £683 more than last year. Interest and redemption of loans cost £2640; the net profit being £1074—an increase of £683 upon last year. This added to £4003, the amount accumulated out of profits in previous years, made £5077, which the Committee had resolved to deal with as follows: £500 to a reserve fund; £577 to the credit of the district fund; and £4000 to carry on the undertaking. The amount of capital now paid off was £4340. Mr. Hallam stated that the Committee would discuss the advisability of reducing the price of gas. Personally he thought that the ratepayers ought not to have all the benefit of the gas-works, but that the consumers were entitled to consideration. The Chairman (Mr. E. Brain) considered the report was a very satisfactory one, and said he thought the Council might congratulate themselves upon the way the gas-works were managed.

Incandescent Gas Lighting at Ipswich.—At the last meeting of the Paving and Lighting Committee of the Corporation of Ipswich, the Gas Inspector (Mr. E. C. Sayer) presented a report in which he estimated that the saving in gas on the twelve large special lamps being fitted with incandescent burners in lieu of governor burners would be 497,670 cubic feet per annum. From this should, he said, be deducted £17 10s., the probable annual cost of renewal of mantles and mica chimneys, and there would still be a saving of £10 16s. 8d. He estimated that the first cost of substituting incandescent burners for the present governor burners would be about £21 17s. 6d. If this were carried out, it would leave only 185 3½-feet lamps with the old form of burner, and these consumed too small a quantity of gas to effect any saving. Mr. G. F. Josselyn gathered that the prime cost would be £21, and they would save £10 a year—the Gas Company bearing the expense of the renewal of mantles and so on, because they had at present to keep the lamps and burners in order. The Inspector said the Committee did the whole of it; and he thought the figures would cover the cost. He added that he proposed to put a cluster of three burners in lieu of each of the large lamps. They would make a saving of £9 out of £30, and give a considerably better light.

The Public Lighting of Canterbury.—The Street Lighting Committee of the Canterbury Town Council made two recommendations at the meeting of that body last Wednesday regarding the lighting of the city. Being of opinion that the time has arrived for the introduction of the electric light, they recommended, first, that Mr. Robert Hammond be retained to advise upon the whole subject; and, secondly, that the present gas contract be continued for one year on condition that the Gas Company supplied all the ordinary lamps with Goodson's governor burners, to consume 6 cubic feet per hour, at the same price per lamp as that now paid. The adoption of the report was moved by Mr. Warren, who, if he desires that smooth relations shall exist between his Committee and the Gas Company, would have done well to have used somewhat more moderate language when speaking of them. Having expressed his belief that the Council could supply the electric light at a reasonable price, and make a profit out of it, he said he thought, when the Gas Company saw they were determined to have a better light at a lower rate than at present, they would alter their prices. Considering the miserable "rushlights" they had throughout the town, it was time they lightened their darkness. The Gas Company had told them that the price of their gas compared favourably with other towns; but they must show them that they would not submit to their prices any longer. Among the other speakers was Mr. Lukey, who felt the Council would all agree that they must have a better light; but the Gas Company, though they had been approached on the subject, did not see their way to give them that light. Alderman Hart (a Director of the Company) contradicted this statement, and said they would be pleased to give the Council a better light on a cheaper basis. He suggested that the Council should have a conference with the Company, and discuss the matter. Alderman Cross proposed that this should be done; but, on a vote being taken, the recommendations of the Committee were adopted.

The Purchase of the Odessa Water-Works by the Municipality.—The Directors of the Odessa Water Company have convened an extraordinary meeting of the shareholders, for the purpose of finally deciding upon the sale of the undertaking to the Municipality of Odessa. In regard to the proposed terms of purchase, the Board, through the Chairman, have previously assured the shareholders that they would keep before them, as a Board, the 44th clause of the concession as the basis of sale, which would give the Company twenty years' purchase of the average annual net income of the preceding five years. They now admit that they were too sanguine in their construction of the proposed terms; and they agree that the view expressed by Mr. Blunt, at the meeting of the shareholders on April 29, was the correct one—viz., that "the offer to the Company was a sum capitalized equal to the profit for the remaining years of the concession." The net result will give as the purchase price about £380,000; and the Directors, while preferring that the "lump sum" should be paid down, are not disposed to take exception to the proposed half-yearly payment pending the raising of the necessary loan by the Municipality, providing such payments are limited to the period of two years dating from the 9th (21st) of September, 1895, this being also the date fixed by the Commission for the acceptance, or otherwise, of the terms now offered to the Company; and it being understood that the balance of the "lump sum," as defined by the Commission, shall be paid on or before the 9th (21st) of September, 1897. The Directors are unanimously of opinion that the terms as defined by the protocol should be accepted by the Company. Two of the Company's shareholders have written to a financial contemporary, advising their fellow-shareholders to pause before assenting to the sale of the concern, upon the terms offered by the Municipality. These are considered "illiberal;" and one of the correspondents (Mr. W. Fox Batley) asserts that the shareholders have been deceived by the Directors, as the Chairman stated, at the last meeting, that they would get about £7 for each £20 share. The present offer is far below this.

Exhibition of Gas Appliances in Dublin.—An exhibition of gas cooking and heating appliances was opened last Tuesday in the Alliance and Dublin Gas Company's Hall, in Hawkins Street, Dublin; the exhibits being mainly manufactured by Messrs. John Wright and Co., of Birmingham. Lectures have been delivered each afternoon and evening by Mrs. J. B. Thwaites, the Principal of the Liverpool School of Cookery; and these will be continued another week.

The Cost of the Opposition to the Felixstowe Water Bill.—The costs, charges, and expenses in connection with the opposition of the Felixstowe and Walton District Council to the local Water Company's Bill amount, including the preliminary costs of promoting a proposed Bill in 1894, to £820 8s. 8½d. Some of the members of the Council are desirous of learning how the money was spent; and a Committee have been requested to look into the matter, and report thereon.

A Gasholder Accident at Providence.—The *Globe* gave publicity last Thursday to the following report: "A gasholder at Providence, Rhode Island, 'exploded' on Wednesday with terrific force. A corset factory in close proximity suffered severely. A portion of the wall of the building was destroyed; and one of the floors was practically blown out. Five men employed in the factory were killed outright; and several others were severely injured." We shall look forward with interest to the receipt of next week's technical papers from America, which will probably contain some confirmation or contradiction of the above.

Nottingham Corporation New Water-Works.—There was considerable discussion at the meeting of the Nottingham Town Council yesterday week upon a report by the Water Committee as to the inclusion of the parishes of Oxton, Calverton, Woodborough, Lambley, Burton Joyce, and Radcliffe-on-Trent in the district of the water undertaking. Mr. Sands moved the adoption of the report, and pointed out that the Committee had selected a site in the neighbourhood of these parishes for new water-works; and they thought it would only be doing what was right if they supplied the parishes with water. The motion was agreed to.

Fire at Messrs. Sadler and Co.'s Chemical Works.—On the night of the 30th ult., a fire occurred at the chemical works of Messrs. Sadler and Co., of Middlesbrough; and but for the timely action of the night-shift workmen and the local fire-brigade, the results might have been disastrous. The outbreak had its origin in one of the pits used for the storage of alizarine; and the material being of an exceedingly inflammable nature, there was at once a glare of light which attracted some hundreds of people to the scene. The fire-brigade were on the spot within a few minutes of receiving the alarm; and their ready efforts confined the flames within an area of a few square yards. Colonel S. A. Sadler was on the scene shortly after the outbreak was discovered.

The Tunnel at Dawsholm Gas-Works, Glasgow.—The Glasgow Corporation Sub-Committee on Works recently had submitted to them a plan of a diversion which the Engineer (Mr. W. Foulis) proposed should be made upon a portion of the tunnel which connects the Dawsholm Gas-Works with the Temple Gas-Works, formerly belonging to the Partick, Hillhead, and Maryhill Gas Company. Many Scotch gas managers know that tunnel well; and they remember that it passes under the Bowling branch of the Forth and Clyde Canal, and gives railway connection between the two works. The plan has been approved of by the Works Sub-Committee; and the Engineer has been authorized to have the work carried out, at an estimated cost of £1500.

Embezzlement by an Official of the Gas Workers' Union.—Last Thursday, at the West Ham Police Court, Edward Parfitt was charged with embezzling three sums, amounting to £1 17s., the moneys of the Trustees of the Gas Workers' Union; and also with forging and uttering receipts for the three sums. Prisoner was the Secretary of the Richmond branch of the Union. When first brought before the Court, on the previous Monday, Mr. Baggallay said he would commit him for trial for embezzlement and forgery, but formally remanded him. His Worship now, however, asked the prisoner to consider his position, and to say if he would have the case dealt with, or if he would prefer to go for trial. Prisoner expressed a preference for the latter course; but on Mr. Baggallay reminding him that there was the charge of forgery to be dealt with, prisoner decided to have the case settled then. Mr. George, for the prisoner, said he had paid over all the money he had been paid. Very foolishly he had given credit to members and signed their cards for money he never received. As to this 37s., there was no evidence that prisoner ever did receive it. Mr. Baggallay said the case was very clear; and, in law, the evidence disclosed forgery. Prisoner had now pleaded guilty to embezzlement; and, under all the circumstances, he would be imprisoned for a month.

A Substantial Reduction in the Price of Gas at Accrington.—An item of £137 for street lighting, in the minutes presented by the Watch and Cemetery Committee at the meeting of the Accrington Town Council last week, was regarded by Mr. Broughton as a very large one for the summer months; and he asked whether there was to be any reduction in the price of gas before long. He complained that the Council obtained very little information as to the proceedings of the Gas and Water Board. The Town Clerk replied that the announcement had already been semi-officially made, that the gas was to be reduced 3½d. per 1000 cubic feet to ordinary consumers and 4d. to the local authorities; so that the price for street lighting would now be 2s. 6d., instead of 2s. 10d.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 630.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23½—24½	..	4 5 8
100,000	10	,,	7½	Do. 7 p. c.	10	16—17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	108—110	+2	4 10 11
200,000	5	1 May	6½	Bombay, Limited	5	7—7½	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	200—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130*	..	3 16 11
320,000	20	28 Mar.	11½	British	20	54—56	..	4 0 4
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½-22½*	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½-17½*	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾—8¼	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31—33	+2	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	300—305	..	4 8 6
165,000	,,	,,	10½	Do. New do.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	270—280	..	4 12 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	207—212	+4	4 14 4
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130*	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100*	292—297	+1	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	187—192	..	3 12 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	131—134	..	2 19 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140—145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	+2	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	248—253	..	4 14 9
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	17½—18½	..	5 8 1
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	28 Mar.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10—11	..	5 7 3
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	360—370*	..	4 3 9
1,350,000	,,	,,	12	Do. B do.	100	302—307*	..	3 18 2
308,685	,,	,,	13	Do. C do.	100	315—325*	..	4 0 0
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	..	2 16 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	224—228	..	3 10 2
651,710	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303—308*	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	258—263	..	2 17 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Aug.	12⅝	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	150—155	−3	2 11 8
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	290—295	..	3 7 10

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EDITORIAL NOTES.

The Folly of Trade Unionists.

THE disparagement we passed last week upon the so-called "work" done by the recent Trade Union Congress after the expulsion of the "independent of labour" element has been echoed in other journals—notably in *The Times*, which has published a leading article deploring the propensity of even the real Trade Union representatives constituting the purified Congress to waste their time, and make themselves ridiculous, by passing puerile resolutions, such as the one censuring the Emperor of Germany. So long as Trade Unionists assembled in public meeting continue to vindicate their independence, and exhibit their practical minds, in the committal of such-like absurdities, they and their cause will stand for little in the estimation of the rest of the community—just as they weighed for little at the general election. Yet though Trade Unionism only embraces a minority of the working-class population of the country, its professed adherents are numerous enough to be reckoned with as a social force, if they could but rally to, and act upon, some common policy qualified (by possession of elements of rationality and legality) to gain the assent of other orders of the body politic. The impotence of Trade Unionists as an order is due to the absence of any such policy from their Councils; and the insignificance of their Congresses, and of the individuals who rank as their leaders, is attributable to the incapacity of the latter to formulate a policy that will stand a moment's independent consideration. Trade Unionists are an army with many flag carriers and sergeant-majors, but no general; and the campaign in which they are supposed to be embarked for the amelioration of their order is devoid of a plan. Such an army can fight occasional soldiers' battles—in the shape of strikes; but it can never achieve a really decisive victory.

To take an example of the inability of the professional leaders in Trade Unionism to take a commanding view of the industrial position, let us look at the actual state of the coal-mining industry. While the delegates were vapouring away at Cardiff, facts connected with the Yorkshire coal industry were being published and discussed elsewhere, which—affecting, as they do, the very basis of the Trade Union system—were of vastly more importance to the supporters of these triflers than the verbal toys they were playing with. In an article appearing in the issue of the *Engineer* for the 23rd ult., upon the Yorkshire Miners' Association, there occurs the gravest aspersion upon the operation of Trade Unionism, as applied to coal miners, that has yet been promulgated in print. It is an exhibition of the insufficiency of Trade Unionism to secure a reasonable week's work to the miner, whatever it may do for the recognition of a nominally fair "living wage." The Yorkshire Miners' Association, it seems, have been forced to admit that the increasing output of coal in the district is coincident with low earnings by the pitmen. There is no mystery about it—although ever more coal is brought to bank, the increase in the number of workers to be paid for getting it is still larger. What is the reason for this? Simply that in their anxiety to get as many men as possible into the Union, the Executive accepted anybody and everybody who would take a ticket. When the miners were getting good wages, agricultural labourers and factory hands took on this job; and so long as they would consent to join the Union, the leaders did not object to them, for obvious reasons. Now it is found that the market is overstocked with labour; but what is to be done? New comers are as good Unionists as the old hands; and they cannot be turned out of employment for "Society" reasons. This is one of the things that Trade Unionism has done for the coal fields of Yorkshire; and it is no wonder that the men brought up to the trade are beginning to ask whether a numerous Trade Union is quite the same thing as a strong trade. The officials may prefer the former; but the workers are likely to find that the trade has been sacrificed to the Union. Our contemporary observes upon this head: "If something could be done at the source of origin "—in making the land worth cultivating, in order to keep "the farm-servant in the field, where he is at home—the "trend of surplus labour to the colliery workings would "be stayed, and the miner have more work every day, "and more wages at the week end. It is too late in the "day to talk of luring unskilled labour out of the pit. It

"is there, rapidly getting skilled, and already endorsed "by the Union regulations." There is the gist of the whole matter. In their solicitude to fill the Union, the leaders did not foresee the consequences of overfilling the pit. It is an illustration of their ineptitude in all matters of statesmanship. They can pass resolutions in favour of a legal eight-hours' day; but they cannot see when they are in danger of giving away the miner's chance of getting a full week's work.

Sheffield Gas Affairs.

THE half-yearly general meeting of the Sheffield United Gaslight Company was held on Tuesday last, when the Chairman, Sir F. T. Mappin, M.P., had a tale of progress to tell, as will be seen by the report of the proceedings in another column. There has been an increase of gas consumption in the district of 8·72 per cent. upon the output for the corresponding half of last year, which speaks well both for the undertaking and the state of trade in the town. The price of gas has been reduced by the substantial figure of 3d. per 1000 cubic feet. Yet, instead of the rental being about £12,000 less in consequence of the reduction—this being the sum representing the saving to the public—the revenue has only suffered from this cause to the extent of £2826. Residuals, of course, have returned less, with the single exception of tar. Yet the accounts show the remarkable result, which will be paradoxical to amateur critics of the gas industry, that in this undertaking the residuals have paid for the whole cost of the coal carbonized, and leave £924 to the good. If this is not a "scientific" way of utilizing coals, we should like to know of a better one. It certainly forms a strong contrast to the methods of central station electric lighting, with a consumption of coal of something like 7 lbs. per horse power distributed, and upwards, and no residual products at all. According to Sir Frederick Mappin, there is "no demand" in Sheffield for automatic prepayment meters; and he adduced what is certainly fair evidence to show that, without this aid to popularity, Sheffield gas is more abundantly used by the small householders of the town than is the case in any other place. We are not convinced, however, that the argument from this fact is as conclusive against the need for prepayment meters as it is good so far as it goes. Similar assertions as to the lack of demand for this kind of accommodation, have been made in regard to other districts before the introduction of the system, which is a peculiarly strong illustration of the manner in which supply creates demand. There is nothing else in the Chairman's address to call for comment here; and the meeting broke up after ample evidence had been given that Sheffield is well pleased with its gas supply, and the proprietors of the Company with the administrators and managers of their fine undertaking. There is indeed no Company in England better qualified to afford the student of the industry "object lessons" in gas manufacture and supply than the Sheffield Company.

The Address of the President of the British Association.

THE British Association Meeting this year has so far been pursuing a mildly interesting and comparatively uneventful course. The inaugural address of the President, Sir Douglas Galton—an extract from which appears elsewhere—was mainly of the chronicle type, which in itself almost forbids escape from the commonplace, and easily descends to the trite and tedious. In this instance, however, circumstances constrained the President, who has for twenty-four years laboured well for the Association as its General Secretary, to submit to the world a case in proof of the progress made during this period of time by science, with the aid and countenance of the organization of which he has so long been a principal stay and guide. As an engineer, Sir Douglas Galton looks at science generally from the engineering standpoint, which is at the same time that of trained, practical commonsense; and for this reason engineers will find themselves much in sympathy with the views expressed in his address respecting a great variety of subjects lying outside the range of their professional interest. Of engineering itself, however, the address contains very little. The President touched upon several sanitary questions; and he took the opportunity for pointing out how little has been done in the way of aerial sanitation. Speaking of fogs and fog prevention, he declared to his audience that we shall continue to "suffer from fog "so long as you keep refuse stored in your towns to furnish "ammonia, or so long as you allow your street surfaces to "supply dust, much of which consists of powdered horse "manure, or so long as you send the products of com-"bustion into the atmosphere. Therefore, when you have "adopted mechanical traction for your vehicles in towns, "you will largely reduce one cause of fog. And if you "diminish your black smoke, you will diminish black "fogs. In manufactories, you may prevent smoke either "by care in firing, by using smokeless coal, or by washing "the soot out of the products of combustion in its passage "along the flue leading to the main chimney-shaft. The "black smoke from your kitchens may be avoided by the "use of coke or of gas." But, so long as the hygienic arrangement of the open fire in living-rooms is retained, Sir Douglas Galton despairs of finding a fireplace, however well constructed, which will not be used in such a manner as to cause smoke—unless, indeed, the chimneys were reversed, and the fumes drawn into some central shaft, where they might be washed before being passed into the atmosphere. This is a very fair summary of the case for domestic smoke prevention, as it stands at the present day, albeit the President might have laid more stress upon the advantages of gas for warming dwelling houses and places of business situated in crowded localities. It was an unexpected recommendation of mechanical, as a substitute for horse, traction in towns, that it would tend towards the reduction of fogs; and the point, although novel and striking enough for a presidential address, is hardly likely to bear strongly upon the development of the principle of traction referred to. We cannot at present do more than allude to the sectional addresses and the papers read at the meeting. Abstracts of such of these as may be of special interest to our readers will be given in the JOURNAL in due course; and the addresses will in some instances form the subject of future comment.

Two District Association Meetings.

Two District Associations of Gas Managers held meetings last week in diametrically opposite localities—the South-Western Association at Barry, near Cardiff; and the Eastern Counties Association at Wisbech. For some reason, however, which may possibly be partly divined, neither gathering can be described as doing great credit to the organization represented by it. Our reports of the proceedings at these meetings show that those who attended them did not receive much by way of reward for their trouble; and—with all good will towards the idea of gathering the gas managers of districts together by means of these organizations, be it said—it will evidently be necessary that more inducements to attend such meetings should be forthcoming if they are not to fall into desuetude. The South-Western meeting was very poorly attended; and the business suffered accordingly. Mr. S. W. Durkin read a short paper, which was not discussed; and a most significant part of the proceedings consisted in the unanimous adoption of a resolution in favour of the proposed amalgamation of the Association with the Southern District Association of Gas Engineers and Managers. This is the first movement of the kind that has been signalized in connection with district gas managers' societies; but it will probably not be the last. It is one thing to start an organization of this nature, and a totally different matter to keep up interest in it after everybody has passed the chair, and everybody else has been through the Committee, and there is nobody left to "draw" for a paper. From one point of view, the disappearance of the South-Western Association as a separate and distinct organism would be most regrettable. But, on the other hand, if it cannot be kept in full and beneficent activity, it would be better to dissolve or fuse it, than allow it to drag on an invalid existence. Those of its members who might pass over into the Southern Association would find a hearty welcome amid friends, and would, perhaps, in the majority of cases have not much farther to go to the meetings than when these were supposed to be fixed with regard to south-western exigencies. This has always been a straggling district—awkward to work; and London would be as convenient a centre for the combined South of England Associations as could be suggested for either separately.

Political Oil-Gas in Bradford.

THERE has been a tremendous amount of uss in a small way in Bradford municipal circles—the word sounds better than "rings"—over the question as to whether or not the

Dvorkovitz oil-gas experiment at the Thornton Road Gas-Works should be discontinued or kept on for a further period to demonstrate, more clearly than has yet been done, its utility or the reverse. The Gas Committee have for some time been divided in opinion upon the matter; and they have employed several experts in gas to help them to make up their minds about it. Unhappily, the result has so far only been to exhibit the unedifying spectacle of the "doctors" differing among themselves; and the Committee have been practically left to draw their own conclusions in the business. It seems odd, upon the face of it, that there should be any difficulty in ascertaining the value of a gas manufacturing process which is open to actual test alongside an alternative system with which it is to be compared. But such is the Dvorkovitz case, as it stands at present. Certainly, the majority of the Gas Committee, who met to consider the matter on the 4th inst., had little difficulty in disposing of the question—reports and all. This meeting had before them Mr. Lewis T. Wright's opinion of the process, and Mr. Wood's criticism of this verdict; and in addition there was a very "sporting offer" from the agent for the patentees, to work the plant for another six months upon conditions more than fair to the Corporation. But the meeting scorned the offer, and resolved (by 10 votes to 2) to abandon the process and order the removal of the plant. This was, at any rate, a decision. But, when the matter came in due course before the Town Council, the resolution of the Committee was sent back for reconsideration by a vote of 23 to 22. This seems a fair thing to do in the circumstances, irrespective of the merits of the process itself. The vote of the Gas Commitee was alleged to have been somewhat of a "snatch;" and it is admitted that the offer under which the experiment could be prolonged contained ample protection for the interests of the Corporation. It is always a mistake, and often a pity, to be hasty in terminating an experimental process that has had at least sufficient *primâ facie* success to render its discontinuance disputable as a matter of policy. Limbo yawns wide enough for failures, and will not be deprived of its own in the end. One of the funniest aspects of this Bradford gas-carburetting controversy—which developed enough heat in the Council meeting to carbonize most of the oil of mutual forbearance that usually lubricates the passage of business through this respectable local authority—is that the Council vote was cast upon strict party lines. It is locally reported that "a Conservative majority" was established in the Gas Committee last November; and that when the proceedings of the Committee are brought before the Council, any question (technical or otherwise) concerning them is settled by the strictest of party divisions. Now it is stated publicly that, since the Conservatives on the Gas Committee will have nothing to do with the Dvorkovitz process, this body will simply ignore the reference of the Council in the matter. The Liberals in the Council, it appears, are not strong enough to overrule, and they are not united enough to outmanœuvre their political opponents; so that the net result of all this voting and countervoting is that the Dvorkovitz process will remain in abeyance, so far as Bradford is concerned. It is admitted in the local press that there is nothing in this political scheming that relates to the merits or demerits of the process; "but in the present state of "affairs that seems to be a matter of minor importance." Such is municipal gas-works administration as understood in Bradford.

Appointment of a Consulting Chemist to the Bradford Corporation Gas Department.—Among the minutes of the Gas Committee adopted at last Tuesday's meeting of the Bradford Town Council was one appointing Mr. F. W. Richardson as Consulting Chemist to the department for one year, at a salary of £100. Referring to this engagement, the Chairman of the Committee (Mr. W. C. Dixon) remarked that Mr. Richardson had been highly recommended as a very clever young man, whose services would be invaluable to the Corporation in connection with the chemical works. The Council, he said, would be aware that at the gas-works a large quantity of sulphate of ammonia had been stored recently; and there was a chance now that the Corporation—by having the help of some scientific man, who could go into the whole matter and assist their Manager—might be able to turn this sulphate of ammonia into various other commodities of a very valuable kind. Already some of the sulphate of ammonia had been made into muriate of ammonia; and the difference between the two was that £26 was the price obtained for the muriate as against £9 7s. 6d. for the sulphate.

WATER AND SANITARY AFFAIRS.

It is officially announced in a letter to Mr. Crookenden that Colonel W. M. Ducat, R.E., one of the Engineering Inspectors of the Local Government Board, and Dr. F. W. Barry, one of the Medical Inspectors, have been deputed to hold the public inquiry into the water supply of East London which has been ordered by Mr. Chaplin. General Scott may be supposed to prefer this arrangement, foreseeing that, if he conducted the inquiry and found that the East London Company were not to blame, his report would be challenged as the fruit of a friendly feeling towards the water interest. But Colonel Ducat must not expect to go free, should he fail to find the Company guilty of the dire offences laid to their charge, especially if he should feel it his duty to point out the extent to which the County Council were the cause of the difficulty in which the East London Company recently found themselves placed. Not even Mr. Chaplin could escape attack on the subject of the water supply, the moment it was discovered that he desired to master both sides of the question. The Progressive party still manage to hold the reins of the County Council, though not able to drive quite so fast as they could wish. Mr. Henry L. Cripps, the Council's Parliamentary Agent, writes long letters to *The Times*, clearly showing what, in his opinion, is still the ruling policy at Spring Gardens. Lord Onslow gravely rebukes this pertinacious scribe for continuing "an "*ex parte* statement calculated to prejudice the case of a "Company whose action is now the subject of Govern-"ment inquiry, possibly fraught with the gravest conse-"quences to the shareholders." Mr. Cripps is reminded that he is in the receipt of "a fixed salary" from the Council, and that his "unauthorized action" will not escape criticism when the Council meet after the recess. But Mr. Cripps both knows his business and his masters, and may be trusted to guide his pen wittingly, so as to serve the cause he has in view. Lord Onslow will not silence him. Strange assertions are made; and old fallacies are repeated. Mr. Cripps maintains that the Bill brought in by the East London Company "did not authorize the "construction of any new works at all." This is certainly a startling statement, and is positively puzzling when Mr. Cripps goes on to say that the principal proposal of the Bill was "to give power to the Company to create "additional debenture stock to the extent of £500,000." The objection is urged that "no plans and sections of "any new water-works" were deposited. We are not aware that there was any necessity for depositing such plans and sections. That new works, or the extension of old ones, was the occasion of more capital being required, was understood throughout. Mr. Cripps himself says it was "suggested on behalf of the Company" that, unless the Bill was passed, they might be "unable to "supply sufficient water." But he brings forward the absurd argument that, because, in a statement addressed to the Royal Commission in April, 1892, the Company declared "their ability to furnish water adequate in "quantity and excellent in quality for the period of forty "years," therefore the Company had, on their own confession, no need to construct new works, or only such small matters as could be paid for out of revenue. According to this showing, the Company's works may practically suffice for the next forty years. The fallacy has been exposed before. But it still survives; and we suppose there are people who believe it. We may refer to an excellent letter from "A City Solicitor" published in *The Times* of Friday last, in which the writer exposes a considerable amount of inconsistency both on the part of the County Council and Mr. Cripps. Another correspondent says: "The audacity "of Mr. Cripps is unbounded," and challenges the champion of the County Council to prove his *ex parte* statements. We fear that this opens up an endless prospect; and, in the meantime, we are thankful for a small mercy, in respect to the Poplar Vestry—the conference on the water question which had been proposed by that body having fallen through, from the circumstance that only three authorities thought it worth their while to send representatives. So, for the present, the matter rests in the hands of Colonel Ducat and his colleague.

Resignation of Mr. T. Whimster, of Perth.—Our Edinburgh Correspondent reports the resignation of Mr. Thomas Whimster, of his position of Gas Manager at Perth (see p. 598).

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 601.)

THE course of things on the Stock Exchange last week was considerably chequered. Pretty well everything opened buoyant and lively all round; and it looked as if there was going to be a boom in the South African market. But the movement received a prompt check. The account open for settlement was very heavy, and caused some apprehension. Rates for carrying over were made very stiff; and enforced closing pulled prices down. Other markets also suffered, especially the American; and, in fact, hardly anything but the very choice stuff held its own through the week. The Money Market had its usual temporary stimulus from the requirements of the Stock Exchange; and lenders were rather cautious. Business in the Gas Market was animated; the big issues being particularly active. Prices were very good; and several leading quotations rose freely. General firmness characterized all the rest. Gaslight "A" was largely dealt in; and, starting at a little better than 294, it pushed steadily up till it was done more than once at 299. But it never could quite touch the level 300. All the secured issues were quite neglected, except the "H" limited, which made a big jump of 5. South Metropolitans were very quiet, but ready to rise. The "B" advanced its qutotation, and changed hands at a bare fraction under 310; the buyer being thus content with £3 17s. 6d. per cent. for his money. Very little was done in Commercials; but that little marked top price. Suburban and Provincial Companies were again more than usually quiescent; hardly a transaction being effected in them all the week. Their quotations, too, were left unchanged. Of the Continental undertakings, only Imperial exhibited any activity. The price showed a slight tendency to harden; and the quotation was put up a point. But there was not much sign of any latent strength. There was a good bit of movement among the rest. San Paulo was in demand at an advance; Ottoman rose *ex div.;* and Bombay had a further rise. Why the latter should be put on a level in point of value with South Metropolitan "A" and better than Commercial, Brentford, and other home stocks is not quite evident. Australians were put down a point, having been too freely lifted the week before. Among the Water Companies, there was a fair amount of business in East London, which recovered a point.

The daily operations were: The Gas Market opened quite lively on Monday, especially for Gaslight "A" and Imperial Continental. The former advanced 1; and ditto "H," 4. Business was almost as brisk on Tuesday; and prices again rose freely. Gaslight "A" improved 2; ditto "H," 1; South Metropolitan "B," 3; and Imperial Continental, 1. On Wednesday, transactions were considerably reduced; and prices remained about the same. Both Bombay issues advanced ¼. In Water, East London recovered 1. On Thursday, business was quiet as a rule; but there was brisk dealing in San Paulo. Quotations remained unchanged. There was just a shade more activity on Friday; and San Paulo advanced ½. Saturday's dealings were not remarkable; but the buying price of Gaslight "A" was advanced 2. Australian debenture relapsed 1.

ELECTRIC LIGHTING MEMORANDA.

Electricians in the Bankruptcy Court—The Health of Telegraphists: A Query for Mr. W. H. Preece.

THOSE who desire accurate and complete information respecting the condition of the electric industries will be well advised to keep an eye upon the reports of bankruptcy proceedings in town and country. From time to time, electric construction and installation companies are ordered to be compulsorily wound up; and the number of electric lighting and engineering firms who have had to seek the protection of the Court is large and constantly increasing. One can hardly pick up an electric journal without noticing, among the paragraphs of general news, reports referring to proceedings of this kind. From the frequency with which such news appears, it mav be gathered either that the trade in electricity is in a bad way, or that the number of people who have gone into it is altogether in excess of the real commercial demand. To cite only one instance, the issue of the *Electrician* for the 30th ult., under the heading "Trade Notes and Notices," mentioned one way or another the financial troubles of half-a-dozen companies and trading firms by name, and referred to the obscurity which enshrouds the fate of "several other concerns." This does not look well for the electric industries. Not the least of the troubles arising out of these failures are those which the breaking up of so many firms, and the notoriously shaky state of many others, bring upon those which still manage, by hook or by crook, to keep in a fairly sound position. It was observed in the last annual report of the Receiver General in Bankruptcy how the reckless trading of firms knowing themselves to be insolvent, works havoc with their respectable competitors in the same line of business. With all their capital hopelessly lost, and without hope of being able to do more than continue to pay directors' fees and management salaries for a little while longer, these tottering firms take contracts at losing prices, and sell their manufactured goods for whatever they will fetch. The consequence of this particular form of commercial immorality, which is one of the cankers of the age, is that honest traders cannot get work to do at fair prices. In no trade is this evil greater than in the new, glorious, scientific, and admired electric industry of the United Kingdom, which is so often acclaimed in the newspapers as one of the triumphs of our material civilization. So it doubtless is, to an extent; but all this high scientific and progressive character does not prevent the industrial aspect of electricity in these days from being seamed with the worst of the diseases of the commercial system.

A recent issue of a medical contemporary deals with the sanitary aspect of the case that has been prepared by the telegraphists in the service of the Post Office against the administrative rules imposed upon them. It appears that the grievances of this body of public servants are neither few nor small; as will be generally conceded when it is known that their rate of mortality from phthisis is actually greater than that of the Sheffield grinders—a trade which has hitherto shown the worst record for diseases of the respiratory organs. According to a tabular statement prepared by a representative of the service, the ratios of mortality from phthisis alone for adult Englishmen, between the ages of 15 and 55, are: Telegraphists, 46·6; Sheffield grinders, 33·1; adult males generally, 13·8. Now the Chief Engineer to the Post Office is, as all the world is being frequently reminded by his public appearance in other capacities, Mr. W. H. Preece, F.R.S., &c. These matters may be supposed to occupy the attention of this eminent person in the intervals of his consulting practice in regard to the installation of municipal electric lighting stations. He has, indeed, testified to the fact of the health of the employees of the telegraph department of the General Post Office being a matter of solicitude with him, inasmuch as it is now some years ago that he vouched for the circumstance of the introduction of electric lighting into this establishment having greatly improved the condition of the operators in this respect. There seems, however, to be plenty of room for still further improvement on the same lines, if these recent reports are to be credited. Perhaps Mr. Preece will look into the matter, and furnish the world with some duly accredited fresh statistics in support of his recorded declaration. Statistics are not his strong point; but the matter at issue is so serious that the authorities of the Post Office ought to take steps for setting the public mind at rest as to the telegraphists' condition. We, of course, know that, in common with that of every other Government department, the administration of the Post Office is not perfect; but there must yet be a considerable section of the public of this country who would be pained to think that our sixpenny telegrams are partly paid for by the lives of sacrificed fellow men. The suspicion is disturbing, as it is; and no Government office can rest under it for a moment longer than the meeting of Parliament. The authorities of St. Martin's-le-Grand will certainly be well advised to have the matter cleared up before then. What we are particularly concerned to know is, how the subject stands affected by the lighting question, in view of Mr. Preece's assertions in this connection. Perhaps our electric contemporaries will be so good as to take notice of this inquiry, and assist in demanding further and fuller information. Honestly and truly, we believe that the sanitary state of the instrument-rooms at the General Post Office would be condemned by any unofficial medical inspector, on the grounds of overcrowding, lack of proper ventilation, and disregard of the natural comfort of the operators who swarm in them in their thousands, night and day. Something more than the substitution of electric for gas lighting is required to render such a hive reasonably healthy, to say nothing of making it pleasant to work in.

Death of the Chairman of the Oxford Gas Company.—We regret to have to announce the death, on Thursday last, of Alderman J. Hughes, J.P., who, for fifteen years, has been the Chairman of the Oxford Gas Company. He was a most influential man in civic matters for a long period of years. As far back as 1859, he was appointed a member of the Corporation, and was elected Chief Magistrate of the city no less than six times. In 1884 (which was one of his years of office), he was largely instrumental in obtaining a Special Act of Parliament for improving the water supply of Oxford.

The Recent Scarcity of Water in the East-End.—The Local Government Board last Thursday addressed letters to the East London Water-Works Company and the Hackney Vestry, relative to the forthcoming inquiry into the recent scarcity of water in the East-End, saying the proceedings will take place at the Hackney Town Hall, on the 1st prox., before two of the Board's Inspectors—Colonel W. M. Ducat, R.E., and Dr. F. W. Barry. Mr. I. A. Crookenden, the Secretary of the East London Water Company, in reply to inquiries on Saturday afternoon, said the Company had completely succeeded in overtaking the waste which undoubtedly occurred in some districts in the early part of the week. As the result, they were able to keep on the continuous supply, which was commenced the previous Sunday morning, and even in the highest levels now the consumers had no ground whatever for complaint. Everywhere the supply of water was abundant; and complaints were now quite the exception.

WATER ACTS FOR 1895.

The following Acts of Parliament relating to water supply have become law this year:—

The Bridlington Water Act incorporates a limited Company formed in 1865, under the name of the Bridlington and Quay Water Company, for supplying the towns of Bridlington and Bridlington Quay and the adjoining parishes and district, all in the East Riding of Yorkshire, with pure spring water. The present capital of the Company consists of £20,000 (all of which is subscribed, and £17,504 paid up), together with a mortgage debt of £400. The name of the Company is changed to that of the Bridlington Water Company; and the capital is increased to £40,000, by the addition of £20,000 of new 4 per cent. capital, with the usual borrowing powers. None of the new capital is to be issued within a period of two years after the passing of the Act, nor more than £3000 borrowed on mortgage except for the purpose of replacing existing debentures. The rate for domestic supplies is to be 5 per cent. on rateable value, with extras, payable in advance by half-yearly instalments. Water is to be supplied for public purposes in Bridlington at the price of 6d. per 1000 gallons. Water may be supplied by meter for other than domestic purposes. A penalty of £5 is enacted for the tapping of mains by any unauthorized person. The Commissioners of Bridlington Harbour may be Directors of the Company; and, similarly, shareholders of the Company may hold the Commissioners' office. At any time after the passing of the Act, the Bridlington Urban District Council may acquire the undertaking, provided that if notice of purchase shall be given to the Company before the expiration of five years from the passing of the Act, the purchase is to be deemed compulsory, and the costs of obtaining the Act are to be added to the price. But the price is not to be enhanced by reason of the Company having obtained statutory powers. If, however, notice is given at a later period, such costs are not to be added to the price, and the purchase is not to be deemed compulsory. The necessary financial arrangements for the purchase are included in the Act; the purchase money being repayable in fifty years.

The Cranbrook District Water Act incorporates a Company with a capital of £15,000 in £1 shares, carrying the usual borrowing powers, for the supply of water to and in the parishes of Cranbrook, Goudhurst, and Hawkhurst in Kent. Parts of the district were included in the area defined in the South Kent Water Act, 1889; but the Company having neglected to exercise their powers in this regard, they are repealed. It is provided that if, after the expiration of six years from the commencement of the Act, the Company are not affording a sufficient supply in any local government district within their limits, the local authority of such district may provide a supply in accordance with the provisions of the Public Health Act, or any company or person may apply for an Act or Provisional Order for the same purpose, as if no Company were authorized by this Act to supply water therein. The authorized works comprise a well and pumping-station to be situate in the parish of Hawkhurst, and a service reservoir in the parish of Cranbrook. Clauses are inserted for the protection of the county roads and the Cranbrook and Paddock Wood Railway Company. The land is to be acquired within three years, and the works completed within five years from the passing of the Act. Rates for domestic supplies are to range from 8 to 6 per cent. on rateable value. Water may be supplied by meter for domestic or other purposes.

The Felixstowe and Walton Water Act incorporates a Company formed in 1894 to supply with water the district of Felixstowe and Walton, in Suffolk, and the neighbourhood, and of acquiring any water-works then existing and supplying water in the district. The present share capital of the limited Company consists of £50,000, divided into 5000 £10 shares, of which 3491 are subscribed and 2451 fully paid up. The remaining 1040 shares, on which only £2 each has been paid up, are held only in fives; and there is no debt. The limits of the Company are defined, subject to liberty to local authorities and others to supply any district not supplied within five years by the Company. The capital of the Company is fixed at £50,000, whereof £26,590 is the original, and the remainder is additional capital. Dividends are limited to 7½ per cent. on the old, and 7 per cent. on the new capital. The usual borrowing powers are granted. It is provided that the Company shall not (except with the consent of the Felixstowe and Walton Urban District Council) raise any capital under the provisions of the Act—except for current capital requirements—until Dec. 21 next; and if the Council shall introduce a Bill into Parliament and *bonâ fide* promote the same in any of the three next available sessions, to enable them to purchase the undertaking of the Company, the same restriction shall apply during the promoting of the Bill, which is not to be opposed by the Company except upon clauses for their own protection. Any such transfer is to be on such terms as may be agreed upon, or determined by arbitration. The works consist of a pumping-station in the parish of Frimley St. Mary, and a pumping-station and water-tower in the parish of Felixstowe. Rates for domestic supply are to range from 9 to 6½ per cent. on rateable value—inns to pay the highest rate. Public institutions are to be supplied by meter at the specified charges of 2s. and 1s. 6d. per 1000 gallons.

The Bristol Water-Works Act enables the Company to raise £350,000 of new capital by the creation and issue of ordinary shares or stock. The time limited by the Act of 1888 for the completion of certain works is extended. Additional lands for the protection of the supply are to be acquired by agreement, subject to certain conditions inserted for the protection of the Trustees of the Bristol Municipal Charities. The Brymbo Water Act authorizes the Company to raise £16,000 of additional capital, bearing 7 per cent. ordinary, or 5 per cent. preference dividend, with the usual borrowing powers. The time allotted in the Company's Act of 1888 for the completion of certain authorized works is extended. The York Water-Works Act empowers the York Water-Works Company to raise £60,000 of additional capital bearing 3½ per cent. dividend. The limits of supply sanctioned by the Company's Act of 1846 are defined and extended. Payment of back-dividends is prohibited for any year prior to June 30, 1888, or after June 30, 1894. The Company's contingent fund (limited by the Act of 1846 to £5000) is enlarged to £10,000. Future loans are to be raised at not exceeding 3½ per cent. interest. Water is to be supplied to the York Corporation for public purposes free of charge, as from the beginning of next year. In place of the provision of the Act of 1846 bearing upon the liability of the Company to supply water, it is now enacted that "the Company shall, at the request of the owner or occupier, furnish to every occupier of a private dwelling-house or part of a private dwelling-house in any public street or road near to which any main or branch pipe of the Company shall be laid, a sufficient supply of pure and wholesome filtered water for all domestic uses" at certain scheduled rates. The rates prescribed in the Act of 1876 for the supply of water for trade purposes are reduced by 5 per cent. for supplies within the city. Special rates are scheduled for "small trades." Subject to certain conditions, the Corporation are to take water for flushing tanks free of charge. Hydrants are to be substituted for fire-plugs. The Whitby Water Act empowers the Company to raise £12,000 of additional 7 per cent. capital, with the usual proportion of loan. Certain works as to the legality of which doubts have arisen, are sanctioned; and the acts and expenditure upon them confirmed. A scheduled agreement, having regard to a grant of water rights, is confirmed and made binding upon the parties. These rights apply to the water of the Hazel Head Springs, which are tributary to the River Esk. The new works are to be completed within four years. In the event of the undertaking of the Company being acquired by the Whitby Urban District Council, the capital raised under this Act—except that applied for authorized purposes—is not to be deemed to have increased the capital value of the undertaking or to be the subject of compensation or purchase.

The Ambleside Urban District Council (Gas and Water) Act provides that the water-works belonging to the Ambleside District Gas and Water Company shall be acquired by the Council at a price to be ascertained by arbitration—being valued separately from the gas undertaking, and thereafter kept distinct. The limits of supply for water are the district of the Council. The works comprise a dam and intake in the stream called Scandale Beck, situate nineteen chains up the stream from Low Sweden Bridge, and a covered water-tank in the parish of Grasmere. Additional lands constituting the water-shed of the stream are to be acquired. The rate for domestic supplies is to be 5 per cent. on rateable value, with extras. Water may be supplied for domestic or other purposes by meter. Clauses are inserted for the protection of the Manchester Corporation in regard to their Thirlmere supply. In addition to the price of the undertaking, the sum of £6000 is to be raised for the purchase of land and the extension and improvement of the works. The Brighouse Corporation Act provides, among other things, that the water undertaking is to continue vested in the Corporation. A scheduled agreement with the Halifax Corporation dealing with the purchase of water in bulk from the Corporation is confirmed. The part of the borough known as Hove Edge is severed from the Halifax water limits. The Brighouse water limits are to be the borough. Not more than 20 acres of additional land are to be purchaseable by the Corporation, by agreement, for water-works purposes. Rates for domestic supplies are to range from 8 to 6 per cent. upon rateable value, with 10 per cent. for all inns or hotels, whether public or private. Water may be supplied for domestic or other purposes by meter. The sum of £10,000 is to be borrowed for the part payment of the principal moneys payable by the Corporation under the scheduled agreement and the extension and improvement of the water-works. Separate accounts of the water undertakings are to be kept.

The Chesterfield Gas and Water Board Act constitutes a Joint Board representing the Corporation of Chesterfield and the Urban District Councils of Whittington, Newbold, and Dunston, with the object of acquiring compulsorily the water undertaking of the Chesterfield Water-Works and Gaslight Company. The agreement or award is to state the amount of the purchase money attributable to the water undertaking. Conditions are inserted with regard to the supply of water by the Board to parishes outside the limits and within the jurisdiction of the Chesterfield Rural District Council. The Council have the right of purchase over parts of the undertaking so situated; but inasmuch as, in order to afford a proper supply to the parishes, additional works will have to be executed by the

Board, it is provided that the Board are to give notice to the Council of their resolve to construct such extensions, and require the latter to exercise the right of purchase. In the event of the Council refusing to take action upon such notice, the power of purchase in such case is to be suspended for 15 years. The sum of £15,000, besides the purchase money, is to be borrowed for water-works purposes. Surplus water revenue is to be applied in reduction of the rates for domestic supplies. Temporary financial assistance may be afforded by the water to the gas undertaking, and *vice versâ*.

The Clonmel Corporation Act contains provisions enabling the Corporation to supply water to consumers within one mile outside the borough, upon such terms as may be agreed on. The Edinburgh and District Water-Works (Additional Supply) Act enables the Trustees to construct additional works, comprising reservoirs in the parishes of Tweedsmuir and Liberton, with the object of obtaining a further supply of water from the River Talla, subject to the immediate duty of discharging down the stream compensation water at the rate of not less than four million gallons daily. During the ensuing seven years, observations of the amount of rainfall in the drainage area of the reservoir are to be taken; and thereafter one-third of such amount is to be discharged regularly and continuously as the corrected amount of compensation water. The undertaking of the Liberton Water-Works Company, Limited, is to be taken over by the Trustees at the price of £3375. The additional capital sum of £750,000 is to be borrowed by the Trustees. The Merthyr Tydfil District Council Water-Works Act authorizes the Council to construct an additional reservoir for impounding the waters of the Tâf Fechan. Certain compensations are to be provided to the commoners whose rights will be affected by the operations authorized by the Act. The construction of the existing Neuadd reservoir is confirmed. Rates for domestic supplies are to range from 8 to 7 per cent. upon rateable value. The sum of £120,000 is to be borrowed for water-works purposes.

"GAIN-SHARING, &c."

In last week's number of the Journal, passing mention was made of the issue by the Labour Department of the Board of Trade of a new report* by Mr. D. F. Schloss, of this department, as a supplement to his report on "Profit-Sharing," recently presented to Parliament, and commented upon at the time in these columns. The methods now dealt with by Mr. Schloss, are explained by Mr. H. Llewellyn-Smith, the Commissioner for Labour, as being systems of remuneration for labour (often confounded with profit-sharing) under which the employees are offered a bonus or premium not dependent upon the rate of profit earned by the business, but upon the saving effected upon a specified standard cost of production. It has been thought convenient to treat such schemes separately from profit-sharing; and the present report is believed to contain the first systematic account of them which has been published. This statement is a sufficient recommendation of the report to all interested in the labour question.

The difference between profit-sharing and "gain-sharing," as Mr. Schloss has happily called those systems which form the subject of inquiry on the present occasion, is fundamental. In any scheme of profit-sharing properly so called, the employee receives, in addition to his ordinary wages—the point is to be insisted upon, with reference to past controversy upon this head—a share of the profits of the business in which he is engaged. Under the systems now being considered, "systems which have been otherwise designated under the general name of progressive wages," the employee receives, as an incentive to the display of a special degree of efficiency, a bonus the amount of which is not governed by the profits or losses of the business as a whole, but is strictly proportionate to the extra activity, carefulness, and intelligence displayed by himself, measured by the reduction effected in the cost of production as compared with certain standard costs. "Thus, if the execution of a given piece of work usually occupies five hours, the workman may be told that, if he can get the job done in four hours, he shall receive by way of premium, in addition to the price of four hours' labour, reckoned at his accustomed rate of pay, the whole, or a definite fraction of the price of the time saved by the more than normal degree of efficiency which he has exhibited." This, in its most simple form, is an example of individual progressive wages; while the offer of a joint premium calculated upon the same principle to a group of workmen working together, would be an instance of collective progressive wages.

It must be admitted that the principle herein illustrated appears at first sight a more natural development of the wages system than profit-sharing. It is so, in fact; inasmuch as it appeals to the beneficiary in precisely the same way as the gains of business offer themselves to the employer himself. Apart from accidents, it is a truism to state that the gains of business to the business man will usually be very much what he can make them by his ability in, and attention to, his business. The apparent simplicity and directness of the principle, however, as applied to the remuneration of special efficiency in the workman, really conceals a good deal of difficulty and complexity in execution; and it has the great drawback of being at best of but temporary and passing operation. A moment's consideration also will show that the securing of gain, at any rate immediately, is not the complete purpose of the employer or head of a business possessing a permanent character. He has rather to build up and fortify his business, and much both of his work and care are not rewarded by actual gain, either present or deferred. So with the progressively-paid workman. After all, progressive wages are but wages—really a modification of payment by the piece—and no system of the kind can be held to be other than an attempt to cure one of the most glaring evils of the wage system without changing its nature or the status of those who are subject to it.

To return, however, to Mr. Schloss. He has to tell of six schemes of gain-sharing, which differ from one another in many details, but may be taken to embody the leading features of the type of industrial method in question. The first of these six schemes is one that was introduced some years ago—eight years, to be precise—by the Yale and Towne Manufacturing Company, of Stamford, Connecticut, who are makers of the well-known locks and cranes bearing their name. The second is in force in a Canadian factory, manufacturing rock drills, air compressors, and so forth. The remainder are English examples; the most important being the "Reference Rate" system of Messrs. Willans and Robinson, of Thames Ditton, and the "Good Fellowship" plan adopted at the Thames Iron-Works. The first scheme was described in a paper read by its author, Mr. H. R. Towne, before the American Society of Mechanical Engineers, and reprinted in full in the report. We cannot attempt to give particulars of this interesting experiment; but as it has since been abandoned in favour of a piece-work system, it must be regarded as having condemned itself. The workpeople and the employers both derived some advantage from it while it lasted. But the practical difficulty of standardizing efficiency in all the operations of a large factory was enormous; and the character of the premium offered under the scheme was discovered to be seriously defective. Mr. Towne thought at first that the device would prove more workable than profit-sharing; but he found he was mistaken.

The second scheme is known as Halsey's "Premium Plan." It consists in offering to the workman a premium on the time saved in doing a given job; it being a cardinal point with the author that the hourly premium is less than the hourly wages. The scheme is fully expounded in the report; and the results in four cases where it has been applied are stated to be satisfactory. At the same time, it is noted that the plan is of limited applicability. It seems to suit single-handed jobs of repetition work, such as turning out specialities by combined hand and machine labour; but "the limited range of Mr. Halsey's experiment, covering as it does only that part of the field in which the success of any such system as this 'premium plan' is most facile of attainment, makes it impossible to accept the results of his experience as conclusively demonstrating the general utility and applicability of his plan." Two other bonus schemes that come next in Mr. Schloss's list do not appear worth discussing.

Willans and Robinson's "Reference-Rate" system is a most interesting experiment, fully explained in the report. The scheme is decidedly complicated; and while the firm declare the results to be satisfactory on the whole, it shares the quality of Mr. Halsey's plan, in answering better for single-handed jobs than for work done by groups of men. Thus it is recorded that the men working in the firm's foundry have so far failed to earn any bonus, which in their case would be based upon the aggregate output. According to the Works Manager, this "Socialistic" arrangement, as he calls it, is ill calculated to promote that special efficiency which it is the object of the bonus scheme to evoke. It is admitted besides that the plan necessitates a good deal of book-keeping; and that the special class of work done by the firm facilitates their peculiar system of remunerating labour.

The "Good Fellowship" system of the Thames Iron-Works and Shipbuilding Company, Limited, was introduced by the Managing-Director, Mr. A. F. Hills, after a proposed profit-sharing scheme had been rejected by the workmen acting under the influence of the Trade Unions. The leading features of the scheme are payment by results, as contrasted with time-wage payment, and the collective nature of the system of remuneration. When the firm tender for a contract, the amounts reckoned as labour-costs are arrived at after consultation with the foremen of departments. If the contract is secured, the estimates are gone through in detail, and the job is divided into "takes," which are given to "Fellowship" groups to carry out. How the scheme is ultimately managed, can be seen by Mr. Schloss's painstaking investigation of its ramifications. The report is in this respect a monument of labour directed to the record and explanation of a most remarkable industrial experiment. The trouble that Mr. Hills must have taken in carrying his scheme out in almost every one of the multifarious departments of the Thames Iron-Works, argues strongly for the gravity of the antecedent labour troubles which it was designed to remedy. It is significant that this scheme shows to least advantage where the Willans and Robinson plan also breaks down—in the iron and brass moulding departments. Mr. Schloss, while regarding the scheme benevolently, does not think its advantages proved for either employers or employed.

* Report on "Gain-Sharing and Certain Other Systems of Bonus on Production," by Mr. D. F. Schloss. (Board of Trade, Labour Department.) London: Eyre and Spottiswoode, 1895.

On the whole, and after an impartial survey of all there is to note on behalf of these exhibitions of the gain-sharing principle we cannot say we like it, or see in the applications anything more than a well-meaning but mistaken attempt to secure the benefits of piece-work without the inevitable drawbacks. The principle, in its essence, is simply a means of inducing workmen to exert themselves more—to put forth a more strenuous effort, to produce more than the average or standard deducible by common observation and experience for the kind of labour, the time, and the men. There are no doubt many kinds of work, and of workmen, to whom this forcing process may be fruitfully applied; but is it the right thing to do, particularly as it cannot be done for all? It is admitted both by Willans and Robinson and by the Thames Iron-Works, that work in the foundry does not lend itself to the forcing system; and it is easy to understand the reason for this failure without dragging in fancy considerations concerning the effect of the "Socialistic" cast of foundry work. The rivetter may be speeded up by the prospect of earning a bonus; the moulder must take his time. Is then the moulder less worthy of encouragement than the striker? The opposition of certain Trade Unions to piece-work may proceed from mixed motives; but, so far as it is based upon an objection to "driving" the workman, it is wise and justifiable. What is wanted in the world is faithful, honest, reliable work; not specially fast, or even most profitable, production. It is for this reason mainly that we prefer the idea of profit-sharing to that of gain-sharing. That can be no satisfactory reformation of the conditions of labour which only takes account of the obvious producer—be he smith, or hoister, or rivetter. "They also serve who only stand and wait;" and the elevation of the wage earner will not be complete while a single door-keeper is overlooked in the operation. This consideration also supplies the best answer to those who (like Mr. Towne and Mr. Halsey) object that in profit-sharing workmen get a share in what they do not earn. It is, however, by virtue of the combined services of every individual in a particular employment that the eventual result is brought about; and it would be an error to divide these services into effective and non-effective branches. Nor, from what we can gather, does Mr. Schloss think differently from us in this matter.

AN UNFIT SURVIVAL.

It is recorded of the late Fleeming Jenkin that, when he took up his professorship of Engineering at Edinburgh, he ordered the removal from the library shelves of the University of all text-books and technical manuals more than ten years old. The rule here indicated is a sweeping one; and, of course, it has its notable exceptions. But it is a pretty safe guide to what is worth study in purely technical literature; and it needs a master to distinguish the exceptional books which are worthy of being kept for reference or reproduced from time to time by means of new editions. Unhappily, publishers of technical books are very unsafe guides in a matter of this kind. The interests of their trade are not always identical with those of the trades which form the subject of their books; and this is especially the case in regard to the reissue of old manuals, whether cold or *rechauffé*. This little book upon gas-fitting* is an example of the reproduction of a work that no skilled technician would have thought worthy of being reissued, at any rate without its being rewritten from end to end, and not merely "freshened up" in a totally inadequate fashion by the addition of an extra chapter or two purporting to describe the latest improvements in gas-burners. The book is not of sufficient importance to call for detailed criticism here; indeed, another volume of equal size would be required to expose the errors, and make good the deficiencies, of the original. Suffice it to say, that we cannot recommend the book as a safe or "up-to-date" authority upon the subject of which it professes to treat; and we are quite sure that it will not be put upon the City and Guilds of London Institute list of manuals suitable for the technical instruction of the student of either gas manufacture or plumbing. When we state that the first portion of the book gives an elaborate direction for making holes for service-pipes in gas-mains by the aid of the round-nosed chisel; and that, in the "supplementary chapter," the only regenerative burner illustrated is the oldest Siemens pattern, while the "Douglass" burners are described as having been "only recently placed upon the market," enough has been said to exhibit the quality of the whole publication. Why does not some competent gas company's inspector give the world an acceptable guide to gas-fitting?

Mr. Sydney J. H. Willey, youngest son of the late Mr. Alderman Willey, founder of the firm of Willey and Co., of Exeter, was married on Tuesday last to Miss Florence Alice Husson, younger daughter of the late Mr. J. F. Husson, of Kilmore, Pennsylvania. The employees of the firm with which Mr. Sydney Willey is associated, presented him with a barometer, thermometer, and clock combined, mounted in a handsome carved oak case, bearing a suitable inscription.

* "Gas Fitting: A Practical Handbook treating of Every Description of Gas Laying and Fitting." By John Black. Second Edition. Enlarged. Weale's Series. London: Crosby Lockwood and Son; 1895.

TECHNICAL RECORD.

SOUTH-WEST OF ENGLAND DISTRICT ASSOCIATION OF GAS MANAGERS.

Half-Yearly Meeting at Barry.

The Half-Yearly Meeting of the above-named Association was held at the Gas-Works, Barry, near Cardiff, on Tuesday last. Mr. F. G. Dexter, of Winchester, the President, occupied the chair.

A Welcome to the Association.

The President, in opening the proceedings, said that many arrangements had been kindly made for their reception and entertainment at Barry. He had to introduce to their notice Mr. Meggitt, the Chairman of the Water and Gas Committee of the Barry Urban District Council, and Mr. Jones-Lloyd, a member of the Committee.

Mr. J. C. Meggitt, addressing the members, said he wished to offer them a very warm greeting upon their meeting at Barry. He expressed the feelings of the whole of his colleagues on the Urban Board, when he hoped that they would have very pleasant experiences during their visit. Barry was of very recent growth. Eleven years ago, within a radius of three miles of the building where the meeting was being held, there were not 500 inhabitants where now there were 20,000. Such enormous progress was due to the commercial enterprise of those who had created the Barry Docks. It involved provision for the wants of the people, of which gas and water were most important items. The property of the Barry Gas-Works had until recently been owned by a Company; and it proved very profitable. The people of the district, however, had decided that, if profitable for a Company, the provision of these necessities might become even more profitable and serviceable if the town took it in hand. The Urban District Council therefore had acquired the Barry gas and water undertaking; and a magnificent property it was.

Mr. Jones-Lloyd endorsed the hearty welcome Mr. Meggitt had tendered to the Association. He remarked that, although Barry was new in some respects, it was old in others; for over on the Island they would find remains of a church which took them back 1100 years.

The President moved a vote of thanks to the representatives of the District Council, who had so kindly welcomed the Association; and he referred to the very complete arrangements made by Mr. F. M. Harris, the Engineer and Manager, for their entertainment. Their gratitude was, however, partly due to the members of the Urban Council for permitting him to undertake the work.

The vote was carried with acclamation; and Mr. Meggitt briefly responded.

Formal Business.

In the absence of the Hon. Secretary, Mr. W. Sainsbury, of Salisbury, read the notice convening the meeting; and the minutes of the meeting held at Winchester in April last were taken as read.

Scrutineers were then appointed to examine the ballot-papers for the election of officers for the ensuing year.

Mr. Sainsbury next read the items of the balance-sheet, from which it appeared that on the income side the balance from last year was £34 15s. 2d.; the receipts, £19 19s.; making a total of £54 14s. 2d. The expenditure for the year was £23 13s. 8d.; leaving a balance in hand of £31 0s. 6d.

The President moved that the statement of accounts be adopted.

Mr. H. F. Vincent (Frome) seconded the motion, and it was agreed to.

The Late Mr. Hardick.

The President said that, at their last meeting at Winchester, it had been their painful duty to chronicle the deaths of two active members of the Association; and at the present meeting again they had to mourn the loss of another one—Mr. Thomas Hardick, of Salisbury.

Mr. H. Sainsbury (Trowbridge) moved the following resolution: "That this meeting desires to express a feeling of sincere regret at the decease of the late Mr. Thomas Hardick, to record the high esteem and respect entertained for him as a Past President and member of the Association, and to convey a vote of sympathy and condolence to his sorrowing relatives." He remarked that the deceased gentleman was one of the fathers of the Association. He had reached the advanced age of 90 years; but until about three months before his death, he was at his post superintending the gas-works at Salisbury. They would all remember the kindly way in which Mr. Hardick treated them, and the value which always attached to his advice and assistance. He was present at nearly every meeting; and when anything was to be done which required special tact and judgment, it was always put in his hand. The memory of Thomas Hardick would always be green and fragrant in their recollection.

Mr. S. W. Durkin (Southampton) seconded the motion, and the meeting voted it by rising in silence.

ELECTION OF OFFICERS.

The PRESIDENT announced that the following was the result of the ballot:—

President.—T. W. R. White, of Sherborne.
Vice-President.—R. Beynon, of Torquay.
Hon. Secretary.—N. H. Humphrys, of Salisbury.
Auditor.—W. Higgs, of Basingstoke.
Members of Committee.—C. V. Bennett, of Wells; W. Davis, of Poole; and A. V. Daniel, of Portishead.

NEW MEMBER.

Mr. J. W. Turner, of Torrington, was elected a member of the Association.

PROPOSED AMALGAMATION WITH THE SOUTHERN DISTRICT ASSOCIATION.

Mr. D. IRVING (Bristol) moved, in the absence of Mr. Lowe, of Weymouth, the following resolution: "That this Association approves of the proposal for amalgamation with the Southern Association; and that the President, Mr. Irving, and the Hon. Secretary be appointed to meet a Committee of the Southern Association, to confer on the matter, and, if desirable, arrange terms." In a delicate matter of this kind, said Mr. Irving, it would be desirable he should not discuss details, and he would leave the matter with the meeting, only remarking that the passing of the resolution would not bind them to any final decision.

Mr. H. SAINSBURY, as one of the old members of the Association, seconded the motion. He agreed that the interests of the Association would be best served by not discussing the matter that day. Sometimes there was a good deal of overlapping between Associations, and he believed that amalgamation would help both Associations.

The resolution was carried unanimously.

NEXT PLACE OF MEETING.

The PRESIDENT said they could not yet fix the next place of meeting because the newly-elected President was not present. He suggested the matter should be left to the Committee.

MR. DURKIN'S PAPER.

Mr. DURKIN then read a paper entitled—

THE WANT OF MUTUALITY BETWEEN VARIOUS AUTHORITIES USING THE SUB-SOIL OF PUBLIC ROADS.

It has often occurred to me when giving notice to local authorities in our district, before breaking ground for the purposes of my Company, that the law was very one-sided in this matter, compelling us to give specific notice of our intention to the surveyor of the borough or district council, as the case may be. In our district, the names of these is legion; our mains running into so many parishes or places outside the county borough. These various authorities grant permission to all sorts of persons to open the ground for different purposes, without affording gas undertakings the opportunity of taking precautionary measures, to prevent mishap to their pipes.

I confine my remarks to gas-pipes, as they require safeguarding to a larger extent than water-mains; because, owing to the nature of their contents, one can hardly specify the amount of damage that may accrue from accidental breakages.

In our time, I daresay we have had many hair-breadth escapes, arising from damaged mains and service-pipes, from causes beyond individual control—such as those terrors by day, the steam-roller, sewerage works, &c. One instance is fresh to my mind. An escape of gas was reported in a certain busy street, in which there was a main on either side. As the gas found vent at a gully, the main nearest to it was stripped, but revealed nothing. Still the gas was in evidence; and precautionary measures were taken to prevent an accident. From some local knowledge of the drainage system, I recollected that the surface drains were distinct from the sanitary system. But, being late in the evening, no information was obtainable as to the position of these surface drains until the next morning; and then, owing to changes in the staff of the sanitary authority, the information given was not very satisfactory.

However, the Inspector of Works pointed out that a branch sewer had been laid on the opposite side of the street, close to another gully. Instructions were at once given to open the ground over the main across this branch sewer cutting. In doing this, the overflow from gully No. 2 was found sunk and broken from the subsidence of the sub-soil; the rainfall doing what the jerry sewerman (who I believe was a joiner by trade) had left undone. The sub-soil sinking broke the drain; and our gas-main followed suit—the escaping gas finding its way into the fractured drain-pipe, following its course down and across the street, and up to gully No. 1., which was unsealed. Fortunately, no accident occurred, and matters were soon put right. A claim was sent in to the jerry sewerman, which claim he ignored, stating, as a reason, that he had paid a deposit of 10s. at the Borough Surveyor's office, and that the deposit had been returned to him on the presumption that he had done his work in a satisfactory manner. This is only one of many instances in my town, as well as others, going on year in and year out, and of which, I contend, we should have had intimation. As some safeguard, our lamp lighters are instructed to report on these matters to the street inspector; but I cannot say they do so at all times.

In these days of so-called advancement, we have to face fresh difficulties. Take, for instance, tramways. A very stringent clause has been inserted (33 and 34 Vict., cap. 78, clause 30) for the protection of those who use the sub-soil for various purposes. Yet, on several occasions, I have had to assert our legal position with the local Tramway Company, whose Engineer first disputed the position taken up, but afterwards acknowledged the mutuality of our relative positions. Then we have the Electric Light Company to deal with. In this case, we have recognized our mutual responsibilities, and serve notices on each other. But, in the first instance, I had to be very firm; and I prevented them from covering over a main with their culvert, as, under the powers of the General Act, the Board of Trade had inserted in the Licence provisions to ensure access to gas-mains, &c. Then again Railway Officials will sometimes ignore the mutuality of our respective obligations, and need watching. I have also known that officials in different departments of the Sanitary Authority do not recognize the controlling department of the public roads.

I feel that, for want of time, I have not done this subject full justice; but, in bringing my remarks to a close, allow me to call your attention to the judgment recently delivered in London in the case of *Price v. The South Metropolitan Gas Company*. His Honour considered negligence had been established—first, in that the defendants had not discovered the fracture by the smell of the escaped gas, and also in not seeing that their pipes were left properly supported after other persons had, to their knowledge, been excavating and working around them.* There, gentlemen, by that judgment, you are supposed to know what is going on in your several districts; and it is your responsibility to deal with these matters, whether you know of them or not. Whether the defendant Company did know of the disturbance or not, leave was given to appeal against this judgment; and I trust it may be reversed.

In conclusion, it appears to me that a short Act of Mutuality might be passed, to enforce notice to be given by all parties who have powers of disturbing the soil for legalized undertakings. What your views may be, I know not, but now you have an opportunity of expressing them.

The PRESIDENT, after the reading of the paper, said the question dealt with was a very important one, particularly for gas companies as distinct from gas and water companies. He had himself recently had a case in which the overhauling of drains had resulted—through the under side of the gas-pipes not being properly protected when the subsoil was replaced—in the breakage of gas-pipes, the escape of the gas, its lodgment in a a man-hole, and subsequent explosion—tearing up the roads. He suggested that, in view of the importance of the question and the small attendance at the present meeting, the discussion should be postponed to the next meeting.

This was agreed to.

Mr. J. H. CORNISH (Bridgwater) proposed, and Mr. J. J. JERVIS (Swindon) seconded, a vote of thanks to Mr. Durkin.

The motion was carried; and

Mr. DURKIN, in acknowledging the vote, remarked that his paper was merely introductory to a very large subject.

VOTES OF THANKS.

On the motion of Mr. IRVING, seconded by Mr. J. H. GREY (Weston-super-Mare), a vote of thanks was passed to the retiring President, for the tact, energy, and organizing ability he had displayed during his occupancy of the chair.

The PRESIDENT expressed his gratitude for the vote, and moved a similar resolution in regard to Mr. Harris, for the large amount of trouble he had undertaken in connection with the meeting of the Association.

Mr. DURKIN seconded the motion; and the vote was accorded with applause.

Mr. HARRIS briefly responded; and the formal proceedings terminated.

Subsequently the members inspected the Barry Gas-Works and the Barry Docks; and they afterwards drove over to Barry Island. Later in the evening, they dined at the Barry Hotel.

Mr. F. M. HARRIS thoughtfully prepared a few notes referring to the gas and water works, the docks, and the new graving dock, so as to give the members some idea of the rapid extension of the district during recent years. He said: Before the commencement of the construction of the Barry docks and railways, the population of the district was a very small one; certainly not exceeding 1000 people in all, and probably much under this number. At the beginning of the extensive works connected with the docks, a large number of workmen flocked to the district; and the contractors for the docks had to erect houses for them. But the centre of the district, now the most populous, was not built upon until after the opening of the railway in 1889, as the carriage of building materials was too costly before this date. The capital of the Gas and Water Company authorized by their Act of 1886 was only a small one. But it was imperative to commence operations; and as indications became apparent that the place was likely to grow rapidly, the main object for consideration was to obtain as much land as the Act permitted, and, in the case of the gas-works, to erect a few buildings as large as possible, but arranged to allow of easy

* See JOURNAL, Vol. LXV., p. 1385.

extension. This course was followed with the other plant; and the mains were laid as large as possible. The principal building, the retort-house, measures 100 feet by 73 feet, and now serves the double purpose of retort-house and coal-store combined. But ample space has been reserved on the ground for the erection of a new coal-store; also for the extension of the retort-house and other buildings, and for additional gasholders. The population of the district has increased from about 5000 to over 20,000 in five years; and the gas consumption has about doubled during the past three years. It is expected that it will soon attain to 50 millions and more. The water supply is from a well sunk at Biglis, about three miles from the gas-works. The water is pumped by vertical high-pressure triple-expansion direct-acting "Worthington" condensing engines into the high-level and low-level reservoirs. The height of the water in the reservoirs is communicated by electrical indicators to the pumping-station, and to the Engineer's office at the gas-works; and the pumping can be regulated accordingly. The Barry dock is the largest single dock in the world; and it contains the most modern plant of any existing dock. The dock gates are opened by direct-acting hydraulic rams, 26 feet stroke and 30 inches diameter. The whole of the tips, capstans, and other appliances are actuated by hydraulic power. The shipments of coal from the dock have now attained to about 5 million tons annually. The deep-water lock entrance, when completed, will give Barry an advantage over any docks in the Bristol Channel; and besides this, an extensive import dock is in course of construction, as well as a new railway called the Vale of Glamorgan Railway, which will open up an entirely new district. The Barry Graving Dock is an undertaking independent of the Barry Dock Company; but it is connected to the main dock, and like the Barry dock contains the most modern and approved appliances. It will dock a vessel, if required, up to 700 feet in length. The centrifugal pumps are capable of delivering 40,000 gallons of water per minute. Barry can thus claim to be probably the most progressive town—if not in England, certainly in the South-Western district of the United Kingdom.

Lectures on "Gas Manufacture."—The Committee of the Goldsmiths' Institute, New Cross, have arranged to give a course of lectures on "Gas Manufacture;" and the session will be opened on Friday evening, Oct. 4, with an introductory address by Mr. A. Vernon Harcourt, F.R.S.

The Autumn Meeting of the Incorporated Institution of Gas Engineers.—The programme for this meeting has now been issued; and it promises full employment for the members on Thursday and Friday of next week. An early start on the former day—9.50 a.m. from Lime Street Station—is to be made for the Garston Gas-Works of the Liverpool United Gaslight Company, to see the carburetted water gas plant and other special features of the place. Brakes will then take the members through Sefton Park to the Herculaneum Dock; and an inspection will afterwards be made of the plant working the Electric Overhead Railway between Nelson Dock and Pier Head Stations. The tender of the Cunard Company will at 3 o'clock convey the party to look over the R.M. steamer *Lucania*, accompanied by the General Manager of the Company, Mr. Thomas Boumphrey. At 7 o'clock, the members are invited to dine with the Chairman and Directors of the Liverpool Gas Company. On Friday, a visit will be paid to Chester—travelling *viâ* the Woodside ferry-boat to Birkenhead. After an hour and a half spent in the ancient city, and luncheon at the Grosvenor Hotel, there will be a trip by steamer on the River Dee as far as Eaton Hall, the seat of the Duke of Westminster. All the six stations of the Gas Company will be open to members during the two days; so that everything has been done to make the visit both instructive and interesting.

Institution of Civil Engineers.—In accordance with their custom, the Council of the Institution have issued a circular inviting original communications on subjects of professional interest for the session 1895-6. A number of suggestions for papers—66 in all—are supplied; but the list is not, it is pointed out, in any sense exhaustive. Many of the subjects mentioned are more or less interesting to our particular class of readers. Among them are: "The Methods of Enriching Coal Gas, and their Effect on its Calorific and Illuminating Values;" "The Production and Enrichment of Water Gas;" "The Recent Developments in Gas-Engines and Oil-Engines, including a Comparison of the Relative Merits of the Several Cycles, with Reference to 'After-Burning';" "The Application of Oil and Gas Engines to Tractive Purposes on Common Roads and on Tramways, and to the Propulsion of Vessels;" "The Methods of Conveying and of Using Natural Gas;" "The Modern Methods of Pumping, Compared as to Cost and Efficiency;" "The Use of Steel in the Construction of Large Water-Tanks;" and "The Purification of Large Quantities of Water after its Use in Manufactories." Several subjects dealing with electrical matters are suggested, in one of which gas and water engineers are specially concerned—viz., "The Electrolytic Action of Return Currents in Electrical Tramways on Gas and Water Mains, and the Best Means of Providing against Electrical Disturbances." For approved papers, the Council may award premiums, arising out of special funds bequeathed for the purpose, particulars of which are given in the circular.

EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.

Meeting at Wisbech.

The Fourteenth General Meeting of this Association was held last Thursday, at Wisbech, under the presidency of Mr. C. W. Grimwood, of Sudbury. Thanks to the assistance of the Manager of the local Gas Company (Mr. R. J. Sharman), admirable arrangements for the day were made by the Committee. The members first assembled at the gas-works, where light luncheon was provided by the kindness of the Directors of the Company. The works were inspected by the visitors, who appeared to be much struck by the neatness which everywhere met the eye, and especially by the flourishing condition of Mr. Sharman's orchard and garden adjoining the works, which would disabuse the most sceptical mind of the belief that vegetation will not thrive in proximity to gas-works.

The meeting was subsequently held in the Town Hall; and before the business on the *agenda* was proceeded with,

The President introduced to the members the Mayor of Wisbech (Mr. A. W. May).

The Mayor said it gave him great pleasure in being present at the meeting. He esteemed it no small honour to have the privilege of welcoming the Association to the borough; and this, in the name of the burgesses, he did most heartily.

Confirmation of Minutes.

The Hon. Secretary and Treasurer (Mr. H. Wimhurst) read the minutes of the meeting held at Sudbury in May last; and they were confirmed.

New Members.

The following gentlemen were elected members of the Association: Mr. H. Keirman, of Thorney; Mr. R. G. Shadbolt, of Grantham; and Mr. H. Green, of Market Rasen.

Thanks to the Mayor.

The President said their next duty was to pass a vote of thanks to the Mayor for so kindly gracing the meeting with his presence, and for lending the Association the Chamber in which they were meeting. On behalf of the members, he might say they sincerely felt the honour his Worship had done them in welcoming them; and he begged to thank him most heartily for doing so.

Mr. J. Carter (Lincoln), in seconding the motion, said it was not at all an unusual experience for the Association, as they visited the various towns within their district, to receive a hearty welcome from the gentlemen who had been elected to fill the highest positions of civic honour in these towns. The members had highly appreciated what those gentlemen had done on previous occasions; and they equally highly appreciated what the Mayor had done that day.

The Mayor, in acknowledging the kind way in which the members had accorded him the vote of thanks, said he anticipated having an opportunity later in the day of again referring to the honour done him in inviting him to be present at the meeting.

Letters of Apology.

The Hon. Secretary reported having received letters of apology for absence from Mr. W. R. Chester, the President of the Incorporated Gas Institute, and from some of the members who were unavoidably prevented from attending.

Regenerative Systems of Firing for Small Works.

The President said the Secretary had taken an immense amount of trouble in sending letters to the members, in order to obtain a suitable paper for this meeting; but owing to circumstances over which he certainly had no control, he had been unsuccessful. This being the case, at the last meeting of the Committee, it was suggested that, failing a paper, they must inaugurate discussions on matters that might be of use to the members. The Committee therefore decided to introduce three subjects for discussion—viz., (1) The incandescent system of supplying the public lamps; (2) regenerative systems of firing; (3) the manufacture of sulphate of ammonia in small works. They had hoped that Mr. Joliffe would have been present, as he had recently introduced the incandescent system for public lighting in a large way at Ipswich. They were still hoping that he might, later on, arrive in Wisbech; so that they would pass over the first subject for the present, and take the next one—on the regenerative system of firing.

Mr. A. Drage (East Dereham) said that, at the last meeting at Sudbury, he read a paper on gas-works construction, in the course of which he mentioned regenerative furnaces. He then remarked that he found, in a bench of sixes which he now had, with nozzle holes in the top of the arch, that the top retorts got cut away; and, on this point, there was a little discussion. Some of the members said that the centre retort was protected, and could not be destroyed; but he said he did not know what would happen to a centre retort in a bench of seven. His experience was that the top or centre retort usually suffered most from the cutting action of the heat. At the Ipswich meeting, Mr. Best read a paper in which he gave some information as to air passing in through a patent brick that he had; but there was not sufficient reason given as to why he required this supply of air. By cutting a way through the nozzle holes,

he (Mr. Drage) had done away with the arch altogether. He could not see why these arches should be put in, when it was said that, what they required to have, was a large combustion chamber. Mr. Child told them at the Yarmouth meeting that he had adopted the late Mr. Somerville's patent setting. He (Mr. Drage) had these settings; but Mr. Somerville's son had a patent setting, in which were two arches. Why he had these two arches when the combustion chamber should be as large as possible, he could not conceive. He found that he obtained the best results by taking the arches completely out, and allowing the heat to play freely through the furnace.

Mr. C. Green (Market Rasen) said his experience had been with generator furnaces on Drake's principle. They formerly worked three beds of fives on the ordinary system. At this time of the year, however, they used a bed of threes without generator furnaces, and during the heavy part of the winter a bed of sevens. They made 9900 feet of gas per ton of coal during the past year, without an exhauster. If they tried to push the make, it would run to about 7000 feet per retort per day. Their place being a small one, they did not always want the retorts all charged. He found, in the bed of sevens, that the middle retort was as good as ever. The past year had been an excellent one for his Company. They had been used to a dividend of 1½ per cent.; but this year they had paid 5 per cent., and, in addition, £160 to Messrs. Drake and Son. He might mention that the retorts were 22 inch by 15 inch and 9 feet long.

Mr. W. J. Best (St. Ives) said that, seeing Mr. Drage had attacked his secondary air supply, he might say that the object of introducing this secondary air was to get complete combustion in the retort-setting. At many works he had seen the flames from the furnaces playing about the tops of the chimneys, which showed that combustion was taking place there rather than in the furnace itself. But, with the secondary air supply, he found there was better combustion, the charges were burnt off much quicker, and there was a less consumption of coke than with the ordinary furnace.

Mr. A. Mitchell (Bury St. Edmunds) said he had had no experience with regenerative furnaces beyond that which one might have by general knowledge of what these furnaces had done and were doing. They must all agree that the use of the regenerative furnace for the carbonization of coal had passed the experimental stage; and that it was an improvement on the ordinary method of firing had passed the stage of discussion. The regenerative system of firing appealed to each individual, whether it was worth while adopting it in his own works. The whole question seemed to him to lay in this: There was a considerable additional capital outlay in putting down the regenerative system over that of the old-fashioned direct system of firing; and in many gas-works in the Eastern Counties it was just possible it would not be economical to pull down the stacks of retorts—more especially in towns where they were non-progressive—and construct a new system. In these cases, it was a question of pounds, shillings, and pence; and, in all likelihood, it would not pay to pull down and rebuild for all the benefit that might be derived. No two gas-works were alike as far as their conditions were concerned. In many works in the Eastern Counties, they had ample gas-making power; and under the direct system of firing, they found they had sufficient retorts for years to come without altering the system. On the other hand, by introducing regenerative firing, they would economize largely in the matter of fuel. This was just the point, whether it would be, under these circumstances, worth while incurring this outlay for all that the increased saving of fuel would bring in. He knew that, from the ordinary scientific way of looking at things, this was not the proper light in which to regard the matter; but in works of the description in their district they must consider the question of pounds, shillings, and pence. If they produced, by means of regenerative furnaces, more coke for sale than they could get rid of, they would have to reduce the price; and he did not see, in that case, where the gain would come in. Then Mr. Green had pointed out that with his regenerative furnaces, he was not able to have continuous working. Now he (Mr. Mitchell) maintained that, if he could not have continuous working because of the regenerative settings, it would have been far better to have kept to continuous working with the old settings, because he might in this way be consuming as much fuel as on the old lines for the amount of gas produced. Then it was no use for a manager to go in for a higher result per mouthpiece if he had not ample gasholder accommodation, because in a bed of (say) six retorts making 45,000 cubic feet per 24 hours, this 45,000 cubic feet would perhaps represent an extraordinary addition to the previous make and consumption of gas; so that, unless the manager had ample storage, he would simply have to fill his holder up, and then lay off. It was therefore a matter for each one to take up, and find out whether there would be any benefit in introducing a new system which would give him 45,000 cubic feet per day, or stick to the old system by which he obtained (say) 24,000 feet, which his consumption and gasholder capacity could cope with. However, he freely admitted that the regenerative system was not only an economical one, but scientifically a vast improvement on the old method.

Mr. J. G. Hawkins (Spalding) believed that regenerative firing was the proper system, supposing the works were of sufficient size to warrant its adoption, because (as Mr. Mitchell had pointed out) it was of no use making gas if they had not the place to store it. It resolved itself into this—Did they make more gas per ton of coal when firing on this principle than on the ordinary system? It was just possible they did, because if the retorts were kept at a uniform heat, and were worked regularly, he thought they must get a larger yield; and this was what they must look at when considering the kind of firing they should adopt.

Mr. J. Barton (Peterborough) said that, though he had not had any experience of regenerative gas-firing, he believed that the system was the correct one, whether the works were small or large. There could be no question that the saving in fuel was very considerable with regenerative firing; and, moreover, they had greater control over the heating of the retorts. He believed they obtained better and more constant heats; and so there could be no question that the results per ton of coal were better, and the illuminating power of the gas more uniform. It had often puzzled him why there should be such variations in the quality of the gas with the old system of firing. Using precisely the same coal from one day to another, there would be a great variation in the illuminating power—all the conditions being the same, except the heats. He had often noticed that, when the heats of his retorts were lower than they ought to be, the quality of the gas was not so good as he should have liked. He was quite convinced that any neglect that might arise on the part of the stokers in letting down the fires and their heats (as many of them did) was frequently the cause of the quality of the gas suffering. They could only get uniform heats by using regenerative furnaces; and there was a considerable saving of fuel. He firmly believed that it would pay every gas manager, no matter what was the size of his works, to adopt the regenerative system. He was himself putting in four furnaces this year.

Mr. Wimhurst said that he had lately gone in for regenerative firing, for Sleaford, on a very extensive scale. He had adopted Winstanley's system; and they had put down a plant capable of making from 160,000 to 200,000 cubic feet per day. Whether he would reach the maximum figure, he could not say; but he was hoping, during next winter, to get through with a make of 7000 to 8000 cubic feet per mouthpiece per 24 hours. If the figures given by Mr. Winstanley could be relied upon, they could readily make, at a push, 9000 feet, with 21 in. by 15 in. ovals, 10 feet long. In all probability, the members would have an opportunity, in the course of next month, of visiting Sleaford, to see what was being done in this respect, and also other extensions. By that time, they would have the whole of the new plant at work, and possibly by then he would be able to give a few figures as to the results obtained. He was sorry he had not been able to get the works finished, so that they might have adjourned from this meeting to visit them. But the contractors were delayed very much indeed through the severe weather in the spring; and, consequently, they were about two months behind the proper time. He hoped, on some future occasion, to give the Association a paper on this installation of regenerative settings. He believed the regenerative system was the one to adopt not only in large but in small works. Mr. Mitchell had spoken about the plant standing off when there was no holder room. He (Mr. Wimhurst) thought this was one of the chief features—that they could damp down or check the regenerative furnaces much more than in the ordinary system. The air supply could be fully shut off, and the heat maintained for 24 or 48 hours, without any apparent injury. This was one of the beauties of the system; and he only hoped that what they had done at Sleaford would meet with its reward.

Mr. J. Mason (Oakham) mentioned that he had just had two beds of retorts constructed on the regenerative system.

Mr. Green asked to be allowed to add that, during the past winter, through having the regenerative setting at work, he had been able to do without a night man altogether, which saved 11s. a week for six months.

Mr. T. Greaves (Melton Mowbray): You say you obtain 9900 cubic feet of gas per ton, without an exhauster. What coal do you use?

Mr. Green: Strafford and Barrow nuts. Replying to Mr. Troughton, he said he could not give any figures regarding the fuel account, because they were often firing when they did not want to use the retorts; but the air-flues were then closed, so that little fuel was used. He knew that they were saving a great amount.

Mr. Wimhurst: The patentee of the system put down at Sleaford guarantees that the percentage of fuel shall not exceed 10 lbs. per 100 lbs. of coal carbonized.

Mr. Barton said one point struck him with reference to Mr. Drage's remarks. He mentioned that he had a cutting action on the top retorts; and he would suggest that this might result from the nostrils being too small. He had perhaps too much primary or secondary air, which caused a cutting draught through the nostrils, which, of course, must cut away the retorts next to the nostrils. He (Mr. Barton) put down a generator furnace last year; and he had had this experience. He found the nostrils were too small; and, since he had enlarged them, he had had no trouble. The nostrils were previously 4 inches square; now they were about 6 inches.

Mr. Drage stated that he had found a cutting action through the nostrils, which were 4½ inches square; but since he had removed the arch, the cutting had ceased.

The PRESIDENT, in closing the discussion, remarked that he was, a few months ago, at the Croydon Gas-Works, and there he saw Mr. Winstanley's system in operation. They were very pleased with the results there. When they found works of this magnitude adopting the system, they could not but come to the conclusion that it must be a good one. There was a little works in the vicinity of the town in which he lived where the system had been adopted during the past summer; and he hoped to benefit by their experience.

THE MANUFACTURE OF SULPHATE OF AMMONIA ON SMALL WORKS.

Mr. SHARMAN opened the discussion on the above subject. He said his Directors went thoroughly into the question of manufacturing sulphate of ammonia some thirteen years ago. They came to the conclusion that it would be for the benefit of the Company to undertake it; and he believed the facts he was able to lay before the members would bear that out. After visiting several works, the Directors adopted the simple plant which was now in operation. Of course, being a small works, they could not carry on sulphate manufacture continuously. They worked in the winter time three days a week, or every other day; and with the liquor at a fair strength—4° Twaddel, or 8-oz. liquor—they could average a production of 15 cwt. of sulphate per day. It took about 2000 gallons of liquor to produce this quantity. They used, per ton of sulphate, 18 cwt. of acid; and the cost of the fuel and lime he put together at 8s.—the coke at 7s. 4d., and the lime at 7d. This made the cost so far £3 11s.; but the total cost of manufacturing a ton of sulphate including labour for unloading acid, revivifying oxide, and emptying purifiers, was £4 8s.—including acid and everything. In 1894, they made 32 tons of sulphate from 3200 tons of coal, which was equal to a ton of sulphate per 100 tons of coal. This, with the system he had at work, was, he believed, up to the average. They netted for the 32 tons rather more than £250. He had made an estimate of the value of the liquor. He took the weekly prices quoted in the JOURNAL OF GAS LIGHTING, and worked out the average, which was 11s. per ton for 10-oz. liquor. His liquor being only 8-oz. he deducted a fifth, and then allowed a little more margin, having taken the highest prices. It was frequently quoted at a difference of about 2s. 6d. per ton; and valuing his liquor at 8s. per ton, it came to £135 12s. Then, after making a deduction for fuel—about £12 or £13—he had left rather more than £100 clear profit over what he would have realized had he been selling his liquor. This, he thought, was a very good result for a small works like theirs; indeed, it seemed to him to be a handsome profit—representing 1d. reduction in the price of gas. There was one thing a manager had to take into account when he was considering the adoption of sulphate plant; and it was that, in some places, there would be great difficulty in getting rid of the refuse. At Wisbech, he was in such a position that he had not to contend with this difficulty. They got rid of the condensation from the gas in a well, as they could not discharge it into the public drains, being prohibited by the Local Government Board inspector. The waste liquor, after it was boiled and cooled down, was not detrimental to them at all. In places where there was no system of drainage, there would be a difficulty. To run it into a stream would be undesirable; but in a tidal stream, perhaps it would not matter. He most decidedly advised all managers of works making over 20,000 cubic feet of gas a day, to go in for the manufacture of sulphate. Anyone beginning now would no doubt put down plant which would excel his; and perhaps the same acid would not be used. He employed B.O.V. acid; and they made white sulphate. Of course, they could buy acid cheaper; but he would not get that quality of sulphate which he liked to send on to the market.

Mr. BARTON said they manufactured sulphate at Peterborough, and had done so for many years. But he should certainly not advise any gas manager to go in for its manufacture at the present time. With the price of sulphate so low, there was nothing in it. The results obtained by Mr. Sharman were very satisfactory; and no doubt the business paid them at Wisbech as it did his Company at Peterborough. But he (Mr. Barton) did not know that it would pay a small works to put down plant, and attempt to make sulphate just now. When the price ran up to £12 or £13 per ton, then he would advise them to go into it at once. He did not suppose they could get more than £9 for sulphate now; and, calculating the liquor at 7s. or 8s. a ton, he should say it would be better to sell the liquor than to make sulphate.

Mr. J. CARTER (Lincoln) said Mr. Barton's remarks did not fill him with any great amount of encouragement, because he happened to be in the position of starting a sulphate plant in the coming week. He was wondering how far Mr. Barton's argument would answer, because he presumed that, if the market for sulphate of ammonia was depressed (as it had been for some months past), the market for ammoniacal liquor would decline in precisely the same proportion, seeing that the liquor was only bought for the manufacture of sulphate.

Mr. BARTON explained that what he stated was that, if 7s. or 8s. per ton could be obtained for the liquor, he should not advise the putting down of sulphate plant at present prices; but if there was any difficulty in getting rid of the liquor, then he should say put down a plant. Sulphate at £9 per ton was like getting change for a sixpence. If the price increased, and anything above £10 per ton could be obtained, then it would be profitable. But, when they took into consideration the cost of the plant, the wear and tear, the anxiety attending the manufacture, and all the rest, really at present sulphate was not worth making; and it would be better to leave it to those who were already in the business.

Mr. WIMHURST asked Mr. Sharman what profit he made per ton of sulphate.

Mr. SHARMAN replied that the net profit was about £8 per ton—that was, less the fuel (which he deducted afterwards), about £7 10s.

Mr. WIMHURST said the price he was obtaining for liquor, under a contract expiring at the end of December next (which he should try to get renewed certainly to Midsummer), was 12s. 6d. per ton for 12-oz. liquor, and 11s. 3d. for 11-oz., at the works. This would bring them in this year about £150. If he turned this liquor into sulphate, allowing £6 per ton clear profit, it would only produce £132; so that they would be in the position of losing £18 a year, and the interest and wear and tear on the sulphate plant.

Mr. SHARMAN pointed out that Mr. Wimhurst was quoting on the present market price. Sulphate had been low for the last three or four months; but it was not so low at the first part of the year. The price he had obtained was higher than that mentioned by Mr. Barton. The market had been low before, and had again gone up; so that it was necessary to take one year with another. If the price of sulphate continued at the present low rate, many works would find it difficult to sell the ammoniacal liquor at all, on account of the cost of carriage. It would then be better to put up a small sulphate plant.

Mr. WIMHURST remarked that they had often been surprised at getting the price they had for liquor. They had obtained shillings more than their neighbours, although there was the same railway rate to pay.

Mr. MITCHELL pointed out that Mr. Sharman had mentioned, in his reply to Mr. Wimhurst, £7 to £8 per ton as the net profit; but, in his opening statement, he gave them the round figure of £100 as the profit obtained by manufacturing 32 tons of sulphate. [Mr. SHARMAN: After deducting the value of the liquor.] The figures £7 to £8 were misleading. What he had realized was £3 per ton, as compared with selling the liquor. All things being equal, and if the spent liquor could be disposed of without nuisance, it was bound to pay the gas manufacturer better to make sulphate than to sell the ammoniacal liquor, as somebody had to defray the carriage on it; and, as chemical manufacturers had not turned philanthropists, the gas company must get a lower return from their liquor by selling it. Mr. Barton had advised them, if they could get 7s. or 8s. per ton for the liquor, not to make sulphate while it was at £9 per ton; but, if sulphate continued at this figure, chemical manufacturers would not give them 7s. or 8s. for the liquor next year. The plant Mr. Sharman had in use was simplicity itself; and Mr. Hawkins had assured them that, in years past, he had realized as good results by similar plant as were obtained with the best plant of the present day. If this were so, it was no use going to the expense of the new type of plant.

Mr. SHARMAN mentioned that gas liquor was quoted in the JOURNAL for Sept. 10 at 6s. 6d. to 7s. 6d. per ton.

Mr. DRAGE stated that it had been proposed to put sulphate plant down at the East Dereham Gas-Works; but as there was some difficulty regarding the disposal of the spent liquor, the idea was abandoned. He was obtaining 6s. 6d. per ton for ammoniacal liquor; but, from the figures Mr. Sharman had given, he believed it would pay anyone to manufacture sulphate. He suggested that something should be done to make known to agriculturists in the Eastern Counties the value of sulphate of ammonia.

Mr. CARTER said the real question appeared to him to be this: If it would pay the manufacturer to buy the ammoniacal liquor of the gas company, and pay the heavy carriage, how came it that there should be any doubt as to gas companies working it up, when they had no carriage to pay?

Mr. HAWKINS thought the point that had to be considered, when it was proposed to enter upon sulphate manufacture, was whether or not they could keep the plant regularly going. Unless this could be done, instead of making 32 lbs. of sulphate per ton of coal (which was what ought to be produced), they were more likely to get only 20 lbs. This being so, it would be readily understood why manufacturers could pay for the conveyance of the ammoniacal liquor to their works, and make a profit on the sulphate, while small gas companies could not. He had no difficulty in keeping his works going regularly, and making 32 lbs. of sulphate per ton; but if less than this were produced, sulphate was being lost.

The PRESIDENT thought, in connection with this question, that the present outlook was a serious one. It was a matter that affected him personally. The price he had been receiving for ammoniacal liquor during the past two or three years was 1s. per barrel, loaded on to railway trucks. It cost him 3d. for cartage; and taking 1d. for filling, bungs, &c., left him only 8d. per barrel. He had been supplying 14 oz. liquor at 1s. per barrel; but the manufacturer had written to say that he could not now afford to give him this price. With regard to making sulphate of ammonia, unless the plant could be kept continuously at work, they could not get such good results as they would do

otherwise; and it was the same with other kinds of plant. He had consulted a friend who carbonized about 1400 tons of coal per annum—the same as he (the President) did—and he had given him the following figures as to the cost of manufacturing sulphate of ammonia:—

Coal carbonized per annum, 1400 tons.			
Sulphate made, 20 lbs. per ton, or 12½ tons, at £10 per ton	£125	0	0
Cost—			
Acid, 18 cwt. per ton of 1·750 sp. gr., on 12½ tons	£ 39	7	6
Labour, 20s. per ton, on 12½ tons	12	10	0
Fuel at 12s. 6d., including packing sulphate	7	16	3
Bags, 125 at 3d.	1	11	3
Cartage from works to station, at 2s. 6d. per ton	1	11	3
Wear, tear, and depreciation on £225	22	10	0
Interest, 5 per cent. on £225	11	5	0
	£ 96	11	3
Leaving for liquor	28	8	9
	£125	0	0

The manufacturing expenses worked out to £7 14s. 6d. per ton of sulphate, which was sold for £10. The liquor thus produced £28 8s. 9d. without charging anything for superintendence; and his friend was pleased to get this. He (the President) received for his liquor in 1892, £25 11s. 4d.; in 1893, £36 10s.; and in 1894, £38 10s. This made together £100 11s. 4d., or an average per annum of £33 10s. 5d. The expenses on this were: Filling barrels, bungs, &c., £5 16s. 8d.; and cartage, £8 15s. This made £14 11s. 8d. per annum; and left him £18 18s. 9d. for the liquor made out of 1400 tons of coal. Mr. Hawkins said that as much as 35 lbs. of sulphate could be produced from a ton of coal. Mr. Newbigging put the quantity at 28 lbs., or 1¼ tons per 100 tons of coal, which would work out to 17½ tons of sulphate from the coal he carbonized in a year. From a catalogue which had been recently furnished to gas managers, some figures were given as to sulphate manufacture which were very different to those his friend had supplied to him; and if sulphate could be made at the price stated in the book referred to, he thought that small works like his own would be able, with profit, to undertake its manufacture, even though they did not work continuously. The figures were: Acid, per ton of sulphate, £2 8s.; lime, 1s. 6d.; coke, 4s. 8d.; labour, 12s. 8d.; bags, 3s. 7d.; and wear and tear, 4s. 7d—making a total of £3 15s. This on 12½ tons of sulphate worked out to £46 17s. 6d. So that, if £10 per ton could be obtained, there would be a profit of £78 2s. 6d. on the liquor. If they could get a plant that would turn out sulphate at this cost, gas managers would have to put one down.

THE INCANDESCENT SYSTEM AS APPLIED TO PUBLIC LIGHTING.

The President remarked that unfortunately Mr. Jolliffe had not arrived; and therefore he would call on Mr. Drage to open the discussion on this subject.

Mr. Drage said that they commenced using incandescent burners for public lighting at East Dereham in July last year; and they had now 35 in use. The inhabitants were very pleased with them. The price paid for gas was 4s. 6d. per 1000 cubic feet; and they found there was a saving compared with the ordinary burners. The incandescent lamps had been burning 36,000 hours. Under the old system, they allowed a consumption of 7 cubic feet per hour; but the incandescent lamps only burnt 3¾ feet. At the beginning of the summer months, he removed the burners; and, on then testing them, he found the consumption was still 3¾ feet. This was a saving on the old burners of 3¼ cubic feet, which meant that a total of 117,000 cubic feet had been saved during the time the burners had been in use. At 4s. 6d. per 1000 cubic feet, this represented £24 6s. 6d. The mantles used during the lighting season averaged three per lamp; and 14s. per dozen was what they paid for them. He therefore put the cost of mantles used at £5 12s. In regard to the alteration required in the lamps, they purchased a lantern from the Incandescent Gas-Light Company, and saw what changes were necessary, and then altered their own lanterns at a cost of £3. Deducting these expenses from the saving in gas, they had a net saving of about £15 10s., besides having the benefit of the extra light. With these burners, anyone putting down fresh lighting plant would find that the lamps could be placed quite 75 yards, instead of 50 yards apart. He saw from the Journal of Gas Lighting that the Gas Inspector at Ipswich calculated that there was a saving of £10 16s. 8d. per annum on twelve large special lamps fitted with incandescent burners in lieu of governor burners. Replying to the President, Mr. Drage added that his bye-pass was always burning.

The President said he had fitted a few incandescent burners on the public lamps; but he had not found any saving in the consumption of gas. Perhaps, however, this was a peculiarity of the town of Sudbury. For instance, six or seven nights every moon, they did not light the lamps at all; and the bye-pass arrangement was burning the whole of that time, 24 hours per day. Then all the lamps in which the incandescent burners had been fixed were turned out at 11.30 p.m.; and the bye-pass in these lamps—22 or 23 of them—were burning some 19 or 20 hours a day when the light was not required. Further than this, he could prove there was no saving with such a system as theirs—he did not say there was no saving under ordinary conditions—in adopting the light. One of the lamps of the twelve on the Market Hill had a meter attached; and he found that it registered just as much gas with the incandescent burner, as it did previously fitted with one of Borradaile's 4-feet regulator burners. He attributed this to the bye-pass. However, he certainly thought the principal part of a town should be lighted by incandescent lamps.

Mr. Drage, in reply to Mr. Barton, said he tested his incandescent burners at a pressure of 18-10ths. He had the bye-pass in his lamps regulated to a consumption of 1 foot per nine hours. In his case, the ordinary lamps consumed 7 cubic feet per hour, while the President's only burned 4 feet, which made a vast difference.

Mr. C. Banham (Wymondham) suggested that it might be possible to apply self-lighting burners to incandescent lamps; and so do away with the bye-pass.

Mr. Mitchell remarked that the bye-pass appeared to be a troublesome matter in connection with the incandescent system. He thought it was accepted on all hands that the incandescent burner would give a greater light per foot of gas than the ordinary burner. But the question they had to consider was whether the system was applicable to public lighting. Mr. Drage was the only member who had told them he had found it applicable in his case, and that there was a saving of gas. Saving or no saving, that was not a question for gas companies, but for local authorities, who had to pay for the gas whether it was consumed by an incandescent or an ordinary flat-flame burner. He should like to inquire whether there were any difficulties in applying the incandescent burners that did not exist with the ordinary burners? Was there any difficulty in keeping the bye-pass alight? Did the jerking of the tap in lighting and extinguishing the lamp put out the bye-pass, and so necessitate a lamplighter procuring a ladder to re-light it?

Mr. Drage replied that, during last season, only one or two of the bye-passes in his lamps were extinguished through a gale of wind. He used the chain arrangement, and not a tap, for lighting and putting out the lamps. At first he found that the chain, going through the glass, used to touch it, and upset the mantle. He then applied a piece of copper wire, so as to avoid friction; and he had not experienced trouble since.

Mr. Mitchell remarked that he had only one incandescent burner in use; and he had experienced a difficulty through the jerking out of the bye-pass both when lighting and extinguishing. He thought that this question of incandescent lighting in the streets was really one for local authorities to take up; and it was for them to put up with both the difficulties and the expense. The difficulties appeared to be very few indeed; but the cost of the gas consumed by the bye-pass must be paid by the authorities. He thought it would be just as well if the authorities paid the gas companies for 5 cubic feet per hour, which would cover the normal consumption of 3¾ cubic feet and the gas used by the bye-pass. He did not think gas companies ought to be put to any trouble in this matter of public lighting at all.

Mr. Drage: The gas-works in my case are owned by the District Council.

Mr. Sharman related his experiences with an incandescent burner which he fixed in a lamp in the centre of the Market Place at Wisbech. He frequently found the bye-pass out; and to obviate the trouble that this involved, he made the bye-pass larger, which considerably raised the consumption of gas in keeping it going during the whole 24 hours. He also found that the destruction of the mantles was great; and at the end of the lighting season, he decided to remove the burner. However, after further experiments had been made, he might take the matter up again.

Mr. Best was of opinion that, considering the wear and tear of the mantles, and the amount of gas wasted by the bye-pass, as far as gas companies were concerned, they would not be justified in adopting incandescent burners for street lighting.

Mr. Barton had tried two of the incandescent lamps; but his experience had not been very satisfactory. There was a doubt in his mind whether these incandescent lamps diffused the light as well in the streets as indoors. He was inclined to think that the ordinary 5-feet burner diffused the light equally as well as the incandescent burner. With the latter, they obtained a glare of light inside the lantern; but there was not the diffusion of light that was obtained with an ordinary burner.

Election of Office-Bearers.

On the proposition of the President, seconded by Mr. J. Mason (Oakham), Mr. Drage was elected to the office of President for the ensuing year.

Mr. Mitchell moved that Mr. Jolliffe, of Ipswich, be elected Vice-President.

Mr. Wimhurst seconded the motion; and it was unanimously carried.

Mr. Carter could not say that he rose with any very great pleasure to submit the next proposition; and he was sure that Mr. Troughton would quite understand his feeling. For the past six or seven years, they had had the pleasure of re-electing their friend Mr. Wimhurst to the position of Honorary Secretary and Treasurer; but now, for the first time in the history of the Association, they had to propose another name for the office. This being so, he did not think they could find one in their ranks

more fitted for the position than Mr. Troughton, whose name he had pleasure in proposing.

Mr. MITCHELL seconded the proposition, which was adopted.

Mr. TROUGHTON, in response, assured the members that he should endeavour to do his best for the interests of the Association; and he hoped they would all support him by rallying round and volunteering papers for the meetings.

Messrs. Pike, Sharman, and Wimhurst were next elected members of the Committee; and Messrs. Panchen and Ellis were re-appointed Auditors.

THE SPRING MEETING.

The PRESIDENT-ELECT moved that the members of the Association visit East Dereham for their meeting in April next; mentioning that he had the support of the District Council in giving this invitation.

Mr. WIMHURST seconded the motion, which was agreed to.

VOTES OF THANKS.

The PRESIDENT proposed a hearty vote of thanks to the Directors of the Wisbech Gas Company for the cordial and hospitable manner they had received the Association.

Mr. BANHAM seconded the proposition, which was cordially agreed to.

Mr. MITCHELL said the members could not allow Mr. Wimhurst to relinquish his office without according him a hearty vote of thanks for the great amount of work he had done on their behalf during the time he had been their Honorary Secretary and Treasurer. He had put his heart and soul into the work; and certainly the Association would not have thriven through the years of infancy up to the present time had it not been for the extraordinary interest Mr. Wimhurst had taken all through in their affairs.

The PRESIDENT, in seconding the motion, hinted that the services of Mr. Wimhurst would, in all probability, be recognized in a more tangible form than by the passing of a mere vote of thanks.

The motion was carried by acclamation.

Mr. WIMHURST said he was much obliged to the members for the vote which had been so cordially passed. As he had said on a previous occasion, what he had done for the Association had been a labour of love.

The services during the past year of the President and the various officials were also suitably acknowledged; and this concluded the proceedings.

The members with several friends afterwards dined at the Rose and Crown Hotel—the Mayor and some of the Directors of the Gas Company honouring them by their presence. A short toast list was subsequently gone through. The Mayor, in proposing "Success to the Eastern Counties' Gas Managers' Association," associated with the toast the name of the retiring Secretary. In responding, Mr. Wimhurst stated that the meeting at which the Association was formed was held at Peterborough in 1888. There were then enrolled 25 members from a district reaching from Mansfield in the North-West to Chelmsford in the South-East. The Association now numbered 69 members. He had arrived at the end of his apprenticeship in the office of Secretary; having served the Association in that capacity for seven years. He was about to vacate the position; and he had the greatest confidence that his successor, Mr. Troughton, would faithfully carry on the work.

THE BRITISH ASSOCIATION MEETING.

The President's Address.

The Sixty-fifth Annual Meeting of the British Association was opened at Ipswich last Wednesday. The retiring President, the Marquis of Salisbury, was unable to be present to introduce his successor—Sir DOUGLAS GALTON; but the duty was performed by Lord Kelvin, who referred to Sir Douglas as having been one of the mainstays of the Association during the past quarter of a century.

The PRESIDENT, amid hearty cheering, took the chair; and at once proceeded to deliver his Inaugural Address, which, as no doubt had been anticipated, was a long and learned one. It touched upon many fields of scientific research; but in regard to the subjects affecting the industries to which the JOURNAL is devoted, it was almost barren. Six Douglas commenced by recalling the agreeable memories of the former meeting of the Association at Ipswich 44 years ago; and then followed with a few words on the loss which science has sustained by the death of the Right Hon. T. H. Huxley. The foundation of the Association in September, 1831, was alluded to, and its democratic constitution enlarged upon. In taking a rapid glance at the condition of sciences at its formation, the President remarked: "When we consider how completely the whole habit of mind of the populations of the Western world has been changed since the beginning of the century, from willing acceptance of authority as a rule of life to a universal spirit of inquiry and experimental investigation, is it not probable that this rapid change has arisen from society having been stirred to its foundation by the causes and consequences of the French Revolution? One of the very earliest practical results of this awakening in France was the conviction that the basis of scientific research lay in the accuracy of the standards by which observations could be compared." This led him to the principles which were then laid down as a basis for the measurements of length, weight, and capacity. He mentioned that the metric system did not come into full operation in France till 1840; and it was now adopted by all countries on the Continent of Europe, except Russia. He claimed for the Association that they early recognized the importance of uniformity in the record of scientific facts, as well as the necessity for an easy method of comparing standards, and for verifying differences between instruments and apparatus required by various observers pursuing similar lines of investigation.

Some remarks upon the observatory at Kew, the Geological Survey, and achievements in geography brought the President to the subject of chemistry, upon which he said: The report made to the Association on the state of the chemical sciences in 1832 says that the efforts of investigators were then being directed to determining with accuracy the true nature of the substances which compose the various products of the organic and inorganic kingdoms, and the exact ratios by weight which the different constituents of these substances bear to each other. But since that day, the science of chemistry has far extended its boundaries. The barrier has vanished which was supposed to separate the products of living organisms from the substances of which minerals consist, or which could be formed in the laboratory. The number of distinct carbon compounds obtainable from organisms has greatly increased; but it is small when compared with the number of such compounds which have been artificially formed. The methods of analysis have been perfected. The physical, and especially the optical, properties of the various forms of matter have been closely studied, and many fruitful generalizations have been made. The form in which these generalizations would now be stated may probably change, some, perhaps, by the overthrow or disuse of an ingenious guess at Nature's workings, but more by that change which is the ordinary growth of science—viz., inclusion in some simpler and more general view. In these advances, the chemist has called the spectroscope to his aid. Indeed, the existence of the British Association has been practically coterminous with the comparatively newly developed science of spectrum analysis; for though Newton, Wollaston, Fraunhofer, and Fox Talbot had worked at the subject long ago, it was not till Kirchhoff and Bunsen set a seal on the prior labours of Stokes, Angström, and Balfour Stewart that the spectra of terrestrial elements were mapped out and grouped; that by its help new elements were discovered, and the idea was suggested that the various orders of spectra of the same element are due to the existence of the element in different molecular forms—allotropic or otherwise—at different temperatures. But, great as have been the advances of terrestrial chemistry through its assistance, the most stupendous advance which we owe to the spectroscope lies in the celestial direction.

Passing over the President's references to astronomy, the address proceeded: If we turn to the sciences which are included under physics, the progress has been equally marked. In optical science in 1831, the theory of emission, as contrasted with the undulatory theory of light, was still under discussion. Young, who was the first to explain the phenomena due to the interference of the rays of light as a consequence of the theory of waves, and Fresnel, who showed the intensity of light for any relative position of the interference waves, both had only recently passed away. The investigations into the laws which regulate the conduction and radiation of heat, together with the doctrine of latent and of specific heat, and the relations of vapour to air, had all tended to the conception of a material heat, or caloric, communicated by an actual flow and emission. It was not till 1834 that improved thermometrical appliances had enabled Forbes and Melloni to establish the polarization of heat, and thus to lay the foundation of an undulatory theory for heat similar to that which was in progress of acceptation for light. Whewell's report in 1832 on magnetism and electricity shows that these branches of science were looked upon as cognate, and that the theory of two opposite electric fluids was generally accepted. . . . In electricity in 1831, just at the time when the British Association was founded, Faraday's splendid researches in electricity and magnetism at the Royal Institution had begun with his discovery of magneto-electric induction, his investigation of the laws of electro-chemical decomposition, and of the mode of electrolytical action. But the practical application of our electrical knowledge was then limited to the use of lightning conductors for buildings and ships. Indeed, it may be said that the applications of electricity to the use of man have grown up side by side with the British Association. One of the first practical applications of Faraday's discoveries was in the deposition of metals and electro-plating, which has developed into a large branch of national industry; and the dissociating effect of the electric arc, for the reduction of ores, and in other processes, is daily obtaining a wider extension. But probably the application of electricity which is tending to produce the greatest change in our mental and even material condition is the electric telegraph and its sister, the telephone. The knowledge of electricity gained by means of its application to the telegraph largely assisted the extension of its utility in other

directions. The electric light gives, in its incandescent form, a very perfect hygienic light. Where rivers are at hand, the electrical transmission of power will drive railway trains and factories economically, and might enable each artisan to convert his room into a workshop, and thus assist in restoring to the labouring man some of the individuality which the factory has tended to destroy. In 1843, Joule described his experiments for determining the mechanical equivalent of heat. But it was not until the meeting at Oxford, in 1847, that he fully developed the law of the conservation of energy, which, in conjunction with Newton's law of the conservation of momentum, and Dalton's law of the conservation of chemical elements, constitutes a complete mechanical foundation for physical science. Who, at the foundation of the Association, would have believed some far-seeing philosopher if he had foretold that the spectroscope would analyze the constituents of the sun, and measure the motions of the stars; that we should liquefy air, and utilize temperatures approaching to the absolute zero for experimental research; that, like the magician in the "Arabian Nights," we should annihilate distance by means of the electric telegraph and the telephone; that we should illuminate our largest buildings instantaneously, with the clearness of day, by means of the electric current; that by the electric transmission of power we should be able to utilize the Falls of Niagara to work factories at distant places; that we should extract metals from the crust of the earth by the same electrical agency to which, in some cases, their deposition has been attributed? These discoveries and their applications have been brought to their present condition by the researches of a long line of scientific explorers, such as Dalton, Joule, Maxwell, Helmholtz, Herz, Kelvin, and Rayleigh, aided by vast strides made in mechanical skill. But what will our successors be discussing 60 years hence? How little do we yet know of the vibrations which communicate light and heat! Far as we have advanced in the application of electricity to the uses of life, we know but little even yet of its real nature. We are only on the threshold of the knowledge of molecular action, or of the constitution of the all-pervading ether. It is only within the last few years that we have begun to realize that electricity is closely connected with the vibrations which cause heat and light, and which seem to pervade all space—vibrations which may be termed the voice of the Creator calling to each atom and to each cell of protoplasm to fall into its ordained position, each, as it were, a musical note in the harmonious symphony which we call the universe.

Among the other subjects dealt with was bacteriology, in the course of his remarks upon which, Sir Douglas observed that the early reports to the Association show that the laws of hydrostatics, hydrodynamics, and hydraulics necessary to the supply and removal of water through pipes and conduits had long been investigated by the mathematician. But the modern sanitary engineer has been driven by the needs of an increasing population to call in the chemist and the biologist to help him to provide pure water and pure air. The purification and the utilization of sewage occupied the attention of the Association as early as 1864, and between 1869 and 1876 a Committee of the Association made a series of valuable reports on the subject. It was not till the chemist called to his aid the biologist, and came to the help of the engineer, that a scientific system of sewage purification was evolved. Dr. Frankland many years ago suggested the intermittent filtration of sewage; and Mr. Baldwin Latham was one of the first engineers to adopt it. But the valuable experiments made in recent years by the State Board of Health in Massachusetts have more clearly explained to us how by this system we may utilize micro-organisms to convert organic impurity in sewage into food fitted for higher forms of life. To effect this, we require in the first place a filter of any material which affords numerous surfaces or open pores; and secondly, that after a volume of sewage has passed through the filter an interval of time be allowed, in which the air necessary to support the life of the micro-organisms is enabled to enter the pores of the filter. Thus this system is dependent upon oxygen and time. Under such conditions, the organisms necessary for purification are sure to establish themselves in the filter before it has been long in use.

While admitting that the sanitary engineer has done much to improve the surface conditions of towns, to furnish clean water, and to remove sewage, Sir Douglas remarked that he has as yet done little to purify town air. Fog is caused by the floating particles of matter in the air becoming weighted with aqueous vapour. Some particles, such as salts of ammonia or chloride of sodium, have a greater affinity for moisture than others. We shall suffer from fog so long as refuse is stored in towns to furnish ammonia, or so long as the street surfaces are allowed to supply dust, of which much consists of powdered horse manure, or so long as the products of combustion are sent into the atmosphere. Therefore, when mechanical traction has been adopted for vehicles in towns, one cause of fog will be largely reduced. And by diminishing black smoke, black fogs will be also diminished. In manufactories, smoke may be prevented, either by care in firing, by using smokeless coal, or by washing the soot out of the products of consumption in its passage along the flue leading to the main chimney-shaft. The black smoke from kitchens may be avoided by the use of coke or of gas. But so long as we retain the hygienic arrangement of the open fire in our living-rooms, the President said he despairs of finding a fireplace, however well constructed, which will not be used in such a manner as to cause smoke, unless, indeed, the chimneys were reversed and the fumes drawn into some central shaft, where they might be washed before being passed into the atmosphere. Electricity as a warming and cooking agent would be convenient, cleanly, and economical when generated by water power, or possibly wind power; but it is at present too dear when it has to be generated by means of coal. He can conceive, however, that our descendants may learn so to utilize electricity that they, in a future century, may be enabled by its means to avoid smoke in their towns.

Touching upon the relation of mechanical engineering and chemistry, the President pointed out that the development of the iron industry is due to the association of the chemist with the engineer. The introduction of the hot blast by Neilson, in 1829, in the manufacture of cast iron had effected a large saving of fuel. But the chemical conditions which affect the strength and other qualities of iron, and its combinations with carbon, silicon, phosphorus, and other substances, had at that time scarcely been investigated. In 1856, Bessemer brought before the British Association at Cheltenham his brilliant discovery for making steel direct from the blast-furnace. This discovery, followed by Siemens's regenerative furnace, by Whitworth's compressed steel, and by the use of alloys and by other improvements too numerous to mention, revolutionized the conditions under which metals are applied to engineering purposes.

Locomotion and explosives next received attention; and then Sir Douglas pointed to the fact that our neighbours and rivals rely largely upon the guidance of the State for the promotion of both science teaching and research—referring especially to what is being accomplished in Germany. In Great Britain, our records show that hitherto, in its efforts to maintain its position by the application of science and the prosecution of research, England has made marvellous advances by means of voluntary effort; and while the increasing field of scientific research compels us occasionally to seek for Government assistance, it would be unfortunate if, by any change, voluntary effort were fettered by State control. The President mentioned, in this connection, that the Association has contributed £60,000 to aid research since its formation; and he also alluded to the grants made by the Treasury to assist voluntary effort.

The address concluded with a reference to the ever-widening field of usefulness for the Association, and an expression of the confidence of the writer that its future records will chronicle a still greater progress than that already achieved.

A hearty vote of thanks was passed to the President for his address.

At a meeting of the General Committee of the Association on the same day, the report of the Council, which was read by Professor Vernon Harcourt, stated that the election of Sir Douglas Galton as President for the year deprived them for the future of his services as General Secretary; and the Council recorded their grateful sense of the unfailing zeal and energy displayed by him in the affairs of the Association during a tenure of office extending over 24 years. Professor Schäfer has been appointed General Secretary.

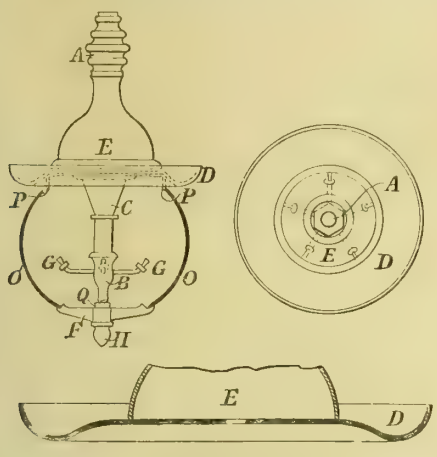
Suggested Purchase of the Kington Gas and Water Works by the Urban District Council.—At the last monthly meeting of the Kington Urban District Council, the following resolution was carried unanimously: "That a Committee be formed to inquire into the present supply of light and water to the town, with a view to ascertaining whether it would not be more advantageous if these were placed under the control of the Council; and that the Committee be empowered to obtain expert evidence, if it is deemed necessary to the inquiry."

The Dorking District Council and the Water Company.—The District Council of Dorking recently asked the Local Government Board if, seeing that several complaints had been made as to the inadequacy of the water supply, they would hold an inquiry into the question of whether the local Water Company are able and willing to furnish water proper and sufficient for all reasonable purposes. The Board have replied that the question is not one which they are empowered to determine; and it will have to be settled in the manner provided by section 52 of the Public Health Act, 1875. At the meeting of the Council on the 5th inst., the Special Committee who have the matter in hand recommended that a notice be served on the Company, to the effect that the Council intend commencing to construct water-works within the limits of the supply of the Company, and generally to carry out the requirements of section 52 of the Act. The Council were also recommended to reappoint the Committee to do what was necessary, especially with reference to the matter being referred to arbitration. In moving the adoption of the report, Mr. Young said there seemed no alternative but to give the Company notice that the Council intended to provide works of their own. In the course of the discussion, it was stated that it was apparent to the Committee, as it must long have been to the Council, that, in the language of the Act, the Company were not able to supply the place with water. Willing they might be, but able they apparently were not. Therefore it was incumbent on the Council to see that the public interests were not neglected. The Act went on to say that, although an urban authority might supply their district with water, where there was an existing company having a monopoly, it was necessary to give them notice of what the authority intended doing. If the Dorking Company resisted, and said they were able and willing to supply the town, the matter had to be referred to arbitration, and a public inquiry would have to be held, presided over by Arbitrators, who would decide whether the Company had or had not fulfilled their obligations. The report was adopted.

REGISTER OF PATENTS.

Reflecting Gas-Lights.—Bray, G., of Leeds. No. 16,297; Aug. 27, 1894.

As shown in the engraving, the main pendant of the light consists of a centre pipe A, provided with a connection B, having two or more branches G for lights. A short distance above the connection B is an inverted cone C, upon which rests a reflector D, having a raised centre.



The reflector may be punctured with holes round its centre, through which the products of combustion pass, and are diffused by coming in contact with the concave baffler or hollow vase E. The products of combustion pass away through the space intervening between the top of the reflector D and the vase E, and thus lessen the blackening of the ceiling above that would otherwise be the case. Above E is an ornamental cap, through which proceeds the main pendant A.

In combination with the above, the patentee specifies to use the arrangement for supporting and staying the glass globe O, as described in patent No. 20 of 1893, in which case the ornamental connection B is extended and prepared to receive the sleeve Q, supporting the globe holder F, which is kept in position by the knob H—the globe being stayed at the top by guides P, attached to the reflector.

Disc Engine, Suitable as a Water-Meter.—Kent, W. G., of High Holborn, W.C. No. 18,286; Sept. 26, 1894.

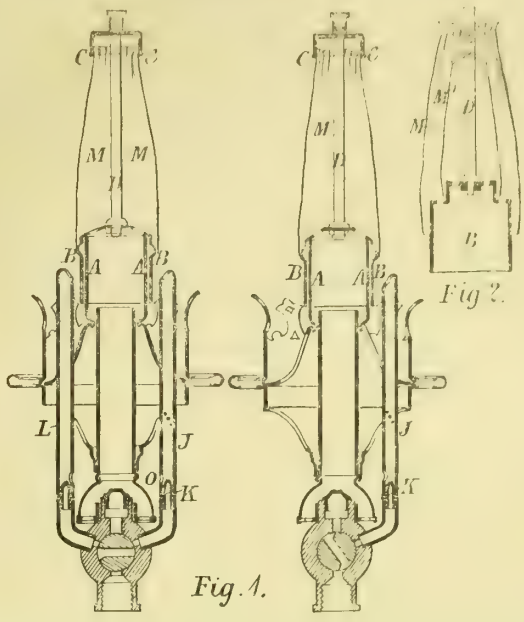
The working chamber or so-called cylinder of this disc engine is formed in two parts; the bottom being a flat dish, with a cylindrical boss on its underside, to give sufficient thickness for the hollow which receives the ball at the centre of the so-called disc or piston. The sides of the upper part of the cylinder are formed of a portion of a sphere lying between two parallel planes, one of which passes through the centre. The top consists of a cone pointing downwards; the apex being cut off so as to leave a circular hole through which the spindle and a portion of the ball on the piston project. The upper part fits into a recess round the inner edge of the rim of the dish-like bottom; or it may be screwed in so as to allow of adjustment, to compensate for the wear of the ball; or the same object may be effected by screwing the boss into the lower part of the cylinder, instead of casting it in one piece with it. The upper part of the cylinder has on its outside three or more vertical radial wings; and the outer edges of these, and of the rim of the dish, fit the inside of the casing which is slightly conical. The partition in the cylinder is fixed to one of the radial wings in the manner described in patent No. 10,981 of 1893. The inlet and outlet pipes to the casing are diametrically opposite to each other, and the inlet and outlet ports to the cylinder are formed, as usual, one on each side of the partition. Additional outlet ports are also formed in the top and bottom of the cylinder. The so-called disc or piston consists of a cone pointing downwards, and having a ball at its apex. It is slotted to receive the partition; and on the outlet side it is notched to receive a friction or thrust roller which bears against the partition. The gearing which works the counting and recording apparatus is contained in an oil-filled box carried by the cover of the outer casing. It is actuated by a worm wheel driven by a worm on a vertical spindle passing down through the cover. This spindle has a conical end working in a corresponding bearing formed of graphite. The downward thrust of the worm is taken by a bow spring.

Incandescent Gas-Burners.—Redfern, G. F.; a communication from La Compagnie Parisienne du Bec Deselle-Gillet. No. 20,093; Oct. 20, 1894.

Two arrangements of this incandescent gas-burner are shown in fig. 1; while fig. 2 is a vertical section of a burner-cap with two mantles.

A cylindrical tube A is adapted to receive a cap B, the upper part of which is furnished with orifices or slits. A rod D is fixed to the top of the cap, and is provided at its upper end with a stirrup or support having eyes or holes in it to receive ligatures of asbestos thread, by means of which the upper part C of the mantle M is attached. The support is placed on a shoulder of the rod D after the incineration of the mantle, and is maintained in position by a nut. The asbestos covering for the rod D can be in the form of agglomerated powder, but is most suitable as thread wound around it. By coating the asbestos covering, says the patentee, with one or more layers of any suitable silicate—such as silicate of soda or silicate of potash—its resistance is considerably augmented; and the asbestos covering can also be impregnated with metallic salts or oxides for the purpose of modifying the tint of the light emitted by the mantle. Oxide of didymium (for example), which gives a rose colour, may be employed for the purpose of partially neutralizing or modifying the green rays emitted by certain of the oxide constituents of the mantle.

Sometimes two mantles M M^1 are employed, arranged concentrically on the central rod D, for the purpose of obtaining a more powerful light, as shown in fig. 2. The two mantles may be of the same chemical composition, and may both emit rays of the same tint; or one of them may be composed of metal oxides giving specially coloured rays—such, for example, as oxide of didymium, which produces rose-coloured rays, for the purpose of modifying the tint of the rays emitted by the other mantle. When two mantles are employed, the burner may have either a single ring or row of openings, or two such rings as shown.



For igniting the gas issuing from the burner an outside tube is provided, as shown in fig. 1, having a number of holes arranged above, or as a continuation of, a small Bunsen burner K which branches laterally from the gas supply cock. In the engraving, the perforated hole and the Bunsen burner are shown as formed of one tube J. With this arrangement, the gas (which burns for a short time in the tube J before reaching the mantle) does not form any carbonaceous deposit, as it is well mixed with air and it can be ignited with a match, thereby obviating the necessity of a pilot flame. The upper end of the tube J is bevelled and slightly curved so that the igniting jet issues horizontally from it. The tube, at its lower part, communicates with a passage which can communicate with the plug of the cock.

L is a bye-pass also branching laterally from the cock, and similar to the tube J, with the exception that it is not perforated on its periphery except at the lower end, just above the gas nozzle. This arrangement may be dispensed with, if desired, as shown in the right-hand modification. With burners of this kind, says the patentee, the gas may be automatically ignited by an arrangement depending for its action on the property possessed by porous bodies (especially finely divided platinum and palladium) of absorbing gases, and to this purpose he arranges within the refractory mantle a bag of fine platinum gauze containing platinum or palladium black.

Manufacture of Oil Gas.—Mayer, F., of Baltimore, U.S.A. No. 13,230; July 9, 1895.

The claims for this invention (which is not described apart from the eight sheets of drawings accompanying the specification) are as follows: 1. The combination of a retort chamber containing a series of vertical retorts; a furnace situated under the retort chamber, and separated from it by a perforated arch; a body of brickwork in the rear of the furnace, having circuitous passages therein, through which the products of combustion from the retort chamber pass to heat it; a vaporizing chamber erected over the brickwork, having circuitous passages therein, which form a continuation of those in the brickwork, and which lead finally to a stack; and gangs of vaporizing pipe, which are partially or wholly within the vaporizing chamber, leading ultimately to the upper ends of the retorts, to convey hydrocarbon vapours from the top of the vaporizing chamber to the top of the retorts. 2. A furnace covered by a perforated arch, combined with a retort chamber erected over the arch; the system of vertical retorts situated in the retort chamber, having wings which are cut away at certain points, to give continuity to the various spaces exterior to the retorts, and between them and the brickwork of the retort chamber; and plates which form partitions in the retort chamber between the rows of retorts therein, provided with spaces or openings through which the products of combustion ascend to the upper portion of the retort chamber. 3. The combination of a vaporizing chamber and a series of vaporizing pipes within the chamber with their ends projecting from it; a box to which the ends of the vaporizing pipes are connected; a supply pipe supported within the box, having knife-edged or conducting plates, the points of which are over the ends of the pipes; and overflow apertures, and a pipe, for conveying hydrocarbon to the supply pipe. 4. The combination of a series of vaporizing pipes connected to a box at their ends; a supply pipe in the box, having knife-edged triangular plates on its lower side with the points over the ends of the vaporizing pipes; a conveying pipe to feed the supply pipe; and sustaining bolts, which pass through stuffing boxes in the top of the box and are adjustable in length, whereby the supply pipe may be levelled in the box without reference to its position.

Incandescent Mantles for Gas-Lamps.—Crocker, S. H., of Furnival Street, E.C. No. 13,638; July 16, 1895.

This invention consists in forming incandescent mantles for lamps from threads spun of material which, in its natural or raw state of fibres or filaments, is loaded with a solution for yielding refractory earths.

The organic matter being subsequently removed by burning, leaves behind the refractory compounds in approximately the same shape as the fabric obtained before.

To carry out his invention, the patentee takes any suitable material of a fibrous nature in its raw state, and thoroughly loads or incorporates with it the refractory earths, after which they may be dried and spun into threads, and these threads made up into a mantle of suitable shape by weaving, netting, or like operations.

In some cases instead of forming the loaded raw material directly into threads, it is first made into thin flat sheets or tissue, by felting after the manner of making paper; and from these sheets strips or shreds may be cut which can be spun or twisted into threads. By treating the fibres as described—that is to say, in their raw or natural state—they become loaded "in a very even and uniform manner, so that when woven or netted, they produce a textile fabric or base in which the refractory compounds are equally distributed throughout."

APPLICATIONS FOR LETTERS PATENT.

16,377.—Lees, W., "Steam or water valves; also applicable to water-gauges." Sept. 2.

16,383.—Craig, J., "Connecting taps and pipes by mechanical contrivances to lead, brass, iron, and other pipes without the use of solder." Sept. 2.

16,424.—Elliott, R. L., "Gas and other internal combustion engines." Sept. 2.

16,428.—Riordan, T. V., "Gas-burners." Sept. 2.

16,471.—Walder, T. J., "Manufacture of water and coal gas." Sept. 3.

16,473.—Holt, H. P., "Gas or oil motor cars." Sept. 3.

16,475.—Holt, H. P., "Governing apparatus for gas or oil traction engines." Sept. 3.

16,480.—Talbot, R. M., "Constant-service water-supply system." Sept. 3.

16,502.—Ducretet, E., and Lejeune, L., "Production and utilization of acetylene." Sept. 3.

16,509.—Ingle, J., "Gas-branding machine." Sept. 3.

16,539.—Young, W., "The production of illuminating gas from liquid hydrocarbons and apparatus therefor." Sept. 4.

16,556.—Gass, A., "Gas-engines." Sept. 4.

16,587.—Hookham, G., "Manufacture of gas-cylinders." Sept. 4.

16,609.—Campbell, H., "Gas and oil motor engines." Sept. 5.

16,642.—Deimel, F., "Incandescent gas-burners, for use both indoors and in the open air." Sept. 5.

16,682.—Chester, W. R., "Indicator to be attached to gasholders, tanks, and other vessels of this description." Sept. 6.

16,691.—Campe, R., "Generator for acetylene gas lamps." Sept. 6.

16,705.—Couttolenc, M. E., "Regulating apparatus applicable principally to incandescent gas-burners." Sept. 6.

16,722.—Harff, M., and Siebert, A., "A device for releasing automatically the closing or stopping mechanism in gas or water supply pipes." Sept. 6.

16,728.—Eastwood, C., and M'Ewen, C. J., "Apparatus for charging gas-retorts." Sept. 6.

16,730.—Wheatley, W. H., "Incandescence burners." A communication from C. Schmid. Sept. 6.

16,744.—Fox, W., "Improvement of coal gas or other illuminating gases." Sept. 7.

16,786.—Boult, A. J., "Incandescence gas-lamps." A communication from E. Dispot. Sept. 7.

16,798.—Armstrong, J. T., and Bailey, M., "Burners for gas and other lamps." Sept. 7.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Regulation of Consumption in Incandescent Gas-Burners.

Sir,—With reference to Mr. H. E. Jones's publication, in your last issue, of the results of my tests of the incandescent gas-burners at different consumptions, it may perhaps be useful to attempt to give some explanation of the variation of the illuminating power at different consumptions.

It is obvious that the ratio between illuminating power and gas consumed must depend upon the heat of the flame, and the efficiency of the "mantle." When the proportion of gas consumed exceeds a certain limit, two things occur—both depending on increased gas consumption. There is the increased height of the Bunsen flame, which, extending beyond the "mantle," does not develop its corresponding proportion of light; and there is also a shifting of the zone of maximum combustion, and of maximum heat, to a higher elevation, with consequently a less proportion of the mantle heated to a degree to give maximum incandescence. A larger mantle would deal with this emergency; but a simpler method is the adoption of a governor to regulate the gas consumption to a proportion calculated to afford the best results. I believe the Incandescent Gaslight Company provide such appliances at a small additional cost.

Stepney, Sept. 11, 1895. H. Leicester Greville, F.I.C., &c.

A Generous Offer.—The question of providing a better water supply for Milverton has for some years occupied the attention of the local public authorities. At the last monthly meeting of the Wellington Rural District Council, it was announced that Miss Broadmead, of Milverton, is willing to place £1000 at the disposal of the Council for the purpose of securing a suitable supply, provided the Council would undertake all additional expense (if any) in the completion of the work, and afterwards hand over the management and maintenance thereof to the Parish Council. The offer was accepted, with hearty thanks.

MISCELLANEOUS NEWS.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

A Criticism of Mr. Lewis T. Wright's Report.

In last week's Journal, we published the supplementary report by Mr. Lewis T. Wright to the Bradford Corporation Gas Committee upon the experiments in oil enrichment of gas by the Dvorkovitz process, as well as communications to the Committee on the subject by Mr. W. Wood, the Corporation Gas Engineer, and Mr. Isaac Smith. A further report dealing with the points raised by Mr. Wright has been addressed to Mr. Isaac Smith by Messrs. T. Newbigging and Son, of Manchester; and it reads as follows:—

5, *Norfolk Street, Manchester, Sept.* 7, 1895.

Isaac Smith, Esq., Bradford.

Sir,—We are duly in receipt of the copy of Mr. Lewis T. Wright's "supplementary report" dealing with the question of the enrichment of ordinary coal gas by means of cannel, and comparing the cost of this with the cost of enrichment by the use of the Dvorkovitz oil-gas process, at the Thornton Road station of the Bradford Corporation Gas-Works; and we make the following observations thereon.

You will observe that Mr. Wright states in his report that the result at which he has arrived is "an estimate based upon actual working experience on a large scale." It would be interesting to know where this "actual working experience" has been obtained.

In estimating the cost per candle of enriching by means of cannel, Mr. Wright makes the mistake of basing his calculation on the full 23 candles' value of the cannel gas, instead of taking the value—18¾ candles—of the mixed gases. Had he done this, his cost per candle would have come out to 0·98d., instead of 0·81d. However, we will deal with the estimate on Mr. Wright's lines.

This is taking Mr. Wright's figure of 0·76d. per candle as the cost of the oil enrichment. But, in reality, the saving would be very much more than this. It will be seen on reference to our report of the 6th ult. [see *ante*, p. 404] that we make the cost of enrichment by the oil process 0·367d. per candle. The difference therefore between enrichment by cannel, 0·952d., and enrichment by oil, 0·367d., is 0·585d. per candle; and 0·585d. × 3 = 1·755d., the amount of the saving per 1000 cubic feet on an enrichment of 3 candles. So that 1,506,822,000 cubic feet × 1·755d. per 1000 cubic feet = £11,018 per annum.

In arriving at the cost of enrichment by the oil process, we differ from Mr. Wright on two vital points—(1) As to the price of the oil; and (2) as to the value of the bye-products. Mr. Wright took the price of the oil at 3·8d. per gallon—the price at which Messrs. Besseler, Waechter, and Co., of London, offer to supply it. We took the price at 3·25d. per gallon, for the reason that the oil actually used in the experiments was of inferior quality. In regard to this, Messrs. Besseler, Waechter, and Co., writing to the Town Clerk, July 31, say: "We are not at all surprised to learn that the results obtained from the waggon of oil recently supplied to you were not anything like as good as those obtained from Nobel's oil, which was supplied to the Corporation in February last. We regret we were unable to supply you with Nobel's oil on the last occasion; but you will understand that the oil for which we quoted in our last is Nobel's oil, the same as we supplied to you in February." We had a further reason for taking the price of 3¼d. The trials of other oil-enrichment processes were made on the basis of oil at 3¼d. per gallon; and, as comparisons were to be made, it was only fair that the price in this case should be the same.

As regards the value of the bye-product, which we put at 4·695d. per gallon, we have given the data in our report on which this value was arrived at; and our figures are unrefuted. It has been stated that we omitted to make an allowance for the cost of distillation. But this is not so, as we allowed for this by quoting something lower than the current rates for the secondary products.

Mr. Wright persistently ignores the fact that the bye-product obtained in the Dvorkovitz process is a totally different thing to that obtained in other oil-gas processes. The analysis by Mr. Craven, given in our report, is sufficient proof that the two products are entirely dissimilar. On the face of it, it is clearly wrong to say, as Mr. Wright does, that a liquid containing 23 per cent. of benzol and 12½ per cent. of naphtha, not to mention the heavy oils and pitch, is only worth 1·71d. per gallon; the market price of both benzol and naphtha being close on 1s. per gallon. The statement carries its own refutation. And even if it be assumed that the value which we put upon the bye-product is a high one, and should be reduced, there is sufficient room for this being done, and still leave a handsome margin of profit in favour of the oil process.

In his calculation, he adopts the following figures, among others: Price of cannel of an enriching power of 23 candles, 13s. per ton; yield of tar, 19½ gallons, at 1·2d. per gallon; yield of ammoniacal liquor, 23½ gallons, at 0·84d. per gallon. Unless these prices and quantities hold good for Bradford, his calculation is worthless. We agree with Mr. Wood, the Corporation Gas Engineer, when he says that cannel of this quality delivered at the Bradford Gas-Works cannot be obtained at 13s. per ton. Similarly, a yield of 19½ gallons of tar obtained in ordinary working from cannel in the Bradford district is out of the question; and that the ammoniacal liquor could be sold at 0·84d. per gallon is equally wide of the mark. Mr. Wright makes a special note of his having credited the cannel coke at only 3s. 4d. per ton. As a matter of fact, the coke from many high-class cannels is absolutely worthless.

So much for the figures on which Mr. Wright bases his "estimate." If these are fallacious, as we believe they are, his cost of enrichment by cannel falls to the ground. Correcting the prices and quantities as above, and accepting for the moment the other figures (which we have not the means at hand of verifying) as to working cost, given by Mr. Wright, the calculation comes out at 0·952d. as the cost per candle

of enrichment by cannel, as against Mr. Wright's figure of 0·81d. per candle, thus—

Net Cost of Cannel per Ton.

	Pence per Ton.		Pence per Ton.
Cannel, at 14s. 6d. per ton .	174·00	Tar, 14 gallons, at 1·2d. per gallon	16·80
Fuel used in furnaces, 4 cwt., at 7s. 6d. per ton. . .	18·00	Ammoniacal liquor, 23½ gallons, at 0·5d. per gallon	11·75
		Coke, 11·6 cwt., at 3s. 4d. per ton	23·20
	192·00		51·75
	51·75		
Net cost of cannel per ton .	140·25		

Cost of Gas per 1000 Cubic Feet.

	Pence per 1000 cub. ft.
Net cannel as above (producing 10,000 cubic feet per ton)	14·025
Purification, salaries, wages, repairs, maintenance—average of three years ending 1893	6·171
Interest and sinking fund	1·918
	22·114
Less spent oxide	0·226
Cost per 1000 cubic feet into gasholder	21·888

Or 0·952d. per candle of enrichment, the total enrichment being 3 candles—viz., from 15¾ candles to 18¾ candles illuminating power.

Comparing this figure of 0·952d. with Mr. Wright's figure of 0·76d. as the cost per candle (according to his method of estimation) of enrichment by the Dvorkovitz oil process, the difference or saving in cost is 0·952d. − 0·76d. = 0·192d. per 1000 cubic feet per candle, or 0·192d. × 3 = 0·576d. for the total enrichment of 3 candles required. The saving, therefore, by adopting the oil process in question, on the 1,506,822,000 cubic feet (quantity of gas made at Bradford for the year to March, 1894), would be £3616 per annum.

We notice that Mr. Wright makes a point when speaking of the enrichment of coal gas, whether by cannel or by oil, of always stating that the candle enrichment is "per 1000 per candle per 5 cubic feet," in allusion to the 5 cubic feet of gas supplied to the test-burner. There is no justification for so stating it. It is only a way of "darkening counsel;" and we can only conclude that he is committed to this absurd formula in having originally advised the Gas Committee that Mr. Wood's ascertained figure of cost per candle "was altogether wrong, and should be multiplied by five!" He has doubtless since found out his mistake; but the precious "5" must be retained to lend a colouring of accuracy to what was a serious blunder, and which, indeed (if we are rightly informed), has been the chief cause of the present wranglings.

Even assuming that a suitable cannel were offered to the Corporation to-day, at a price which would reduce the difference of cost of enrichment, as compared with oil, to *nil*, it appears to us that, as a matter of common justice and fair play as between the Corporation and you, the calculation as to the cost of enrichment by cannel should be based on the price of cannel and other conditions at the time when the agreement was entered into.

(Signed) THOS. NEWBIGGING AND SON.

A Warm Debate on the Question in the Town Council.

At the Meeting of the Town Council last Tuesday—the MAYOR (Alderman W. W. Wood) in the chair—the minutes submitted by the Gas and Electricity Supply Committee contained the following resolution: "That, after full trial of the apparatus and process patented by Dr. Dvorkovitz for the enrichment of gas by oil, and after careful consideration of reports by Mr. Lewis T. Wright, the expert called in to advise on the matter, the Committee find that the experiment has not proved a success to warrant the adoption of the system by the Corporation, and that the Council be accordingly recommended to abandon the scheme. The Committee, however, desire to acknowledge the kind services rendered by Mr. Isaac Smith in affording to the Corporation all possible assistance in the carrying out of the experiment."

The TOWN CLERK stated that he had received a copy of the report by Messrs. T. Newbigging and Son, dealing with Mr. Wright's second report to the Corporation.

It was decided that Messrs. Newbigging's report should be taken as read.

Mr. W. C. DIXON, the Chairman of the Committee, moved, and Mr. J. KAY seconded, the adoption of the minutes.

Alderman F. PRIESTMAN inquired whether the Chairman of the Committee would be willing to withdraw for one month that part of his resolution which discontinued the Dvorkovitz process, in order that the members of the Council might have an opportunity of acquainting themselves with the details of the scheme, which they had not yet had. He said he should also like to ask whether, if Mr. Dixon assented to this proposition, he would do it on the understanding that the Dvorkovitz process should be continued, in order that members of the Council, and others who were interested in the matter, could view it for themselves. It appeared to him the present was an exceedingly inopportune time to discuss the matter.

Mr. DIXON said it seemed to him that any time was a very inopportune one for dealing with this matter; but he was there to get at the bottom of it if possible. He had been connected with this business for a year and a half, and had had quite enough of it; and the members of the Council had had the same opportunity of going into the whole of the details. He was very sorry indeed that he was not able to recommend the Council to adopt the oil-gas process which had been experimentally in operation in the Corporation gas-works. The members would be aware that one of the crucial points during the whole of the controversy had been the value of the bye-products; and it appeared to him that there was no limit to the amount of exaggeration which was to be applied in the figures relating to this topic. Dr. Dvorkovitz had stated that he could enrich with one gallon of these bye-products 96,000 cubic feet of gas to the extent of 1-candle power. Mr. W. Wood, the Corporation Gas Engineer, gave as actual results of enrichment 77,000 cubic feet, 66,000 feet, and 50,000 feet enriched to the extent of 1-candle power with one gallon of the oil. From the experience he (Mr. Dixon) had gathered, and from the information he could get from any place in the kingdom, these results seemed to be very doubtful. In order to try to get to the bottom of the question, he himself took a sample of the bye-products, and sent it to be analyzed; and the result was they were stated to be absolutely worthless for carburetting. This was a staggerer to him; and the analysis was the groundwork of his action. He watched the results from time to time; and he at last induced the Committee to have an official test. They ordered the Engineer to get 2 gallons of the bye-products for the purpose; and the Deputy-Chairman and he (Mr. Dixon) went to the Thornton Road gas-works, and in their presence a sample was made up and sealed for analysis. In their presence, too, the sample was despatched to the analyst by messenger. He had the result of the analysis with him; and it thoroughly corroborated the first one. The remarkable part of the matter was that, although the Corporation Engineer did not know where he (Mr. Dixon) had sent his own sample to be analyzed, when he asked him where he would suggest that the one then taken should be sent, he responded that the best place was Messrs. Read Holliday and Sons, Limited, of Huddersfield. That was the very place to which he had sent his sample; and, as he had stated, the results of the two analyses agreed. After he had obtained the result of this second analysis, he saw Mr. Wood at Thornton Road. He told Mr. Wood that there was something radically wrong about the results which it was claimed were being realized by the system, and said, "Do not put your name behind any figures unless you are absolutely certain, because I shall bottom this business, if I have to sleep night and day with it after." The Gas Engineer apparently chose to take no notice of his advice, and results after results were presented to the Committee. They had the same kind of figures always coming, and making out the cost per candle of enrichment on the strength of what they were getting out of the bye-products. Members of the Council would remember that Dr. Dvorkovitz put a long report in the *Bradford Observer* in which he valued the bye-products at 1s. a gallon, and a paragraph in the *Bradford Argus* in which he said that these bye-products had ten times the enriching value of the oil itself. These reports going to the Committee as correct statements were calculated to make them believe that there was something in the process. But the results became less and less; and when they came to be put to the test, the Committee found that there was not one-tenth of a candle per gallon enrichment. In one test at Thornton Road, it was proved that there was not one-tenth of a candle per gallon, let alone the enriching of 96,000 cubic feet by a gallon. As a way out of the difficulty, when the position of the advocates of the Dvorkovitz system was "busted up" they made an offer to the Committee of 6d. per gallon. The Committee agreed to accept this; and the value of the process then rested upon the gas which it was making from the oil. The Committee agreed to accept 6d. before the last thirty-three days' test of the gas; and instructions were given to the Engineer to give Dr. Dvorkovitz and Messrs. Smith and Co. notice to get the bye-products out of the yard. But those bye-products were still in the yard; there were 40 tons of them at Thornton Road. It appeared to him at that time as if they were never going to get to the end of letters and statements upon the subject of this process. But the Committee at last came to the conclusion that, in order to bottom this question, they should appoint an expert; and this decision took a great load off his mind. Up to this point, he had been fighting this question, along with the Deputy-Chairman and others. But now it was decided to have an expert; and a Sub-Committee was appointed. They were instructed to write to Lord Kelvin and to the President of the Institution of Gas Engineers to ask those gentlemen separately to nominate three names of suitable experts. Neither of these gentlemen knew that the other had been written to; and each of them nominated three names. The result of their advice, as given in letters to the Sub-Committee, was that Mr. Lewis T. Wright was the highest authority in England on this particular question; and his name was more highly recommended than any other in England. The General Committee, therefore, had no alternative but to choose him. It was agreed that Messrs. Isaac Smith and Co., with Dr. Dvorkovitz, should superintend their plant; this being done in order to prevent any excuse to the effect that the test had not been carried out according to the instructions of the patentee. The time arrived for the test. He (Mr. Dixon) went up on the morning of the first day, and found at the gas-works, instead of Dr. Dvorkovitz and the Corporation expert being allowed to run the plant in their own way, according to the instructions of the Committee, there was a Mr. Shaw, who was one of the vendors, Dr. Dvorkovitz, and Mr. Newbigging (who was there without the authority or knowledge of the Committee), the two Corporation Engineers, and Mr. Sutcliffe, the Manager at the works. All these were on one side, with Mr. Wright alone in the interests of the Corporation. How Mr. Wright was to give a fair and impartial report with all these interested men around him, he (Mr. Dixon) could not see. But he did begin his work. He (Mr. Dixon) brought the question before the Committee of Mr. Isaac Smith having liberty to bring another expert without the knowledge of the Committee. This state of affairs, however, was allowed to go on. The second day of the test arrived. Mr. Wright came to him (Mr. Dixon) and said: "It is utterly impossible for me to give you an impartial verdict upon this business unless I have some assistance. I cannot watch all the parties. It is impossible for one man to do it; and I cannot take the responsibility of giving you a perfect test unless I have someone to assist me." He (Mr. Dixon) said he did not want to have anything to do with the matter of appointing an assistant, and would be glad if Mr. Wright would appoint one himself, as he had authority to do so. But Mr. Wright, being a stranger in Bradford, did not know anybody; and he (Mr. Dixon) had therefore himself to find some assistant. He asked the mechanic at his place if he knew a man who was out of work, and was referred to a Mr. Robinson, of Shipley. He sent for Mr. Robinson,

and gave him a note with which to go up to the gas-works and take his instructions from Mr. Wright alone. It appeared that the process had been going so badly against Dr. Dvorkovitz, and the Doctor had got into such a state of excitement, that, on the afternoon of the second day, he made the appearance of this assistant a pretext for stopping the whole plant and operations, turning off the retorts, and running away; and he had never heard from Dr. Dvorkovitz since. He put it to the members of the Council that if Mr. Isaac Smith had not been behind this apparatus, the scheme would not have been tolerated for another day. The Committee received a letter from Mr. Smith; and, in order to show there was not any partiality about the matter from beginning to end, they decided to meet him, and hear what he had to say, and what other offer he had to make. Mr. Smith's offer was for a fresh start to be made; and apparently nothing had been said about who was to bear the expenses. This business had cost the Corporation £170 up to the present time; and it appeared that they were not at the end of it yet. Mr. Smith came before the Committee and made another suggestion—that he should appoint Mr. Newbigging to look after his interests; Mr. Wright still remaining in the interests of the Corporation. A fresh supply of oil was obtained for the second test. It was understood, when the Committee allowed Mr. Smith to appoint Mr. Newbigging, that the Corporation had nothing to do with that gentleman's report, because he was obviously a paid servant of Mr. Smith, and that Mr. Smith would not expect that the Committee would be influenced in any way by any report which Mr. Newbigging might make; that gentleman's only purpose being to issue a report to Mr. Smith privately. When the second test was finished, and before Mr. Wright could get his report issued to the members of the Gas Committee, the report made by Mr. Newbigging was sent to every member. He thought no member of the Council would contend that this was a proper thing to do. He, for one, had a great respect for Mr. Isaac Smith, and had no personal animosity against him or anyone else in connection with this matter. He (Mr. Dixon) was acting fairly, and simply from honesty of motive in the matter. The *Bradford Observer* had made a disgraceful charge against him, of having had an interview with Mr. Wright before that gentleman was appointed. He claimed that that amounted to libel. Prior to his appointment, he never had any correspondence with him in any shape or form. The report of Mr. Wright, which was issued to the Committee, showed that the cost of enrichment was 0·76d., and that the value of the bye-products was 1·71d. These were the bye-products which had been conjured with all this time, and for which it was claimed that they would enrich 96,000 cubic feet to the extent of 1-candle power per gallon, which the promoters of the system pretended to offer the Corporation 6d. a gallon for, and which were stored at Thornton Road. The result of Mr. Wright's first test, which was carried out in the presence of Mr. Newbigging, the Corporation Gas Engineer, Dr. Dvorkovitz, and all those who were interested in the process, was that 39½ gallons of bye-products enriched 88,000 cubic feet of gas to the extent of 0·66 candle. Was this good enough for the Corporation of Bradford? He claimed that the figures that were put forward by the advocates of the process had been exaggerated from beginning to end; and he was sorry that their Engineers had put their names behind such figures as had been issued. He had cautioned them before they did it; and he had offered at a Committee meeting (before any expert was called in), £100 to charities if they could divide their figures by ten and then be anywhere near right. After that test, those who were in favour of the process—Mr. Newbigging, the Corporation Engineers, and Dr. Dvorkovitz—suggested that there should be another trial with the carburetter; and the trial on July 26 was taken entirely at the instance of those interested in the system. The result was also unfavourable. He proceeded to call the attention of the Council to important differences in the reports of Mr. Wright and Mr. Newbigging. Mr. Wright took the price of the oil at 3·8d. per gallon; and Mr. Newbigging's price was 3¼d. per gallon. Now, Mr. Wright did not take the price of the oil as it might be purchased in small quantities; but he asked the Town Clerk to write to the people who had the oil to sell, and ask for the price for large quantities. In reply, Messrs. Besseler and Co. wrote that, if they received an order promptly, they could let the Corporation have a few hundred tons of a cargo of Noble Brothers' Solar oil distillate at the price of £4 per ton net cash delivered, though they could not in the present state of the market make a very extended contract at this price. Prior to this, the Gas Engineer had written to this firm to ask the price of this oil; and they, having an exaggerated idea of the quantity required at Bradford—they supposed the requirement of the Corporation would be about 4000 tons per annum—quoted 3⅞d. per gallon net cash delivered. These were the bases on which Mr. Wright had fixed his price, and upon which he made his calculations. Mr. Newbigging's price of 3¼d. per gallon, no doubt, applied to some other kind of oil—used in different places and under altogether different circumstances—to the Russian oil which must be used to enable the Dvorkovitz apparatus to work, and without which it would not work at all. He thought he had shown them that Mr. Wright's price was the correct one. Returning to the question of the bye-products, he said he had referred to the sending away of samples for analysis. After these samples had been dealt with, Mr. Newbigging sent away some samples; but, instead of sending them to the eminent firm of Messrs. Read Holliday and Sons, he submitted his samples to a less-known firm, who had given the process the benefit of an analysis of the oil when separated. Anything more ridiculous than this proceeding, he had never seen in his life. The chemist, taking the analysis in this way, made out the value of the bye-products to be 4⅝d., as against 1·71d., which was proved to be the correct figure. Another point which he had to deal with was the question of expense. It had been generally understood all through the experiments that they had been conducted at the expense of Mr. Isaac Smith. He thought it was high time that the ratepayers of Bradford knew that they had not been carried out in that way. He had a copy of the minutes of the meeting at which the matter had been determined. This showed that the understanding was that Mr Smith was to bear the whole expense, and find pipes and fittings. If there were to be any alterations, these were to be carried out at the cost of Mr. Smith; and in the event of the experiment not being successful, the apparatus was to be taken away by that gentleman. The ratepayers ought to know what had actually been done. The Corporation were in the remarkable position that, without the consent of the Chairman of the Committee, or the body of the Committee knowing anything about it, they had gone to work and spent hundreds of pounds in developing somebody else's patent; and he did not think that a proceeding of this sort would stand the light. Certainly, Mr. Smith had put down retorts and furnaces, two scrubbers and an exhauster, and a water-gas plant which had never been used; but the Corporation had put down four large condensers, 14 ft. high by 2 ft. in diameter, one carburetter, one engine at Thornton Road, which had been rearranged and altered half-a-dozen times, one engine at Mill Street, another carburetter at Mill Street, one square tank 4 ft. by 4 ft. by 6 ft., one boiler 18 ft. by 6 ft., two boilers 25 ft. by 7 ft. 6 in., two large meters, and all the small piping up to 2 inches, besides all the expense of alterations. He wished to know how it was possible that the officials at the Town Hall could take such liberties as these, when there was not a soul who knew that the Corporation money was going in this way. The Committee had tried every possible way with this system, and could not get along any longer with it. Now the Committee were driven into a corner, they were determined to expose the whole thing.

Alderman MOULSON, a former Chairman of the Gas Committee, remarked that, notwithstanding all the statements made by the present Chairman of the Committee, he thought that the matter had been as much exaggerated that afternoon as ever it had been in the past. [Mr. DIXON: Prove it.] One member had said that, whether the process was successful or not, it would be rejected. It was well known by the Committee that, when Mr. Shaw appeared to try to make arrangements for the scheme to be tested, the promise was made that, if it was a success and was a saving to the town, the plant would be taken over by the Corporation at a valuation by their Engineer. If the Council rejected the scheme under present circumstances, they would be doing very wrong, because he held that it had been given in, both by Mr. Wright and Mr. Newbigging as well as by the Corporation Engineers, that it was a success. Putting it in the very worst way he could, Mr. Wright admitted a saving of £942, and said he had no doubt that the use of oil would show an economy over cannel coal as material for enrichment. Then Mr. Wright, in finishing his report, added that, during the tests, both Mr. Charles Wood and Mr. Sutcliffe, the Superintendent of the Thornton Road works, spared no pains in helping him in the inquiry. This did not look as if Mr. Wright had received so much opposition from these two gentlemen. Mr. Wright showed the process yielded a saving of £942; whereas Mr. Smith said it would be a saving of £1400 at Thornton Road only, and £6000 for the whole of the works. He was of opinion that Mr. Isaac Smith's last offer should be accepted; and he moved, as an amendment, that the minutes be adopted with the exception of that portion relating to the abandonment of the Dvorkovitz process, and that the Council accept Mr. Smith's offer in connection with the same.

Mr. J. S. TOOTHILL, in seconding the amendment, said that Mr. Dixon had stated that a sample of the bye-product was sent to Messrs. Read Holliday and Sons, who replied that it was worthless. He (Mr. Toothill) had a memorandum from the firm in which they said that 20 per cent. of the bye-product would be worth 1s. a gallon.

Mr. DIXON: I said that they replied that it was absolutely worthless for carburetting.

Mr. TOOTHILL said that, in the memorandum, they stated that they knew nothing about carburetting; but that both the benzol and the naphtha could be used for carburetting purposes. He did not see why Mr. Dixon should feel so hurt that Mr. Newbigging was present at the trials. The inventor had a good deal at stake; and it was only fair that both sides should be represented. The majority of the Gas Committee had come to a decision, but one which he did not think was in accordance with the evidence produced. There had been several tests; and all, without exception, had shown that the process was capable of effecting considerable economy in gas enrichment. The present proposal of Mr. Smith was as follows: That on the Corporation agreeing to work the plant at Thornton Road for six months continuously, and to utilize the bye-products for the same length of time, under directions to be supplied by him, he would allow £150 to be expended upon additional plant for treating the bye-products, and guarantee, moreover, that the cost of enrichment should not then exceed ½d. per candle for every 1000 cubic feet of gas supplied for consumption. Should the cost of enrichment not exceed this figure, then the Corporation should take over the plant at the end of the six months at cost price. This was altogether a one-sided bargain; and the advantage was entirely on the side of the Corporation. The experiment was to be carried on without risk or expense, and promised to enrich the gas at a saving of 50 per cent.; and the economy thus effected would realize over £6000 a year on a capital outlay of about £2000. The length of time proposed for the experiment was very important, and would settle the controversy once and for all. During the early part of the present year, a 33 days' test was made by the Corporation Engineer, with the result that an enrichment per candle-thousand was obtained at a cost of 0·42d. These figures were arrived at by valuing the bye-products at 6d. per gallon; but if the value was taken at 4d. per gallon, then the cost of enrichment would be ⅜d. per candle thousand. Now the bye-product had been a cause of considerable difficulty in the Committee. It was the remains of the oil after having passed through the retorts, and consisted of benzol, naphtha, and other substances of commercial value. Several analyses had been made, but with varying results. One test had been made by Mr. John Craven, chemist to Messrs. Hardman and Holden, tar distillers, of Newton Heath, near Manchester. The reputation of this firm was well known. The result of the test was stated to be that out of 100 parts there were 23 per cent. of benzol, 12·5 per cent. of naphtha, 40 per cent. of heavy oils, and 24·5 per cent. of pitch, the commercial value of which was between 4d. and 5d. per gallon. The tests were not sufficiently conclusive for several members of the Committee, one of whom communicated with Mr. Lewis T. Wright, who stated that Mr. Wood's calculation as to the cost of enrichment was wrong, and should have been multiplied by five. Thus, instead of the cost being 0·42d. it should be 2·1d. This was a most mysterious statement for a gas expert to make; and it had cost the members of the Committee a serious amount of trouble. Was it

misrepresentation, or was it ignorance? Mr. Wright came before the Committee, and was questioned as to the accuracy of his statement; and with reluctance he admitted that Mr. Wood was right, and that he was wrong. But he offered neither explanation nor apology. Yet this gentleman, out of eight or nine distinguished names, was chosen as the Corporation's expert. With reference to the appointment of this expert, he had always been of opinion that no expert was needed. Their own Engineers were quite capable of carrying out any tests of this description; but others thought differently. When the idea of appointing an expert came before the Committee, it was resolved to write to Lord Kelvin and Mr. Charles Hawksley, asking them to suggest suitable names for the appointment. Now, a local paper had recently stated that Mr. Lewis T. Wright had been recommended by Lord Kelvin and Mr. C. C. Carpenter, the President of the Institution of Gas Engineers. Lord Kelvin only gave one name, and that was Dr. John Hopkinson; Mr. Charles Hawksley recommended five, but Mr. Wright was not one; and Mr. C. C. Carpenter three, of whom Mr. Wright was the last, with a few friendly words of recommendation. As a "gas expert," Mr. Wright was a mere baby in experience; he having only been in practice about twelve months. Previous to this, he was a Gas Manager in South America. Reverting to the tests, Mr. Toothill said that the last were made a few weeks ago, with Mr. Wright acting ostensibly on behalf of the Corporation, and Mr. Newbigging, on behalf of Mr. Smith. The tests were for one-and-a-half days; and Mr. Newbigging stated that, generally, his results were very similar to those of Mr. Wood—the cost per candle enrichment per 1000 cubic feet being about one-third of a penny—0·367d.—that was, taking the bye-products at 4¾d. per gallon. Mr. Wright also submitted his report, the ramifications of which he (the speaker) defied the ordinary lay mind to follow. His findings were that the cost of enrichment by oil gas was 0·76d. per candle per 1000 cubic feet; and the value of the bye-products was 1·71d. He also stated that the adoption of the process would effect a saving of £940 a year. To summarize: On the one hand, they had the two tests by their own Engineers, the evidence of Mr. Newbigging, and the claims and evidence of the patentee (Dr. Dvorkovitz), with Mr. Smith and Mr. Shaw as promoters. These, one and all, asserted that a saving of 50 per cent. might be realized by the enrichment of gas by this process, or a gross saving of above £6000 a year to the Corporation. On the other hand, they had the solitary figure of Mr. Lewis T. Wright, who ran up the cost of enrichment on the one hand, and ran down the value of the bye-products on the other, but whose statements would not bear sifting. Mr. Wright assumed a very serious position in giving the direct lie to every other man who had had to do with the process. The appointment of this expert had cost the Corporation about £200; and the sole result had been entanglement and bewilderment. The only way out of the present awkward and unpleasant position was to accept the offer of Mr. Smith, and give the scheme a fair and uninterrupted trial of six months. If the plant had been allowed to work since its erection, it would by this time have entirely cleared its cost.

Mr. W. Land supported the original motion. He said he was a member of the Sub-Committee appointed in connection with the process; and at the first meeting, after a brief reference to the Dvorkovitz system, the Chairman proposed to put a resolution authorizing the Committee to spend £500 in experimenting on the process. He happened to know something of a process with which Dr. Dvorkovitz had been connected, and which had been tried by another Corporation; and he strongly objected to the £500 being spent on the particular process. He believed then, as he did now, that it was the duty of the inventor and the gentlemen connected with him to have perfected their invention, and not asked the Council to spend public money in doing it for them.

Mr. T. Speight also supported the original motion. He said he would take up the aspersions on the character of Mr. Wright. He had letters at home from the Mayor and Aldermen of Nottingham speaking of Mr. Lewis T. Wright when he was their Engineer, and of how the Corporation offered to present him with £2000 to £3000 in appreciation of his services when he left them. Mr. Toothill had said that Mr. Wright had been in Buenos Ayres. He had there a salary of £3000 a year, which they were not likely to give to a numskull. Mr. Toothill also said that Mr. Wright had had to admit before the Committee that Mr. Wood's figures were correct. Now, in the presence of Mr. Wood and of the whole Committee, he (Mr. Speight) asked Mr. Wright if he had anything to withdraw or contradict in the statements he made on the question of this division of five. He said: "I have nothing to withdraw; but allow me to explain. If you take this paragraph, literally, as it was presented to the Committee, Mr. Wood is five times wrong; but to let Mr. Wood down gently, I am willing to believe that Mr. Wood did not intend to convey the impression he did convey."

Mr. Toothill: Mr. Wright withdrew the whole thing before the Committee.

Mr. Speight proceeded to say that on Feb. 27 Dr. Dvorkovitz told the Committee that the oil-gas enrichment would cost 0·33d.; but Mr. Wood informed them that the cost was 0·25d. per 1000 cubic feet for 1-candle power. Again, on Feb. 27, Dr. Dvorkovitz informed them that, if they adopted this system, they could save £11,279 a year. How did he get at this? In every case he took the cannel coal at 16s. per ton, when the cost was only 13s., and calculated the oil at less than cost; and he, like Mr. Wood, put the illuminating power at 111 candles, while Mr. Newbigging placed it at 82 candles. The £11,279 had dwindled down to £7300, and finally to £6000. Why should this be so? If the figures of Feb. 27 and in March were true, why did not they stand to them? Then they were told again by Mr. Wood that one gallon of the bye-products had enriched 66,000 cubic feet of gas; and afterwards he reported that he had taken some of the bye-products down to Valley Road, and there they had only enriched 40,000 cubic feet. Mr. Wright stated that it took 39·5 gallons to enrich 88,000 cubic feet of gas 0·66 candle. On March 28 Mr. Wood said in his report that, if they enriched the whole of the gas made at Thornton Road, which amounted to 3,500,000 cubic feet, by this oil gas, they would have a saving of £950 per annum. On April 1, which was only three days later, and quoting the same figures as Mr. Wood, Dr. Dvorkovitz said that, if they enriched the gas by his process, the profit would be £2396. How could anyone possibly reconcile such discrepancies as these? Mr. Wood had acted in such a way that he had begun to wonder whether he was the servant of the Corporation or the servant of Dvorkovitz and Co. He could not yet make out whose interests Mr. Wood was trying to serve. He placed more reliance upon Mr. Wright's figures than upon those of either Mr. Wood or Mr. Newbigging; and he would urge that so small a saving as £952 per annum was not sufficient to warrant them continuing a process of this kind.

Mr. W. E. Ackroyd thought that there was a probability that in the near future a system would be found by which gas could be enriched without any trouble at all as regards bye-products; and therefore it would be better for the Corporation not to commit itself to any particular system. He had been rather puzzled to understand why such apparently generous offers were being made by the Dvorkovitz Syndicate until he read an article in the *Bradford Observer*, in which it was stated that it was pretty well understood that the Syndicate expected to reap their reward, in the event of the success of the Bradford experiment, from the general adoption of the process opening out a new market for oil.

Alderman F. Priestman supported the amendment. He thought that the course recommended by the Committee would be a serious injury to the interests of the ratepayers, and would be a gross injustice to Dr. Dvorkovitz. He did not believe there was a member of the Council who knew anything whatever about the question of gas enrichment who would not readily admit that, in the future, oil gas had a very important part to play in the enrichment of coal gas for illuminating purposes. If there were any who did, he would call their attention to a paragraph in Mr. Wright's supplementary report, in which he said: "But for the introduction of oil-gas processes in their various forms, in view of the foreign demand for the cannels of this country, it is not too much to say that there would be a very great scarcity of this article, with consequent high prices." If there were no other argument in the report, this ought to be sufficient to induce every member of the Council to pause before denouncing the oil-gas process as a failure. Another reason for referring the matter back to the Committee, with instructions to make the best terms they could with Mr. Smith, was the statement that for some reason Mr. Smith had not paid for the apparatus as he promised to do. He knew that Mr. Smith was an honourable gentleman; and that, after terms had been made with him, he would pay every farthing which he had promised to pay. By referring the matter back, the Committee would have an opportunity, by making terms with Mr. Smith for six months, to recoup themselves. He thought the wise course would be to work the process at the Thornton Road gas-works for six or twelve months, and if there was any rival process that could be tried on equally favourable terms, to test it at some other works. Then in a very short time the Committee would be able to recommend one of the processes for adoption. But the main argument in favour of the course he had advocated was that, if the process were rejected, a pæan of rejoicing would be raised among producers of cannel coal, who would immediately endeavour to raise prices, with the result that, instead of saving £1000 or £6000, as the case might be, by the adoption of the one or the other of the oil-gas processes, the Corporation would probably have to pay £5000 or £6000 more a year for cannel coal.

Mr. Robinson said he thought the Council had had enough for the time being of the oxy-oil and other gases, and suggested that the Chairman should give an assurance that no other process should be brought before the Council for some time, and that, when any other process was considered, that of Mr. Smith should receive consideration.

Aldermen Hill and Edhouse were in favour of further experiments with the process.

Alderman Bottomley thought it would be in the interests of the Committee themselves that the resolution should be withdrawn.

The Mayor here read the amendment, which approved the minutes of the Committee, with the exception of the resolution recommending the abandonment of the oil-gas process, and accepted the offer of Mr. Isaac Smith made on the 4th inst., subject to terms to be specified in an agreement to be prepared by the Town Clerk for carrying the same into effect.

It was pointed out that the discussion had not taken place on the amendment as just read; and

Mr. Toothill repudiated the amendment in the terms in which it originally stood.

The Mayor ultimately ruled the amendment in the altered terms out of order; and the amendment was restored to its original form, approving the minutes except that relating to the oil-gas question, expressing the opinion that further information was required before any conclusion was come to, and referring the whole subject to the Committee for further investigation.

Mr. Crossland seconded the amendment in this form.

Mr. Dixon, in his reply, said the discussion had been mainly on side issues. This process was behind others to the extent of 10,000 feet per ton, or 121 per cent. It was absolutely the worst known; and he maintained that the Company wanted to force a plant on to the Corporation for the distillation of bye-products.

On the amendment being put, it was carried by 23 votes to 22.

At Friday's meeting of the Gas Committee—Mr. Dixon in the chair—a resolution was moved that permission be given for the fires to be lighted in connection with the oil-gas apparatus at the Thornton Road Gas-Works, in order that two gentlemen who had come from Paris on the invitation of Dr. Dvorkovitz, might see the process in operation. By a small majority, it was decided to refuse the permission. No further action was taken in regard to the oil-gas question; and it is not contemplated, says the *Bradford Observer*, that the Committee will make any attempt at further investigation during the present month.

Plympton and the Water Supply of Plymstock.—The Plympton District Council have had submitted to them a report on a proposed scheme of water supply for Plymstock. It provides for a reservoir of a capacity of 100,000 gallons and 7500 yards of distributing-pipes; the total cost of the undertaking being estimated at £5119. The report is to be considered at a joint meeting of the Plympton Water Committee and representatives of Plymstock.

SHEFFIELD UNITED GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Tuesday, at the Cutlers' Hall—Sir F. T. Mappin, Bart, M.P., in the chair.

After the usual preliminary business,

The Chairman, moving the adoption of the report [see *ante*, p. 447], said that during the half year they had spent £10,915 upon capital account. Nearly the whole of this sum had been upon the new gas-works at Grimesthorpe, which they were proceeding with gradually. The demand upon the Company last half year for gas had equalled 955,000,000 cubic feet, compared with 878,000,000 cubic feet in the corresponding half of 1894—being an increase of 76,000,000 cubic feet, or 8·72 per cent. This large increase assured them they were doing right in proceeding gradually with the works at Grimesthorpe. The leakage had been 46,894,000 cubic feet, equalling 4·68 per cent. of the make; and last year it was 54,789,000 cubic feet, equalling 5·86 per cent. This was a satisfactory decrease; and he hoped the leakage might be further reduced, though he was told not to be too sanguine on this score. The revenue account showed a profit of £40,987; and after paying in dividend £38,262, they had a balance of £2390 to carry over to the current half year. The proprietors would remember that the corresponding half of 1894 showed a large balance—£17,018, which was carried to the reserve fund. But they must bear in mind the Company were then charging 3d. per 1000 cubic feet more than during the past half year. As soon as the Directors found they had this large balance to their credit, they did not hesitate to reduce the price of gas to the lowest point at which they had hitherto been able to sell it. Although they had sold 76,000,000 cubic feet more gas, they had received less money for it by £2826. If the gas had been charged as last year, the receipts would have been £11,943 more. The residuals had been disappointing, as they had been with other companies; for it was only natural, as they bought their coal for less, they should obtain less for their coke. This had been the case to the extent of £3883. Sulphate of ammonia had produced £4170 less. He was often surprised that this valuable commodity was not more used in England. No doubt, agriculturists had much to learn, not only about manures, but about other things. Coals had cost £1037 more; but for this money they had obtained 6398 tons more to produce the gas they sold. Stokers' wages had been increased by £1349; and repairs to works and special items had cost £2676 more. They were making great alterations in their plant for the manufacture of gas; and the Board and their Managers were satisfied that the money which had been liberally spent had been well spent. They had received £1881 more for tar, which was the only item which showed an increase over last year. The reserve fund was now in a very satisfactory state; being at its maximum—£86,192. The working of gas companies was very erratic; and he found, on going through the accounts, that the total they had received for residuals per ton of coals was 7s. 4¾d. for the six months, against 9s. 3½d. in 1894. This was an item they had no control over. They had to accept a fair market price; and he thought he would be able to show them they had done that very well. "Field's Analysis" for 1894 showed a result with which he thought they had occasion to be gratified; for, after paying for their coals, the residuals left them £924 to the good. They were the only gas company in England who could show anything to their credit after paying for their coals. Mr. Field gave a return, comprising 11 Provincial gas companies, 9 Corporation gas undertakings, 3 London gas companies, and 12 London suburban gas companies; and, as he had said before, the Sheffield Company was the only one whose residuals paid more than the coals cost. The good management in this respect must be apparent to all; and it was satisfactory and beneficial, not only to the shareholders, but to the consumers, who all profited by a company like theirs being worked to the best advantage. During the six months they had made 1150 tests; and the illuminating power of the gas had averaged 17·86 candles, as against 17·92 candles last year. The number of meters they had fixed, after deducting nine 2-light and one 40-light meter less than they had last year, showed that during the twelve months they had 613 more meters at work than in June, 1894—varying from 3 up to 300 lights per meter. They had also fixed 68 additional cooking-stoves during the half year; and the total number now in use was 1768. There had been no demand for automatic prepayment or "penny-in-the-slot" meters. As he had stated on former occasions, the number of their consumers was larger in proportion to their capital than in almost any town in England. They had 48,000 consumers, with a capital of £796,000. Birmingham had 58,000, with a capital of £2,325,000; Liverpool, 72,000, with a capital of £1,859,000; and Manchester, 81,637, with a capital of £1,554,000. It would, therefore, be seen that the working classes of Sheffield had taken advantage of the gas the Company had supplied more than the people of any other town in England; and they evidently appreciated the quality and price of the article they had been able to obtain. From Jan. 1 of this year down to June 30, 20 additional gas-engines had been fixed—equalling 103¾-horse power; and the total number of gas-engines now fixed in Sheffield was 427. This number would doubtless increase, as they occupied little space, and were always ready when their work was required. He noticed that the Chairman of the Great Eastern Railway Company, Lord Claud Hamilton, complained of a falling-off of £36,000 in the coal traffic during the last half year. He attributed this to the coal strike, and to the fact that the people in the district served largely by his Company had substituted gas-fires for the open coal-grates; and he calculated that the Great Eastern Railway Company had carried 90,000 tons less of coal than previously, principally on account of the great increase of gas fires. Speaking for himself, he (Sir F. Mappin) did not know anything that was a greater luxury than a gas fire in a bedroom in the winter time. The Chairman of the Incandescent Gas Company, at a meeting of that Company in July, spoke in glowing terms of the progress of their system of street lighting; and he said he did not believe they had yet touched the fringe of the business that was before gas companies, on account of the great advantage that their mode of lighting was giving to them. At The Gaslight and Coke Company's last meeting, Mr. Frazer, speaking of the lighting of an embankment at Brighton with the incandescent gas light, said it was so satisfactory that the whole of it was going to be lighted on the system. On a previous occasion he had given his opinion of the incandescent gas-burner; and they could not be surprised at the great progress it had made, when they considered that in place of the usual burners, they could have one that gave so much more light at half the cost, and with so much less heat. The development of the Incandescent Company's business had been so remarkable that their turn-over was now fifteen times larger than it was two years ago. Its profit last year was £90,000. Of this sum £20,000 went to the Managing Director and the Chemist; leaving the Company a profit of £70,000. There must be a great deal in the new burner; otherwise the Company would not have achieved such a remarkable success. No doubt, the prosperity would not be continued; for numerous law-suits were pending, to test the question whether the patents of the Company were as substantial as was supposed, and protected the Company to the extent they had hitherto done. His own opinion was that the gas industry in a very short time would be in possession of burners, costing 1s. each, that would place gas in a totally different position to that it had occupied in the past; and that the rivals of gas would have to face the incandescent burner. It was a subject that would require consideration, not only by gas companies, but by those who produced a light in opposition to gas. He was a firm believer in the prospects of gas companies that were well managed, that produced a good article, and sold it at a fair and reasonable price. He had not lost his faith in gas, or in the Sheffield Gas Company. He was satisfied the Company had before it a great future.

Mr. Ebenezer Hall seconded the motion.

Mr. John Wilson suggested that the Company might take 2d. off the price of gas, and "knock out" the electric light. He thought there was a possibility of the electric light reaching them in time; but if they gave people gas at 2s. per 1000 cubic feet, it would keep the new light back.

The Chairman reminded the meeting that, to adopt Mr. Wilson's suggestion, would make a difference of £15,000 a year to the Company; and having regard to the great changes which occurred in the values of residuals, he thought they ought to be very careful how they interfered with the price. A balance of £2000 did not justify them in sacrificing £15,000 a year. He could not, therefore, hold out the prospect of gas being reduced in price at present.

The motion was then put and adopted; and, on the motion of the Chairman, seconded by Mr. H. Hutchinson, the usual dividends were declared.

Mr. Charles Belk proposed the re-election of Sir Frederick Mappin as a Director of the Company. He said the shareholders had a Board of Directors with whom they were well satisfied; and so long as they continued the "sweet simplicity" of the 10 per cent., they would all, at these half-yearly meetings, be a happy and united family. Sir Frederick Mappin had long been associated with the Company; and to him its success was largely attributable. He (Mr. Belk) thought the report was an exceedingly business-like and satisfactory one. During the last half year there had been no periodic scares in connection with electric light—got up perhaps for Stock Exchange purposes, and to depreciate gas shares. There was no doubt the electric light had a future before it as an illuminant; but he did not think there was the slightest probability that, in this generation, it would supersede gas. With such inventions as that to which Sir Frederick Mappin had referred, he did not think they need have the slightest fear as to the success of their property.

Mr. J. B. Wostinholm seconded the resolution, which was carried.

Mr. Henry Hutchinson and Dr. Sorby were also re-elected Directors; and votes of thanks to the Directors and officials, and to the Chairman, terminated the meeting.

HERTFORD GAS COMPANY.

Loss of the Company's Account Books.

At the Annual Meeting of the Hertford Gas Company last month—Mr. E. Manser in the chair—the circumstances leading up to the recent changes in management were detailed in a lengthy report by the Board, of which the following are the principal parts:—

The history of the Company during the past year has included certain events of so extraordinary a nature that the Directors consider it their duty to lay them before the shareholders in a fuller manner than is usual under ordinary circumstances.

About the end of December last, the Board thought the arrears of gas-rent were unduly heavy; and that, for that and other reasons, it was desirable to obtain the advice of an expert. They therefore engaged Mr. Alfred Lass, F.C.A., a London Accountant having specially wide experience and knowledge of the affairs of gas companies, to come down to Hertford, inspect the Company's books, and advise the Board upon them. On Jan. 1 Mr. Lass came down, and made a careful inspection of the books, in conjunction with the Chairman and some of the Directors. Mr. Lass expressed the opinion, after a long examination, that the collection of gas-rents was very bad; that the arrears were very large; and that the Company's accounts were very unsatisfactory. He also advised the adoption of a new system of book-keeping and the opening of fresh books. Mr. R. W. Brett, the then Manager, and Mr. R. W. Brett, jun., his son, the then Collector, were present at that conversation.

After the interview, Mr. Lass had a private conference with the Chairman, and advised him to have the rental and other accounts made up to the 31st of December as early as possible; but, before sending them out, to get them examined by the Company's Auditors, to see that they agreed with the Company's books, and then to send them direct to the consumers.

Accordingly, the Chairman instructed Mr. Brett to get the rental and fittings books made up, and to inform him when they would be ready. About the 12th of January, Mr. Brett stated they would be ready in a few days; and the Chairman then instructed him not to send out any accounts, as the Directors wished them examined and checked with the books before delivery. After that interview, Mr. Brett informed the Chairman that he and his son would complete the balancing on the 15th of January; and the Chairman desired him to have the books at the Company's office on the 16th, and arranged with the Auditors to check the accounts with the books on that day and the next if necessary.

On the 15th of January, the most important books of the Company disappeared—viz., the rental book, the cash book, two ledgers, and the fittings accounts.

On the evening of the 15th of January Mr. R. W. Brett, jun., came to the Chairman's house about nine o'clock, and made the following statement—namely, that he packed the books up on the evening of the 14th, and left them in the office of the Company in Castle Street, Hertford, in the place where parcels were usually left which had to go down to the works; that he had then gone out with his wife for the evening; that the next morning, when he met his father near the town, he asked him if he had received the books, and was told he had not, and said he would go back and look after them. It does not appear that he did anything that morning; but he informed the Chairman that about three o'clock he went to the works and found no books had arrived, and about six o'clock he went to the Police Station to report the loss. No information, however, has been obtained throwing any further light upon the circumstances of the disappearance.

The Directors met on the morning of the 16th, and examined all the inmates of the house; but it appeared no one had seen the books, or received any instructions to take them to the works.

Acting under the advice of the Company's Solicitor (Mr. T. J. Sworder), notice was given to Mr. R. W. Brett and his son to make up their accounts, and deliver up all books, papers, and documents to him; and notice was also given to Mr. R. W. Brett, jun., to leave the house. On the 21st of January Mr. R. W. Brett, sen., was asked if he wished to resign. After requesting seven days to consider his position, he refused to do so; and three months' notice was therefore given to him to leave the Company's employ, and he has accordingly ceased to be Manager of the Company's works.

Both Mr. R. W. Brett, sen., and Mr. R. W. Brett, jun., protest that they are not responsible for the loss of the books, and adhere to the allegation that they have been stolen. The Directors, with the assistance of Mr. Alfred Lass, and information given by Mr. R. W. Brett and his son, and obtained from the remaining books, and by communication with the consumers, made up and collected the gas-rental accounts to the 31st of December, and have now prepared the best statement possible of the present position of the Company. The accounts prepared under Mr. Lass's superintendence, up to the 30th of June, 1895, will be laid before the shareholders. They show that, upon comparison of the present position of the Company with that shown on the last balance-sheet (June 30, 1894), it appears there is a deficiency of about £1800 in the assets and money of the Company.

Under these circumstances, the Directors cannot recommend any dividend; but as it is necessary to raise money to meet the liabilities, they recommend the only course open—viz., to raise additional capital. For this purpose a resolution will be submitted to the proprietors at the special general meeting which will be held at the close of the ordinary meeting, authorizing the issue by the Directors of £3000, the remainder of the sum of £6000, first part of the additional capital authorized by the Act of 1864. The Board propose to issue only so much of this capital as may be needed to place the affairs of the Company on a sound and satisfactory basis.

The Directors have appointed Mr. Robert Watson as Manager of the Company, in place of Mr. R. W. Brett. They have also appointed Mr. Watson as Secretary of the Company, and recommend that a salary of £40 per annum be paid to him for his services as Secretary. They have also appointed Mr. John N. Tomes, as Collector, in place of Mr. Brett, jun.

They believe that the business of the Company is thoroughly sound, and that there is no reason to doubt that under capable management, which the Directors believe they have secured, the prosperity of the Company—which has for a course of over 30 years paid remunerative dividends—will be renewed. They therefore trust that the policy they have recommended may receive the support of the shareholders.

The Directors propose that in future the accounts of the Company shall be under the supervision of Messrs. Alfred Lass, Wood, and Co., Chartered Accountants, of No. 30, Gracechurch Street, London.

The report having been taken as read,

The Chairman called on Mr. Lass for the financial statement.

Mr. Lass said he would endeavour to lay before the meeting, in as clear and lucid a manner as possible, the statement of accounts of the Company for the past year. Before directing his attention particularly to those accounts, he should have to say a word or two with reference to the accounts which were published for the year ending June 30, 1894. There were three or four items in that year's balance-sheet which he should like to submit to their notice. In the first place, the amount owing to sundry persons was there shown as £1673. In making up this year's accounts, it had been discovered that the amount which was owing to sundry persons on June 30, 1894, instead of being £1673, as placed on the balance-sheet, was £2172, so that there was a sum of £499 additional liability should have been included in the accounts of that time. The next item to which he wished to refer was the amount owing to consumers for deposits and interest, £40 odd. As far as he had been able to ascertain, that amount ought to have been £59. Therefore the liabilities of the Company in that direction were understated in the balance-sheet for last year by £19. The next item was the amount owing by sundry persons to the Company for rental and repairs, which came to £2400; taking rentals alone, the sum of £1497. Now the rental-book, which contained the names of the consumers and the sum owing by them, having with the Company's cash-book disappeared, it became necessary to construct from the best available source a new rental-book. The result had been that of the sum of £1497, which appeared to be owing to the Company on June 30, 1894, a sum of only £1090 could be traced; the difference against the Company being £406. The sum of £902 was shown, on June 30, as owing to the Company from sundry persons for residuals sold and for gas-fittings. The ledger containing the names of the persons owing this amount having disappeared, and no list having been discovered among the Company's papers, the result had been that of the sum mentioned they had only been able to discover the amount of £281; the difference against the Company being £620. In last year's balance-sheet there also appeared to be owing by the collector the sum of £42. The difference between the amount which appeared to have been received by the collector from the 1st of July, 1894, down to the 30th of June, 1895, and the amounts which had been paid into the bank amounted altogether to the sum of £166. The total of the various differences he had mentioned was £1713 against the Company, which with £100 which had been added to meet contingencies, came to £1813, which the Company would have to pay off out of future profits. He now came more particularly to the accounts for the past year; and he thought that, instead of reading them through, it would be better that he should explain them, in order that the proprietors might better understand how the working for the past year had turned out. First of all there was the capital account, out of which they had expended £58 in the laying of new mains. Upon new meters, they had spent £18; and the Directors had bought certain fixtures in the house of the late Manager for £20, which made a total expenditure of £96. The amount expended on capital account to June, 1894, came to £15,841; so that the present capital account showed a total expenditure of £15,938. As the total capital raised was £15,990, there was a balance on that account of £51 odd. Next they had the revenue account. For the past year, the amount received from private and public lighting came to £4856; rental of meters, £95; residual products, £689; and transfer fees, 7s. 6d.—the gross receipts of the Company being £5641. Out of this sum they had had to pay for coals, purifying, salaries of managers and officers, and wages and other general expenses, which came to £5446; leaving on the face of it a profit on the year's working of only £194. He would like to give a few calculations with reference to the working for the past year, as there were several points of great interest which he thought should be laid before them, as they would then be able to form some opinion as to whether the undertaking was going to show a profit or a loss in the future. Gas undertakings, as a rule, if managed properly, earned a sufficient amount of profit to enable a dividend to be paid on the capital invested. They found at Hertford there was only a profit of £194 for the past year; and he should be able to give a few facts which he thought spoke for themselves. They had only sold 86½ per cent. of the gas made. The gas used at the works amounted to 2 per cent.; while the leakage was 11½ per cent. He understood that this leakage was not likely to be so large in the future as for the past year, during which time it had been abnormal. He did not doubt that, in the course of next year, they would find that the quantity of gas sold had been greater than 86½ per cent. The capital employed was £15,990, which worked out at £5 12s. 3d. per ton of coal carbonized. This amount compared favourably with other companies with a capital as small as theirs. During the past year they had made 9526 cubic feet of gas per ton; but they had only sold 8240 per ton. Now there was no reason why they should not sell at least 9000 cubic feet per ton, the same as other companies. If they had done this, a saving of 240 tons of coal, which at 19s. 10d. per ton amounted to £238, would have been effected. Then, again, 59⅓ per cent. of the coke made had been used at the works, which was a large percentage. If only 40 per cent. had been used, there would have been an additional 329 tons of coke for sale, which, at 14s. a ton, would have realized £230. Then there was nothing received for ammoniacal liquor—in fact, he found there was a loss of £6 11s. on that account; for it was said that the liquor was so exceptionally weak that a considerable sum had to be paid to get it carted away. All this was wrong; for the liquor could have been made stronger without any difficulty, and it could have been converted into sulphate of ammonia and sold. And if it had been, there would have been probably an income from this source of at least £120. The general expenses which had been incurred in connection with the last year's working were altogether out of proportion to what they ought to be; for they came to 24·71d. per 1000 cubic feet of gas sold. Now, if the working expenses had been but 20d. only, which was quite as high as they ought to be, 4¾d. for every 1000 cubic feet of gas would have been saved, which would have amounted to £460. On the items he had mentioned, there had been a loss of £1048 He doubted not that with very little trouble they could also put their hands on other things where there could have been a saving. So that there was no reason why, in the future, the profit earned should not be as large as that earned by other gas companies; and there was further no reason why the Manager should not be in a position to cause this result to take place. Out of the profit of £194, and the balance with which the year was commenced, £91 10s. 4d., income tax amounting to £37, and interest on the bonds and bank overdrafts amounting to £55, had to be paid. So that there was £193 to go forward to next year. Looking at their assets and liabilities, they would find that their stock in hand amounted to £1422; amounts owing by sundry persons for rentals, £1067; and owing for residuals and fittings, £568 13s. Then they had as an asset of the Company the suspense account of £1813. It was an asset of the Company in so far that it had to be paid out of future profits which were pledged to that extent. The liabilities of the Company were as follows: For coal and other material delivered, £2488; banking account overdrawn, £1092; owing to consumers for deposits and interest, £49; unpaid dividend, £7; due to reserve fund, £990; to capital account, £51; and balance unappropriated on profit and loss and nett revenue account, £193. In conclusion, Mr. Lass remarked that a new set of books had now been made out, and everything was fair and square for a good sound prosperous time; and he saw no reason why, with proper management, things should not go on regularly, and show a sufficient amount of profit to pay a dividend upon the amount of capital invested.

After some questions had been asked and answered,

The Chairman moved the adoption of the report and balance-sheet.

Mr. R. Cocks seconded the motion.

Mr. J. Gripper, in the course of a few remarks, expressed the opinion that the Directors were greatly to blame for the state of things that had come to pass. He considered they ought to have seen, by the large amount put down to the different items in past balance-sheets, that things were not what they ought to be. Referring to the old books, he said that the Directors, as soon as they thought things were not as they should be, ought to have put an embargo on them, which would have prevented all the bother that had occurred, and should have at once placed them in the hands of a chartered accountant, to make up. Past profits were fictitious; and the shareholders had been receiving money to which they were not entitled, and which the Company had never earned. The management must have been bad, or the £1048 mentioned by Mr. Lass as the amount which might be saved in the working, would have been available towards the £1100 required to pay a dividend.

Mr. Munnings, as one of the Auditors, pointed out that they had not the slightest idea that £500 more was owing than was accounted for in last year's balance-sheet; and he presumed that the Directors had not. He could not understand how it was £166 more had been collected than had been paid into the bank; and he thought this circumstance required explanation.

Mr. R. W. Brett, sen., remarked that the amount was only an estimate. No positive assertion was made that this amount had been collected.

Mr. Lass said that receipts for some amounts supposed to have been owing had been produced.

Mr. Brett said that was due to the accounts having to be got together as best they could from the details they had at hand. He complained that, when Manager, he did not have the help that was necessary to keep the books. If efficient help had been given him, he felt confident that nothing would have occurred. It was a case of "the last straw" breaking the "camel's back." Mr. Lass himself had said that the staff was insufficient, although the report did not state that.

Mr. Longmore expressed the opinion that the shareholders were to blame as well as the Directors for what had occurred, through not attending the meetings and taking an interest in the affairs of the Company, instead of leaving everything to the Directors. He congratulated the Directors upon having at last appointed skilled auditors to take charge of the books—remarking that it was a step which should have been taken long since. He deplored the statements in the report put before them; but he considered that the wisest thing for them to do now was to accept the position, and ask the Directors to do their utmost to bring the business up to a prosperous state.

After some few further remarks, the report and balance-sheet were adopted, and ordered to be printed and circulated.

The election by the Directors of Mr. R. Watson, the Manager of the gas-works, as Secretary to the Company was confirmed; his remuneration for the office being fixed at £40 per year.

At the close of the business of the annual meeting, an extraordinary general meeting was held for the purpose of authorizing the creation of capital to the amount of £3000; being the remaining portion of the first of the two sums of £6000, power to issue which was granted to the Company by the Hertford Gas Act, 1864. The capital is to be raised by the issue of shares to the amount of £10 each, either as ordinary shares or preference shares, and subject to the conditions and provisions prescribed by the Act. Authority was given for the raising of the necessary capital; and the proceedings terminated.

PROVINCIAL GAS COMPANIES.

The Chairman of the Dover Gas Company (Mr. W. Mannering) had, on the whole, an eminently satisfactory statement to lay before the shareholders at their recent half-yearly meeting. The report has already been briefly alluded to (*ante*, p. 446); but the Chairman gave some additional interesting particulars. He said that a noticeable feature of the half year had been the large increase of 10¾ per cent. in the sale of gas, as compared with the corresponding period of 1894. A great deal of this was doubtless owing to the severe weather in January and February; but a considerable increase was maintained throughout the six months, and was still going on, which might be attributed to the growing demand for gas for cooking and heating purposes, as well as to the extension of business generally. There had been a loss of revenue owing to the low price obtained for sulphate. The difference, as compared with the receipts for that product in the corresponding period, was £314. There was also an increased outlay in providing and fixing incandescent burners in the public lamps in some of the leading thoroughfares. The change had, so far, proved a success; and the great improvement in the lighting, arising from the use of these burners, appeared to have given general satisfaction. He certainly thought that the brilliancy of the modest little incandescent lamps compared favourably with the towering arc lights of the Electric Light Company. As to the accounts, the receipts for the half year were £1298 more than for the same period of 1894; and the increase was accounted for as follows: Gas-rental, £1083; coke, tar, and other residuals, £172; and meter and other rentals, £48 more. The payments were £1303 in excess of the corresponding half year. Coals had cost an extra £781; the large amount of gas necessitating the use of an additional 1000 tons. The financial result of the half year was a profit-balance of £2696, or £14 more than the amount required for the dividend. Under the able management of Mr. R. Herring, very satisfactory results had been obtained in the manufacture. During the six months, 8913 tons of coal were carbonized, which produced 97,925,000 cubic feet of gas, equal to 10,986 cubic feet per ton of coal. The quantity sold and used was 91,642,600 cubic feet, equal to 10,281 cubic feet per ton of coal The gas unaccounted for was 6·41 per cent. Before concluding, the Chairman expressed regret at the loss by death of the Company's Chief Clerk (Mr. G. J. Roberts), who had faithfully served them for 35 years. The report was adopted; and a dividend at the rate of 7½ per cent. per annum was declared. On behalf of the shareholders, Mr. Mowll suggested that the Directors should recognize in some substantial way Mr. Roberts's long services; and the Chairman intimated that the matter was receiving the Directors' careful consideration at the present time.

In moving the adoption of the Directors' report (noticed on the 3rd inst.) at the annual meeting of the Falmouth Gas Company, the Chairman (Mr. R. M. Tweedy) said he was doubtful whether it would be the last annual meeting, as the Board were in communication with the Corporation regarding the proposal to buy the Company's property. The Directors had offered them every facility; but it was thought the purchase of the gas-works was rather a heavy matter for the ratepayers, and that more money would be required than the Corporation would be disposed to give. However, he congratulated the shareholders on the improved state of affairs. The quantity of gas consumed was 1¾ million cubic feet more than during the previous year, owing principally to the introduction of the penny-in-the-slot meter system. Receipts had improved in every direction, aggregating £[illegible] more that in 1893-4. The report was adopted; and a dividend of 11 per cent. was declared.

The report of the Directors of the Keswick Gas Company, which was noticed in the Journal for the 3rd inst., was submitted to the shareholders at their annual meeting held on that date. In moving its adoption, it was pointed out by the Chairman (Mr. R. Mumberson) that coal had cost 10d. per ton more than in the preceding year, and that, with an increased consumption, there had been an extra expenditure of £274. The receipts from ammoniacal liquor had considerably increased; but they would not be so fortunate with it this year. It was encouraging to find that the Company were better by something like £368 than in the previous year. The report was adopted; and a dividend at the rate of 8½ per cent. upon the original capital and of £5 19s. per cent. upon the additional capital was declared. The Chairman afterwards mentioned that the Directors had found it necessary to make provision for additional gas storage; and they had entered into a contract with the Whessoe Foundry Company, Limited, for a new holder, with a steel tank. From statistics prepared by the Secretary (Mr. J. H. Brodie), it appears that the Company have now 238 cooking-stoves out on hire, and 137 prepayment meters fixed. During the past year 15,578,300 cubic feet of gas were made, which was an increase of 2,250,400 feet on the preceding year. The unaccounted-for gas was equal to 7 per cent. The quantity of coal carbonized was 1490 tons; the average production of gas being 10,455 cubic feet, which speaks well for the management of Mr. T. Heywood. The new gasholder will be 58 feet in diameter by 20 feet deep; and the tank 62 feet diameter by 20 ft. 6 in. deep This will give an increased storage accommodation of 52,500 cubic feet; but, as a small holder will be put out of use, the net increase will be 39,500 feet.

It was stated at the recent half-yearly meeting of the Kingston-on-Thames Gas Company that there had been an increase of 14 per cent. in the consumption of gas. Owing to the considerable growth of the business, it had been decided to enlarge the manufacturing and purifying plant, and to erect a new gasholder, having a storage capacity of 1½ million cubic feet. This would economize labour, and avoid the necessity of working on Sundays. The maximum dividends were declared.

The Directors of the Newmarket Gas Company had a healthy report to lay before the shareholders at the recent meeting. The business, they stated, continued to increase; and consequently they had decided to reduce, from July 6 last, the price of gas to all the consumers—viz., from 4s. 8d. to 3s. 10d. at Exning, and from 4s. 2d. to 3s. 10d. at Newmarket—making the charge uniform throughout the district. As a result of the working during the year ending July 31 last, the Directors were able to report a net balance of profit available for dividend of £5029, from which they recommended a dividend at the rate of 12 per cent. on all the capital, which would absorb £3600. The report referred to what is being done in fitting up small houses under a prepayment system, and also alluded to the Company's new Act of Parliament, which came into operation on Aug. 1, and which the Board believed would prove alike advantageous to the proprietors and the consumers. The Chairman (Mr. R. Stephenson) mentioned that the dividend was 1 per cent. in advance of the previous one; and, in a short allusion to the new Act, he said he was bound to make a few remarks as to their able Secretary and Manager (Mr. J. H. Troughton). It was no use having good officials looking after their interests in London, unless they had at home a capable Manager who knew what they wanted. This he must say described Mr. Troughton. He had gone most carefully into every detail of the Bill; and he was entitled to their best thanks for the splendid service he had rendered them. The report and recommendation as to the dividend was adopted.

The Queenstown (Ireland) Gas Company report a net profit of £761 on the working of the half year, which it is proposed to allocate as follows: £103 to the payment of interest on the debenture loan, £623 to the payment of the full statutory dividends at the rate of 10 per cent. on the "A" shares, 5 per cent. on the "B" shares, and 7 per cent. on the "C" shares, less income-tax; the balance to be added to the reserve fund. The price of gas has been reduced from April 1 last by 3d. per 1000 cubic feet.

The Shotley Bridge and Consett District Gas Company report that, during the six months ending June 30, the consumption of gas was 21,917,000 cubic feet, which was an increase of 6½ per cent. The balance of revenue is £1456, which has permitted of the declaration of a dividend of 5 per cent. on the consolidated stock and "A" capital, and 3½ per cent. on the "B" capital.

At the recent meeting of the Truro Gas Company, it was reported that there was a gross profit for the past year of £3176, and a net profit of £866. A dividend of 7½ per cent. (£900), against one of 10 per cent. (£1200) for the preceding year, was recommended. It was explained that the expenditure had been greater than usual during the past year; considerable outlay having been incurred on buildings, works, mains, and services, in order to place them in a thoroughly efficient state. The sales of gas had realized £5543. Coal, wages, salaries, and other expenses amounted to £6339; rent, rates, and taxes absorbed £361; debenture interest, £264; and additions, renewals, and repairs, £1182. The capital of the Company is £18,850, the whole of which has been called up. A paragraph referring to the proposed econstruction of the Company appears in another column.

Welsh Water for London.—The Usk and Ebbw Board of Conservators had under consideration last Tuesday week, the proposals of the London County Council for procuring water from South Wales and Monmouthshire. The Board determined to ask the landowners and others to subscribe towards a fund for obtaining expert advice as to the rainfall, &c., so as to be prepared with figures when the matter is brought before Parliament, to show why the scheme, in so far as the Usk is concerned, should not be carried out.

The Pontypridd Water Company's Supply.—A letter bearing upon the subject of the recent shortness of water in the Rhondda Valleys, was read at the meeting of the Pontypridd District Council last Thursday week. It was written by the Secretary of the local Water Company, and stated that a good deal of the grievances in connection with the scarcity of supply had arisen owing to the great subsidence of the ground in the mining district. In consequence of circumstances over which the Company had no control, occasionally a portion of the water went into the mains unfiltered; but the bulk of the water was properly purified. It was believed that the contractors for the new works at Mardy would complete them within the specified time.

HALIFAX CORPORATION GAS DEPARTMENT.

An Analysis of the Cost of Gas.

We are indebted to Mr. Thomas Holgate, the Gas Engineer of the Halifax Corporation, for a comparative statement of the results of the operations of his department during the years ending March 31, 1894 and 1895. Generally speaking, the figures disclose substantial progress —the make and sale of gas having increased with a diminution in the cost per 1000 cubic feet.

Dealing first with the information as to the manufacture, the quantity of coal carbonized last year was 69,554 tons; and in 1893-4, 64,828 tons. In the former period, 13·2 per cent. of cannel hub was used; and in the latter, 12·74 per cent. The cost of coal was in 1894-5 £29,066, and in 1893-4 £36,401; or per 1000 cubic feet 11·12d. and 14·84d. respectively. Deducting the receipts for residual products—viz., £18,109 in 1894-5, and £20,115 in 1893-4—leaves the net cost of coal in the two years at £10,957 and £16,286, or per 1000 cubic feet 4·19d. and 6·64d. The other items under the head of manufacture of gas (the first figures being for 1894-5, and the second for 1893-4) were: Carbonizing (wages, tools, and removal of refuse), £9948 and £11,361; purifying, £1409 and £1814; maintenance of works, £8926 and £7410; management and general charges (four-fifths), £1052 and £1050; Town Hall expenses (one-fourth), £608 and £592; rates and taxes (one-half), £1495 and £1451; interest (two-thirds), £6783 and £6693; and sinking fund (two-thirds), £3956 and £3359. These figures made the total cost at the works in 1894-5 £45,136, and in 1893-4 £50,017; or per 1000 cubic feet 17·27d. and 20·39d. Under the heading of distribution of gas, collection of accounts, &c., the following are the comparative figures for the two years: Meter inspectors' wages, £832 and £816; repairing meters, £710 and £599; repairing mains and services, £3366 and £3580; management and general charges (one-fifth), £263 and £262; Town Hall expenses (three-fourths), £1824 and £1776; rates and taxes (one-half), £1495 and £1451; interest (one-third), £3391 and £3346; and sinking fund (one-third), £1978 and £1679. The gross cost outside the works for 1894-5 was £13,860, as against £13,513, or per 1000 cubic feet 5·30d. and 5·51d. Deducting the meter-rents (£2437 and £2359), made the net cost outside the works £11,423, compared with £11,154; or per 1000 cubic feet 4·37d. and 4·55d.

The total receipts for gas amounted to £63,051 in 1894-5, and to £61,398 in 1893-4; or 24·12d. and 25·03d. per 1000 cubic feet. The total cost of the supply was £56,559, as against £61,171; or per 1000 cubic feet 21·64d. and 24·94d. The net profit last year was £6492, compared with £226 in 1893-4; or per 1000 cubic feet 2·48d. and 0·09d.

With regard to the manufacturing results in 1894-5, 681,824,000 cubic feet of gas were produced, or 9803 feet per ton of coal; 627,144,700 cubic feet were sold, and 7,631,500 feet used on the works (together 634,776,200 feet, or 9127 feet per ton of coal); leaving the unaccounted-for gas at 47,047,800 cubic feet, or 676 feet per ton, being equal to 6·90 per cent. The average illuminating power was 17·61 candles. The corresponding figures for 1893-4 were: Gas made, 640,786,000 cubic feet, or 9884 feet per ton; sold, 588,570,700 feet, and used on works, 8,235,000 feet (together 596,805,700 feet, or 9206 feet per ton of coal); unaccounted for, 43,980,300 cubic feet, or 678 feet per ton, being equal to 6·86 per cent. The average illuminating power was 18·01 candles.

THE PUBLIC LIGHTING CONTRACTS FOR WEYBRIDGE.

An Extraordinary Muddle.

A singular statement was made by Mr. W. F. Ward at the last monthly meeting of the Weybridge District Council, which reveals a peculiar looseness in the conduct of the business of this body. The subject was the public lighting of the district, the recent proceedings in connection with which were described by Mr. Ward as "extraordinary, irregular, and illegal;" and the Council have consequently fallen into a "hopeless muddle." A remark made by Mr. Ward in the course of the meeting leads one to assume that he is a lawyer; and it would be interesting to learn why he allowed his colleagues to drop into a muddle of this kind. The secret may perhaps be found in the declaration by Mr. Ward (who, by the way, is the Vice-Chairman of the Council) that he believed the Chairman (Mr. E. Till), if he set his mind on doing a certain thing, "would move heaven and earth to do it." The story of "illegal" procedure, briefly told, is this: On July 10 last, a Lighting Committee was formed, to whom the Council delegated their powers of lighting. On that occasion, it was proposed by Mr. Ward that the Council should purchase standards and lamps for lighting the district with oil. This was carried; and the resolution was subsequently duly confirmed. The Lighting Committee afterwards resolved to hold a public meeting, to ascertain the views of the ratepayers on the question of lighting. This was confirmed by the Council; and the public meeting was held on Aug. 7, and adjourned to Aug. 14. In the meantime, however—on Aug. 8—a meeting of the Council was held, and resolved into Committee, to consider "the lighting of the parish." Such a proceeding as a Council resolving into Committee over a Committee which they had already formed to consider a particular matter is, Mr. Ward asserts, without precedent. At this meeting, on the motion of the Chairman, it was agreed that a contract be entered into with the Walton Gas Company for one year certain. Could anything, asks Mr. Ward, be more monstrous when there was already the resolution confirmed by the Council that standards and oil-lamps should be purchased? How could they pass the second resolution without rescinding the former one? To do this, there is a regular process to go through; and, moreover, the resolution of Aug. 8 was actually passed behind the backs of the public while they were engaged in considering the best means of lighting. Then the Council appointed a Committee to negotiate with the Gas Company; and on Aug. 13, this Committee made a verbal report as to the terms of the Company. Standing Order No. 39, Mr. Ward points out, provides that every report of a Committee shall, if required, be presented in writing, and be entered in the minute-book. Was there, he inquired of his colleagues, no record of this report? After the inhabitants had left the matter for the Council to decide, the proper course would have been to have referred back the whole question to the Lighting Committee, so as to conform with the wishes of the public. They would then have been in order; but now the whole proceedings are, Mr. Ward declares, void. At another meeting of the Council, on Aug. 19, the Chairman reported that the Weybridge Electric Supply Company were prepared to do the lighting for a further three months, at so much per lamp. In the minutes of Aug. 10, there is the resolution that the offer of the Gas Company be accepted; but there is no mention of that offer in the minutes of the previous meeting. Three members voted for the resolution, one against, and five did not vote at all. The resolution was declared carried; and the Chairman signed and sealed the agreement with the Company. On this point, Mr. Ward said: Could anything be more extraordinary than that? He did not think any one of the members could have read the Standing Order No. 42, which said "all deeds and other documents to which the common seal of the Council shall require to be affixed shall be sealed in pursuance of a resolution of the Council, and in the presence of the members of the Council and the Clerk, or his deputy." Where was the resolution directing the contract to be sealed? But, first of all, where was the resolution ordering a contract to be prepared? It was next recorded that the Committee should arrange with the Gas Company to erect 119 lamps in six weeks, under a penalty of £2 for each day over that period. How could they do this? The Committee were appointed to negotiate terms with the Gas Company; and when they reported as to that for which they were legally appointed, their functions ceased. Having shown the members the errors of their ways, Mr. Ward wound up by informing them that he had already been instructed to issue a writ against the Council; but he did not wish to do that. They must consider how to get out of the mess they had so cleverly got into; and, if he could help them, he would, although at present he could not see how it was to be done. They had entirely ignored their own Standing Orders by passing resolutions without proper notice being given. He suggested that the facts should be laid before Mr. Glen, and that they should ask his opinion as to the position of the Council. He had gone as far as to consult Counsel himself; and he had no hesitation in saying that, if he took proceedings against the Council, the gentlemen who had done this thing would have to pay for it. There was a conversational discussion on the subject, in which it was generally agreed that the Council were in a predicament. Dr. Powell inquired whether, if the contract with the Gas Company was illegal, as far as the Council was concerned, it was binding on the Company? Mr. Ward replied that if a contract had been entered into, and the Council did not fulfil it, they would no doubt be liable. He elicited that the contract had not been signed by the Company; but the Clerk stated that he had received a letter from the Manager, stating that he was prepared to get all the lamps erected and ready for lighting in the busier parts of the town before the end of September, and the remainder within two weeks later. It was agreed that the whole of the minutes and proceedings as to the lighting of the town should be submitted to Counsel for his opinion as to the position of the Council.

ELECTRIC LIGHTING NOTES.

According to information which has reached the Antwerp correspondent of *L'Etoile Belge*, there is likely to be a rupture between the Antwerp Municipality and the local Hydro-Electric Supply Company. It may be remembered that the Company were granted a concession in February, 1891, for a combined hydraulic and electric supply system; and it seems that they have now applied to have the terms of the concession altered in no fewer than nine respects. The matter has been submitted to the Municipal Engineer (M. Royers), who has advised that the application should not be entertained. The Company, first of all, do not wish to extend the hydro-electric system; and on this point M. Royers is indifferent. He says it does not matter to the consumer whether the current is generated by a steam-engine or by any other kind of power; and as the Company have laid down the seven or eight miles of pipes they undertook to provide, there is no need for a revision of the contract in this respect. But they go farther, and ask to be allowed to give up the hydraulic supply system entirely; and it is here that the Municipal Engineer comes into collision with them. When the contract was originally discussed, prominence was given to the point that this system would enable large consumers to produce electricity on their own premises, and so get their light at less than the cost of gas—in fact, that it would be a serious competitor with gas. M. Royers appreciates this position; and he does not quite see why the competition should cease. Its advantages, on the score of price, were adduced as a reason for the prolongation of the gas concession by some fifteen years. Moreover, with the proposed new conditions of working, the Company seek to revise the payments to be made into the municipal treasury; and the sum they suggest is regarded by M. Royers as about 50 per cent. too low. The main point, however, is the establishment of a monopoly, not only of electric lighting, but also of the electrical distribution of power, until 1905. A monopoly of any kind should be granted with caution; but, the Municipal Council having sanctioned it in this case, M. Royers thinks the public will be best served by its continuance as a healthful competitor with gas. There seems, consequently, to be but little prospect of the Company's proposals being accepted.

The profit and loss account of the Brush Electrical Engineering Company for the year ended June 30 shows a gross profit of £37,858, after providing for bad and doubtful debts to the amount of £2205, and writing down the value of shares and debentures in other companies. After deducting from the gross profit, general charges, maintenance of buildings, plant, and patents, staff bonuses under the Company's profit-sharing scheme, and interest on debenture stock, there remains a net balance of profit (after including the amount brought forward from last year) of £11,329. An interim dividend at the rate of 6 per cent. upon the preference shares, and at the rate of 5 per cent. upon the ordinary shares, has been already paid for the half year ended Dec. 31, 1894,

amounting to £12,150. The net profit for the year, exclusive of the amount brought forward, is £7541. The preference shareholders have already received £5400 of this amount by way of interim dividend as above; and they will be entitled to receive the balance of £2141 before the ordinary shareholders receive further dividends. While the Directors regret this result of the year's operations—which shows a decrease of net profit as compared with last year of £19,739—they state that it is solely due to loss incurred during the second half of the Company's financial year in connection with the contract which the Company is carrying out for the City of London Electric Lighting Company, and arises out of differences between the two Companies as to the obligations involved under the contract. The Directors report that these differences are now at an end; and work under the contract is being again proceeded with.

The arrangements for the scheme for lighting the main streets of Swansea by electricity, and at the same time using the plant for the purpose of destroying the town refuse, are now complete; and the Committee who have the matter in hand have prepared their report for presentation to the Council. The estimated cost of the work is about £50,000.

It was reported to the Middlesbrough Town Council last Tuesday that the Electric Lighting Committee had, in accordance with the instructions of the Council, asked Mr. R. Hammond to report on the least cost of an economically working electric lighting plant. Colonel Sadler warned the Council that the most influential ratepayers were strongly antagonistic to any expenditure on electric lighting, and very important public action would be taken to prevent it. It was felt that the time was inopportune, because the rates were exceedingly high, and because at the present moment there was such a considerable change in the modes of applying gas for the purposes of lighting. Within the last three years, the most remarkable advance had been made in utilizing gas, so as to extract the best possible light from it. Alderman Jones remarked that the Committee did not at present propose to incur any expense in an installation.

Projected New Schemes of Rural Water Supply.—The Stratford-on-Avon Rural District Council have instructed Mr. J. E. Willcox, of Birmingham, to submit schemes of water supply for the parishes of Alveston, Tiddington, and Moreton Morrell, within their district. The Rural District Council of Winchcomb (Gloucester) have also called in Mr. Willcox to report and advise on schemes of water supply for the villages of Gretton and Guiting Power.

The Bolton Corporation and their Gas Stokers.—The Bolton Corporation are having some further trouble with their gas stokers, who are now accused by the Gas Committee with breach of faith. At a recent meeting of the men, the following resolution was passed: "That the stokers at the Lum Street works have come to the unanimous conclusion that the trial of 3 tons 12 cwt. on Aug. 1 and 2 has given us the satisfaction that it is more work than we can possibly do under the present arrangement. We think also that we have fulfilled our part of the agreement drawn up by the Gas Committee; and therefore we do not see our way to entertain the suggestion made by the Committee, that we should pay back the money we have received since the date of the agreement—namely, April 4, 1895." This resolution was considered by the Gas Committee last Friday; and, after some discussion on the various points raised, the following resolution was agreed to: "That the stokers at Lum Street works be informed that the Committee have received with much regret their resolution refusing to comply with the undertaking given on their behalf for the repayment of the additional wages which they have received from the Corporation upon the faith of the arrangement of the 4th of April last, and must regard such resolution as a breach of faith and indicating a disposition on the part of the workmen which is destructive of confidence in them in the future." These resolutions, which indicate the present position of affairs, will be brought before the next meeting of the Town Council.

Re-construction of the Truro Gas Company.—The Truro Gas Company was established some 75 years since; and its present capital is about £18,850. An extraordinary general meeting of the shareholders is to be held to-day for the purpose of sanctioning the re-construction of the Company. It has long been felt desirable that some steps should be taken to relieve individual shareholders from future unlimited liability, and that the objects of the Company should be extended and its constitution modified to enable this to be carried into effect. The management are satisfied that the proposed modifications would be advantageous to the Company; and Counsel has advised that such modifications can only be effected by the Company going through the form of reconstruction. The scheme is this: (1) A new Company limited by shares, to be formed under the provisions of the Companies Acts 1862 to 1893, under the name of "The Truro Gas Company, Limited," and with a capital of £25,000, divided into 25,000 shares of £1. The objects of the Company are to include the objects of the present Company, and also full power to carry on the business of an electric light company in all its branches, and such other powers as may seem expedient. (2) The undertaking of the existing Company to be made over to the new Company upon the footing that the new Company shall undertake all the debts and liabilities of the existing Company, and shall pay all the costs of winding it up and dissolving it, and all the costs of carrying the re-construction scheme into effect; and further shall allot to every member of the existing Company 50 shares of £1 each fully paid up in the new Company in respect of every composite £37 10s. share (£25, £5, and £7 10s. shares) in the existing Company held by such member, or a proportionate number in respect of the separate shares of smaller amounts. Cash will be paid in the same proportion in respect of the part of an old share, where such part is of less value than a new £1 share. (3) The re-construction to be carried out under section 161 of the Companies Act, 1862, and accordingly the existing Company to go into voluntary liquidation, and to authorize the Liquidators to carry out the re-construction immediately; so that there may be no interruption of the business. (4) With all convenient speed, the existing Company to be dissolved.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

It is with a feeling of the most extreme regret (and I am certain that a great many of your readers share the sentiment) that I have this week to record that the hand of time now presses so heavily upon Mr. T. Whimster, the veteran Engineer and Manager of the Perth Corporation Gas-Works, that he has felt it necessary to resign his post. There is something in the circumstance of the resignation occurring at the present time which makes it more striking than it would otherwise have been. The Gas Commission, as I have already intimated, are in the midst of the consideration of the very important question of the removal of the gas-works to a new site. I fancy that I am not very far wrong when I say that some of the Commissioners have set their minds upon the particular site which has been reported upon—the Sand Island, at the shore—and that Mr. Whimster, in his report on the subject, felt himself rather obliged to report upon the capabilities of the site, than to criticize it. The site has not yet been adopted. Before either it is adopted, or rejected, there will probably be a good deal of controversy; and it therefore looks as if Mr. Whimster did not wish to have anything more to do with the matter. In this, I think he is right. If the proposed new site had been altogether a suitable one, it would have been a pleasure to him to have superintended the transfer of the works, and a solace to him in his declining years to look back upon the placing of the business upon a footing which would be permanent for, no one could say how many, generations. But with the prospect of conflict within the Commission, and, after all, the production of a job not in all respects satisfactory, the situation was greatly changed, and it is possible to sympathize with him in his resolution rather to go out than to have all the trouble of the transfer, and have his name associated with what might turn out to be not so good as was expected.

Mr. Whimster sent in his resignation; and it was considered at a meeting of the Gas Commission on Thursday. The Commissioners, with regret, agreed to accept it; and they unanimously voted him a retiring allowance of £120 a year. He is to be released from his duties on the appointment of a successor. I am not sure whether Mr. Whimster or Mr. Jesse Hall, of St. Andrews, was the father of the gas industry in Scotland; but the distinction lay between them. Mr. Whimster's departure from the scene leaves Mr. Hall in undoubted possession. Mr. Whimster's has been a long and honourable connection with the gas industry. He has spent all his working life in connection with it at Perth. More than 50 years ago, he was appointed collector for the Perth Gas Company; and 42 years ago, he was promoted to be Manager. When the transfer of the Company's undertaking to the Corporation took place in 1871, he was retained in his post; and he has thus served, as Manager, with the Company for 20 years, and with the Corporation for the last 24 years. He has seen the consumption of gas in the city more than quadrupled in his time; and it is still growing rapidly. Month by month, large increases in consumption are reported. For last month, the increase over the corresponding period of last year was 720,500 cubic feet. Though he has been feeling the burden of years for some time past, he has kept himself and his works abreast of the times, in a spirit which would have done credit to a man entering upon his career, instead of, as in the course of Nature he was, approaching its termination. Not many years ago, he was a mover in the scheme for the extension of the gas-works, in connection with which he had to face considerable difficulty; but he carried his point, and great advantage has resulted. He was also so advanced in his ideas relating to gas manufacture that, when the Peebles oil-gas process was brought out, he almost immediately adopted it. He has worked it with success, even to the making of gas, by its means, from tar; and he has been one of the staunchest advocates of the process. In fact, his last public appearance at a gas managers' gathering was a speech he delivered in support of the Peebles process, at the meeting of the North British Association of Gas Managers, that was held at Glasgow in July of last year. On that occasion, he ventured to express the hope that he might come back and tell them more about it. He may, and I trust he will, be spared to give his brethren the benefit of his further working of the process. In this connection, I may say what was in my mind at the time when the Association, at their meeting in Melrose this year, resolved to meet in Edinburgh next year. Recalling Mr. Whimster's promise, I thought it a pity that the members did not select Perth, which was one of the places voted upon, as their meeting place for next year, as he might then have been better able to attend than he will be in Edinburgh. Mr. Whimster was one of the original members of the North British Association, and was for long one of its most active members; and I thought that, in studying his convenience, they would have been doing him the honour he deserved, and would also have been honouring themselves. Mr. Hall, of St. Andrews, is now the only remaining original member of the North British Association who is in active work. Mr. Whimster's retirement from business life, thus leaves a blank which cannot be filled up. His post at the Perth Gas-Works will be; but the original members of the Association can never be replaced. He has, however, done his life-work well; and to his retirement he will carry with him the good wishes of all his colleagues, and their hope that he may have a quiet and pleasant evening to his active life.

The Waverley Association of Gas Managers, which is the oldest of all the gas managers' associations, held their sixty-ninth half-yearly meeting at Dunbar on Thursday. There was an attendance of about twenty managers, over whom Mr. W. Smith, of Melrose, presided. Mr. Smith, in his opening address, spoke hopefully of the future of gas lighting. The address was quite a fair production; but the discussion, or rather conversation—for the proceedings are quite of an informal nature—which followed, was too rambling to be of use to anyone, except the members themselves. This will be apparent when it is stated that a considerable part of the conversation was upon the subject of whether a certain maker's retorts were better than another's. Such a subject would, no doubt, be quite suitable for a private talk, but would scarcely do in a discussion which was to be made public. To be

sure, the Association prefer to meet without the presence of the Press—at least I was once told so by one of the members—and I have never sought to attend any of their meetings. On the other hand, one of the members the other week extended an invitation to me; but I thought he was speaking without book, and did not accept it. I learn, however, that one of the awkwardnesses of the arrangements for the meetings of the Association is that the trades are admitted. With the representatives of tradesmen present, there can be no privacy; and this was exemplified on Thursday by the fact that one of them, thinking his particular product was being hardly dealt by, intervened in the conversation. This was a trifle unseemly, and might lead the Association to consider whether it would not be better for them to make their meetings more formal and regular, one effect of which would be to raise the tone of their gatherings and improve their quality. On the motion of Mr. Blair, of Haddington, Mr. Smith was thanked for his address. The company afterwards dined in the Royal Hotel.

The Works Committee of the Edinburgh and Leith Gas Commissioners have this week resolved to recommend that the price of gas should be reduced from 3s. 2d. to 3s. per 1000 cubic feet. Since the Commissioners acquired the gas undertakings of the two Companies in 1888, the price of gas has fluctuated greatly. At that time it was 3s. 6d. But very soon the trouble with the cannel trade, which marked the earlier years of the present decade, began; and, in the end of 1889, they advanced the price to 3s. 9d. In 1891, they raised it to 4s. 6d.; but in the end of 1892, they were able to reduce it to 3s. 10d. In the latter half of 1893, they brought it down to 3s. 6d.; and in January of this year, to 3s. 2d. The price they are now going to sell it at is the lowest which has ever been charged for gas in the city. The Commissioners are to be congratulated upon the success they have, with experience, achieved in their working of the undertaking.

The sixty-first annual general meeting of the shareholders of the St. Andrews Gas Company, of which Mr. Jesse Hall is Manager and Secretary, was held on Wednesday. It was reported that the quantity of gas manufactured during the year was 29,523,000 cubic feet, an increase over the quantity in the preceding year, of 2,276,900 cubic feet. The quantity of coal carbonized was under 3000 tons—an increase of 257 tons. This makes an output of about 9800 cubic feet per ton of coal, which is a very good result for works of the size of St. Andrews. On the motion of the Chairman (Mr. J. R. Welch) the report of the Directors was adopted; and it was resolved to reduce the price of gas from 3s. 9d. to 3s. 6d. per 1000 cubic feet. The Chairman said that last year they expended upwards of £200 in increasing the storage for coal; and it would be necessary during the current year to spend more than £400 upon the works. They had at present a stock of 1200 tons of coal on hand. If the town increased at the same rate as it was doing, it would be necessary, at no very distant period, for them to consider the question of the removal of the works to a site outside the town, as every available inch of ground was now taken up; and they had practically no room left for further extensions. He attributed the flourishing condition of the Company to the admirable manner in which the works had been managed by Mr. Hall and his son; and he proposed that the thanks of the shareholders to them should be recorded in the minutes, and a bonus of £35 granted to them. The seconder of the Chairman's proposal bore testimony to the excellent way in which the affairs of the Company are conducted. These tributes of praise were not by any means too highly pitched, for Mr. Hall's management of his works, in a confined situation, is well known to be admirable. When it is considered that there is a large carting account, it is a wonder that he is able to deal with affairs so that gas should be sold at 3s. 6d.—a price which, being without meter charges, the Chairman explained was equal to 3s. 4d. per 1000 cubic feet. In some works where the output is much larger, the managers would be glad if they could sell gas at a proportionately low figure.

This week has seen the most of the annual Valuation Courts held in Scotland. So far, I have observed no difficulty anywhere in the fixing of the valuation of gas-works. The only reference I have seen at all to such valuations is a passing notice to the effect that at North Berwick the valuation of the gas-works has been reduced by £157. The Corporation are owners of the works, which possibly accounts for their willingness to place a moderate value upon them.

As bearing out the "Note" which I wrote a fortnight ago regarding the increased amount of public lighting which is likely to be required when rural local authorities begin to exercise their powers under the Public Health and Local Government Acts, I may mention that a proposal is on foot to constitute the district of Giffnock, near Paisley, into a special lighting district. In connection with the proposal, the Busby and District Gas Company have been asked to furnish rates for lighting, and have done so; these being, for all-the-year-round lighting, 30s. per lamp per annum for gas, and 10s. per lamp for lighting; and for six months' lighting, 20s. per lamp for gas, and 5s. for lighting. At a meeting of the local District Committee, the Chairman said he considered they should not have a larger assessment than 4d. per pound for lighting. The offer of the Gas Company has not yet been agreed to. I may say that I consider the figures very high. They are certainly very much higher than is usually paid. But there may be exceptional reasons for an extra charge for rural than for burgh lighting; and I mention the figures in order that they may be a guide to others who may be in the same position.

At both Dunfermline and Millport, where the proposal is being made that the Corporations should acquire the local gas undertakings, the subject was before the Town Councils this week. The Dunfermline Council agreed to call a public meeting to discuss the proposal. In the Millport Council, after much discussion, it was resolved to obtain additional information as to procedure, and to hold another meeting to consider the subject.

Agitations have been started among both the ordinary coal and the shale miners, with the object of securing an advance of wages. In the case of the ordinary coal miners, it is almost admitted that, in the course of a month or so, they might get an advance of 6d. per day, but that at present they cannot obtain the 1s. per day they ask. In the case of the shale miners, the advance has been refused; and the men, it was understood, acquiesced in the refusal. But since then some of their leaders have been endeavouring to continue the agitation, and have induced the men in some of the pits to agree to hold idle days to discuss the situation. It is not likely that any movements, though persisted in, would succeed at present; and thus prices need not be expected to be affected. Among the arguments used by the managers of oil-works against granting an increase to the shale miners was the statement that, while the prices for oils had advanced, there was a loss of £120,000 estimated on the output of sulphate of ammonia during the year.

The Edinburgh and District Water Trust received eighteen tenders for the construction of the first part of their Talla augmentation scheme; and out of these, the Works Committee selected five for the consideration of the Engineers (Messrs. J. and A. Leslie and Reid). A meeting of the Trust was held on Thursday, at which, on the recommendation of the Engineers and of the Works Committee, the contract was let to Messrs. J. Young and Sons, of Edinburgh—a firm who have done a great deal of work for the Trust. The contract price is £49,113; and the offer of the Messrs. Young was accepted, because it was the lowest in conformity with the specifications, and was the most suitable. The works are to be started on Saturday, the 28th inst., when the customary ceremony of cutting the first sod is to be performed by Mrs. M'Donald, wife of the Lord Provost of Edinburgh.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 14.

Sulphate of Ammonia.—During the week, the market has been quiet. Any alteration in prices is rather in favour of buyers. But quotations have been somewhat irregular; and it is difficult to fix exact closing values. The troubles of a London dealer have been the disturbing cause; and it remains to be seen how far this stoppage will affect the market, and in what direction. There is more disposition to buy ahead, but for the most part at prices which sellers do not see their way to accepting.

Nitrate of Soda is quiet at 8s. per cwt.

LONDON, *Sept.* 14.

Tar Products.—Carbolic acid keeps firm; and considerable business is reported having been done during the past week, not only in crude 60's and 75's, but in 35's and 40's crystals as well. Manufacturers hold no stocks; and the price of each quality is likely to be better. Benzol is steady; and, though inquiry is good, there is no improvement in price. Solvent naphtha is in better odour, with more business doing. Creosote oils continue to be a drug; but there is a better demand for heavier oils for grease making and lubricating purposes. The following prices have been noted during the week: Tar, 18s. to 22s. 6d. Pitch, west coast, 35s.; east coast, 37s. 6d. Benzols, 90's and 50's, 11½d. Solvent naphtha, 1s. 0½d. Toluol, 1s. 0½d. Crude, 30 per cent., naphtha, 4⅝d. Liquid creosote, 1½d. Naphthalene salts, 23s. 6d. Cresylic acid, refined, 1s. 1d.; brown, 10d. Carbolic acid, 60's, 1s. 6½d.; 75's, 1s. 9d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia continues quiet, with very little new business being done. Considerable shipments are going on; and sales have been made during the week at prices ranging between £9 and £9 2s. 6d., all ports, less 3½ per cent., f.o.b., bags included. Gas liquor is quoted at 6s. 6d. to 7s. 6d.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—I have already given some particulars with respect to the Salford gas-coal contracts, in regard to which there has been so much controversy and criticism in the district, and the tenders for which were not finally accepted by the Council until the 4th inst. The following further particulars as to the actual quantities of cannel and coal which have been accepted, and the firms who have been successful in securing contracts with the Corporation will, no doubt, be of interest generally. For cannel, tenders amounting to 15,000 tons are accepted—viz., Staveley Coal and Iron Company, 9000 tons; Sutton Heath Colliery Company, 5000 tons; A. Knowles and Sons, 1000 tons. For gas coal, tenders amounting to 90,500 tons were accepted. These were supplied by the following colliery companies: Moss Hall Coal Company, 24,000 tons; Hyde and Co., 12,000 tons; R. White and Sons, 10,000 tons, and 10,000 tons of yard nuts; Clifton and Kersley Colliery Company, 10,000 tons, and 11,000 of washed nuts; Hutton Colliery Company, 5500 tons of nuts; T. Brocklehurst, 5000 tons; S. Scowcroft and Sons, 3000 tons. With regard to the general coal trade, no material improvement can be reported; and pits continue working short time—four days per week being the full average. As regards prices, there is still no upward movement. House coals are, here and there, meeting with rather more inquiry; but, generally, the business doing in these continues very slow, and there is no appreciable increase of buying on account of winter requirements. Prices are without alteration. The lower qualities of round coal are generally in only very limited request for manufacturing purposes; although, here and there, rather more is reported to be doing in descriptions suitable for iron-making. Supplies generally continue a drug upon the market, with excessively low prices quoted to secure orders. At the pit mouth, best Wigan Arley remains at 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; and common house coals, 7s. to 7s. 6d. Steam and forge coals do not average more than 6s. to 6s. 6d. per ton. Engine fuel moves off fairly well; and as the holiday stoppages in the manufacturing districts are now practically over, the demand for mill consumption is getting back to its normal condition. Supplies, however, are plentiful; and prices are not more than maintained at about 3s. and 3s. 6d. for common, to 4s. 6d. and 5s. for best qualities, at the pit mouth. For shipment, only a slow business is doing in steam coals, which can be readily bought at 7s. 3d. to 7s. 6d., delivered at Mersey ports; but in the better qualities of round coal suitable for house-fire purposes, a fair weight of business comes forward; and for these 9s. 3d. to 9s. 6d. per ton is being obtained.

Northern Coal Trade.—The tendency in the coal trade of the North is still, on the whole, towards steadiness; and the demand has been well maintained. The better condition of the iron trade is giving

some ground for the belief that there will soon be a much fuller demand for Durham coal. If this expectation is realized, it would very considerably affect the condition of other kinds of coal than coking, because it would withdraw coal from other markets, and influence prices. In the Northumbrian steam-coal trade, there is still a very heavy shipment; and this gives general activity to the collieries. But there are some of the second-class pits that have to work short time. Best Northumbrian steam-coal is quoted about 8s. 9d. to 9s. per ton, f.o.b.; second-class, 8s. 3d.; and steam smalls, 3s. 3d. to 3s. 6d., according to quality. There is a rather better demand for manufacturing coals; but the price shows no alteration, as so far the supply is more than ample for all requirements. Bunker coals are also in a little better demand; and in one or two instances a slightly higher price is asked, though it is not so readily paid. For unscreened qualities, the quotation varies upwards from 6s. 3d. per ton, f.o.b.; while for the best Durham screened kinds, as high as 9s. is asked. Household coals are slow of sale; and the price, though unaltered, is weak. The gas coal trade is steady; and the fact that the largest of the local users have placed their contracts on the market some months earlier than usual, seems to show that there are anticipations that the price of gas coals may be higher than it is now quoted. For odd cargoes, the price varies from 6s. 3d. to 6s. 9d. per ton, f.o.b.; while contracts that have been taken of late have not been much outside these prices. The deliveries of gas coals are now growing larger; and as there is from week to week an increase in the consumption, it may be expected that in a very short time the collieries will have full work, though there will be the partial counterbalance of the decrease in the exports as the northern ports begin to close. The coke trade is very active; and there is a decided, if not very great, advance in the price, both for export and for local use. The latter shows a strong tendency towards enlargement. For export, 14s. per ton, f.o.b., is now the current quotation; while as high as 13s. has had to be paid for good blast-furnace coke, delivered at the local blast-furnaces. There is no alteration in the price of gas coke this week, but the make is well taken up.

Scotch Coal Trade.—Business continues to improve in Scotland, particularly in the west. In Fifeshire, there is a good deal of disappointment at the absence of demand from the Baltic ports; and stacking is taking place to a considerable extent. Otherwise, the market in Fifeshire is very fair. All-over steam coal is in least demand; but other varieties, and especially splint, are being well looked after. The prices quoted are: Main, 5s. 9d. to 6s.; ell, 6s. 9d. to 7s.; splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d., f.o.b., Glasgow. The shipments for the week amounted to 165,154 tons—a decrease of 6724 tons as compared with the preceding week; but an increase of 155,171 tons as compared with the corresponding week of last year. For the year to date, the total shipments have amounted to 4,969,920 tons—an increase of 1,211,721 tons upon the quantity in the same period last year; and an increase of 39,730 tons compared with the same period of 1893.

The Water Supply in East London.—Some serious complaints were made last week by residents in the high-lying districts of Stamford Hill, Wanstead, Walthamstow, and Leytonstone as to the scarcity of water. The cause of the deficient supply has been carefully investigated by the officials of the East London Water Company. In a report on the subject to his Directors, the Chief Engineer (Mr. W. B. Bryan) states that he traced the shortness of the supply in the high levels in the localities above indicated to the operations which are being carried on at Lea Bridge by the London County Council. Workmen are at the present time engaged in widening the bridge. The Company, the report says, had for several months past been effecting alterations in the 42-inch and 26-inch mains under the River Lea for the County Council; and the cutting off of the 42-inch main on Monday and Tuesday last, prevented the working of two of the Company's engines. The result was a deficient supply to the high levels through lack of the necessary pressure on those days.

Ashton-in-Makerfield Gas Supply.—The Manager of the Ashton-in-Makerfield District Council Gas-Works (Mr. J. Hill) has recently submitted a report to his Committee on the position of the undertaking, with the view of enabling them to consider the question of the price of gas. At the same time, he has given the Committee a short description of the works; so that some idea may be formed as to what improvements and extensions would be necessary to meet an increased production of gas. The works were purchased in 1878 for £7563; and they have since that time been practically reconstructed. This has caused considerable outlay; the total amount borrowed and expended having been, on March 25 last, £22,309. When the re-arrangement of the present retort-benches is completed, the carbonizing plant will consist of 18 retorts, capable of dealing with 9 tons 4 cwt. of coal per 24 hours, and will be equal to a daily output of about 94,000 cubic feet of gas. Mr. Hill does not anticipate that it will be necessary to make any further extensions of the carbonizing plant for at least four or five years. The purifying apparatus consists of a Livesey washer-scrubber (35 feet high by 4 ft. 6 in. diameter) and four purifiers (7 feet square); but the provision of additional power in this respect will have to be considered shortly. There is ample storage accommodation for some years; the two holders having a total capacity of 218,000 cubic feet. The station meter and governor are practically new; and the former is capable of registering 200,000 cubic feet per 24 hours. The make of gas has almost trebled since the works were acquired. Mr. Hill, in his report, adduced a number of figures to make clear to the Committee that they were in a position to reduce the price of gas to ordinary consumers by 10d. per 1000 cubic feet, and allow 10 per cent. discount to large consumers; making a total reduction of £308. The report was considered at a meeting of the Council on the 9th inst., when it was resolved to reduce the price from 5s. to 4s. 2d. per 1000 cubic feet to ordinary consumers, with the usual discount of 10 per cent., making it 3s. 9d. net; to allow an extra 10 per cent. from the charge for gas supplied to engines, cooking stoves, &c., making it 3s. 4d. net; and also to allow large consumers 10 per cent. off the present price—viz., 3s. 3d.—which is equal to a reduction of nearly 4d. per 1000 cubic feet. These concessions will take effect from the 1st prox.

Water-Works Extensions at Widnes.—The Gas and Water Committee recommended the Widnes Town Council on Tuesday last to approve of a report by Mr. Carr with reference to the provision of duplicate plant at Stocks Well, at an estimated cost of £12,000, and to instruct that the necessary plans be prepared. The Committee also advised that a new surface condenser be constructed at Stocks Well, in place of the present cooling-pond, at a cost of £250. In moving the adoption of the minutes, Alderman Timmis observed that the maximum pumping capacity at Netherley was 2,500,000 gallons per diem, and at Stocks Well 1,600,000 gallons; making a total of 4,100,000 gallons. The present maximum supply per diem was 3,342,937 gallons. This left them with a margin of 758,000 gallons, which was a very fair one indeed; but, at the present time, only 900,000 gallons per day were being pumped at Stocks Well, instead of 1,600,000 gallons, so that the margin was reduced to about 58,000 gallons. The recommendations were adopted.

The Liverpool Water Engineer and his Salary.—By 27 votes to 12, Mr. Joseph Parry, the Water Engineer of the Liverpool Corporation, has had his salary raised from £1000 to £1200 a year. At last Wednesday's meeting of the Liverpool City Council, the Chairman of the Water Committee (Alderman T. Hughes) moved a resolution to that effect. He said that at no time had the Committee been doing their work at so little cost as at present. Mr. Parry never spared himself; and night and morning he devoted himself to the work of the Corporation, having no regular hours. Alderman Hughes alluded to the enormous responsibilities resting upon Mr. Parry's shoulders, and said that not a week passed without his visiting the Vyrnwy, Rivington, and home works. In Mr. Parry they had a Water Engineer who was second to none in the kingdom; and his modesty in not pushing forward his claims ought to be no reason for allowing his services to go unrewarded. Some adverse discussion of the proposal followed, in reply to which Alderman Hughes stated that Mr. Parry's duties were continually increasing. There was hardly a week in which they did not get applications from outside authorities for a water supply—the previous day they had three such applications. This meant increased work for their Engineer; but beyond that still more important works loomed in the future. They must all look forward to the time when they would have to put down a second line of pipes from Vyrnwy; and there was also the question of impounding the water of two rivers in proximity to Vyrnwy Lake.

The New Water Scheme for Shrewsbury.—For forty years the Shrewsbury Town Council have been endeavouring to grapple with the question of water supply; and, as already announced in the JOURNAL, they have before them a scheme prepared by Messrs. John Taylor, Sons, and Santo Crimp, which seems to have met with much approval, but which the Council hesitate to adopt without first of all obtaining the approval of those who will have to bear the expense. Instructed by the Water Committee, therefore, the Town Clerk (Mr. H. C. Clarke) has issued voting papers to all ratepayers and property owners in the borough, asking for an expression of opinion for or against the scheme. In an explanatory statement accompanying: he paper, it is urged that the present supply from the river and the state of the mains, are both bad, and render it absolutely necessary that steps should be immediately taken to provide an adequate and improved supply. The intake from the river for the new scheme will be near Shelton; and there will be a pumping-station, subsiding tanks, and filter beds just within the borough boundary. The covered service reservoir will be north of the town, and 108 feet above the highest ground level. The water will be "as good as that of any town in England supplied from a river, and will be suitable for every use." The estimated cost is £48,000; and the expenditure will necessitate the addition of a 1¼d. in the pound on the present water-rate of 1s. 2½d. A somewhat similar river scheme was "floored" by a town's meeting some years ago; and since then an upland scheme has been brought forward, but met with a similar fate in a *plebiscite*, like the present, which took place to ascertain the views of the public on the subject. It may be added that the present supply of river water is not used for drinking purposes; and the voting paper explains that this supply will not be dispensed with, but improved, even if the new scheme is adopted.

The Purchase of the Odessa Water-Works by the Municipality.—An extraordinary meeting of the Odessa Water Company was held last Wednesday, to consider resolutions (1) for selling the Company's concession to the Municipality of Odessa, and (2) for winding up the Company with a view to distributing the proceeds of the sale. Sir Peter Spokes, in moving the first resolution, stated that the proposals for acquiring the undertaking by the Municipality were practically the same as those which were submitted to the shareholders at the annual meeting on April 29 last. The position, however, was simply this—that at the last meeting the Directors thought that the terms offered by the authorities meant 20 years' purchase of £20,000 a year, producing a round sum of £400,000, *plus* the value of the meters, stores, &c.; whereas it was now made clear to them by the protocol of the Commission which had inquired into the subject, and by the letter of the Chairman of the Commission addressed to Mr. Platts (the Company's Agent and Manager in Odessa), that the offer made to them was to purchase, on a 5 per cent. table, an annuity having 27 years' run of 200,000 roubles per annum, which would produce, not £400,000, but something under £300,000. Mr. Blunt was therefore right in the interpretation which he placed last April upon the offer; and he (the Chairman) and his colleagues were there that day to make this admission, and to advise the shareholders to accept the terms of purchase formulated by the protocol under date of July 20 last. The Directors could not see their way to advise the shareholders to embark any more capital in the undertaking; and they therefore thought that it would be wise to accept the offer now submitted as a fair solution of the difficulties between the city and the Company, and regard it rather in the nature of a compromise, by which neither party would get all it thought it was entitled to. Mr. Goodsall seconded the motion. An amendment was proposed for adjourning the meeting; and a second in favour of accepting an annuity instead of a lump sum. Both were rejected; and the original motion was agreed to. A resolution winding up the Company voluntarily, and appointing the Directors liquidators, was also adopted.

Storage Extensions at the Birkenhead and Middlesbrough Corporations' Gas-Works.—We learn that Messrs. Ashmore, Benson, Pease, and Co., of Stockton-on-Tees, have finished the enlargement of a holder at the Birkenhead Gas-Works, by the addition of two lifts working on the Pease rope system. The holder has now four lifts, 160 feet diameter, by 30 feet deep; the two lower ones being controlled by columns, &c. In the course of a few days, a still larger holder will be working at Middlesbrough. It will consist of a steel tank, 184 feet in diameter, standing on the ground level, and three lifts (30 feet deep), guided on the rope system.

The Leeds Water-Works Extensions.—The Water Committee of the Leeds Corporation last Friday further considered the high-level gravitating scheme, which is to do away with the cost of pumping to the higher levels in the district. The proposal is to make one or two new reservoirs in the Washburn Valley above Thruscross, the total capacity of which would be 1715 million gallons, and the water area 168 acres. The construction of this additional storage accommodation is a matter of necessity not very remote, because, even if begun at once, the reservoirs would, of course, take some years to construct; and the city, increasing at its present rate, would be in need of the extra supply by the time they were completed. It was resolved that a Sub-Committee should make inquiries before taking parliamentary action.

Morley New Water-Works.—Included in the report submitted by the Water Committee at the last monthly meeting of the Morley Town Council, was a letter from the Water Engineer (Mr. C. Gott) with reference to the contracts for the water-works at Withens Clough. The total cost of the whole of the works of the reservoir and north and south conduits was £49,820, of which amount £47,700 had already been paid, leaving the final balance now due. He had dealt with the whole of the claims of the Contractors, and considered that the settlement was in every way satisfactory. His original estimate for these works was £45,903; and the excess of expenditure was £3917, which covered the additional cost of the removal of peat, the wing puddle trenches, the pitching of the inner slopes, and all extra works. The reservoir has a capacity of 30 million gallons larger than the original design.

Carlisle Corporation Gas and Water Accounts.—The annual report and accounts of the Carlisle Corporation Gas and Water Committee (which were noticed last week) were submitted for adoption by Alderman R. Foster at last Tuesday's meeting of the Town Council; and, in addition, he proposed that £7325, the balance of profits from the gas-works, be transferred to the city fund, and £4565, the balance of profits from the water-works, to the district fund. He intimated, in the course of his remarks, that, in view of the extension of buildings in the city, and the increase in the consumption of water, it would be necessary at no distant date to spend some money upon obtaining an adequate supply either by increasing the present pumping power or getting a supply by gravitation. In seconding the motion, Mr. Corbett mentioned that the penny-in-the-slot meter system had been largely taken advantage of; the number of consumers being now 1200. The consumption of gas was now so great that he believed, in the course of two or three years, it would be necessary to make extensions at the gas-works. In answer to questions, it was explained that the sums handed over to the city and district funds represented gross profits. Mr. White stated that there was £3460 to be paid out of the £7300 gas profits for interest, &c., and £2518 out of the £4500 water profits. In two years' time, they would be much relieved as regarded loans. The motion was carried.

The Kent Water Question.—The Chairman of the Bromley Urban District Council has forwarded a letter to the London County Council, with reference to the Bills promoted in Parliament for the acquisition of water-works in Kent. In the course of the letter, the Council are asked if their Bills are merely suspended, or whether new Bills will be introduced; and the writer then continues: "I have also to ask you to be good enough to let me know whether the London County Council, in the event of their proceeding with the old Bill, or introducing a new one, will be prepared to consider favourably a proposal that the several Kent authorities interested in the matter shall be at liberty to acquire, through the London County Council, or from the Kent Water-Works Company direct, that portion of the undertaking which is situate outside the Metropolitan area, subject, of course, to arrangements being made which shall be satisfactory to both parties, for the control of the sources of supply situate outside the Metropolitan area. If some satisfactory arrangements in this direction could be made before next session, I presume that the London County Council would not object to the Kent authorities promoting a Bill to enable them to acquire the portion of the undertaking I have referred to, such Bill to run concurrently with, and be considered by, the same Parliamentary Committee as your own Bill." The London County Council now being in recess, the letter has only been formally acknowledged.

The Accounts of the Halifax Corporation.—The Borough Accountant of Halifax (Mr. James Nicholl) has issued his abstract of accounts for the year ending March 31 last. It gives, in convenient tabular form, the leading figures of the various Corporation departments for the past three years. With regard to the Gas Department, it is shown that the total income for last year was £84,623; for 1893-4, £85,508; and for 1892-3, £77,150. The total expenditure was £78,131, £85,281, and £73,513 respectively. The Water Department produced, in 1894-5 £46,051; in 1893-4, £85,508; and in 1892-3, £77,150—the expenditure being £40,388, £39,837, and £38,194. The income of the Electric Lighting Department last year was £571; and the expenditure, £1661. The total capital expenditure on the electric lighting works is entered at £35,449.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 578.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23½–24½	..	4 5 8
100,000	10	,,	7½	Do. 7 p. c.	10	16–17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	−1	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼–7¾	+¼	4 3 10
40,000	5	,,	6½	Do. New	4	5¼–5¾	+¼	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253–258	..	4 13 0
180,000	,,	,,	9	Do. New	100	200–210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227–232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125–130	..	3 16 11
320,000	20	28 Mar.	11¼	British	20	54–56	..	4 0 4
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½–22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½–17½	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	7¾–8¼	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101–104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31–33	..	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	300–305	..	4 8 6
165,000	,,	,,	10½	Do. New do.	100	225–230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143–147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	270–280	..	4 12 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	207–212	..	4 14 4
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125–130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25–26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17–18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	297–300	+4	4 5 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107–112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c.Pf.	100	280–285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130–135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197–202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	192–197	+5	3 11 1
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277–282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163–168	..	3 11 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	131–134	..	2 19 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140–145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	202–207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	249–254	+1	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾–6¼	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115–117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	17½–18½	..	5 8 1
150,000	5	24 May	8	Oriental, Limited	5	7¼–7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5–5½*	+¼	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½–2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102–106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100–105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10½–11½	+½	6 1 9
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	360–370	..	4 3 9
1,350,000	,,	,,	12	Do. B do.	100	305–310	+3	3 17 5
308,685	,,	,,	13	Do. C do.	100	315–325	..	4 0 0
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174–177	..	2 16 6
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230–235*	+5¾	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290–295	..	3 7 10
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	225–229	+1	3 9 10
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157–162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117–122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303–308	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	258–263	..	2 17 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208–213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145–150	..	2 13 4
500,000	100	14 Aug.	12⅖	New River, New Shares	100	385–395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143–145	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	150–155	..	2 11 8
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140–145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	290–295 *Ex div	..	3 7 10

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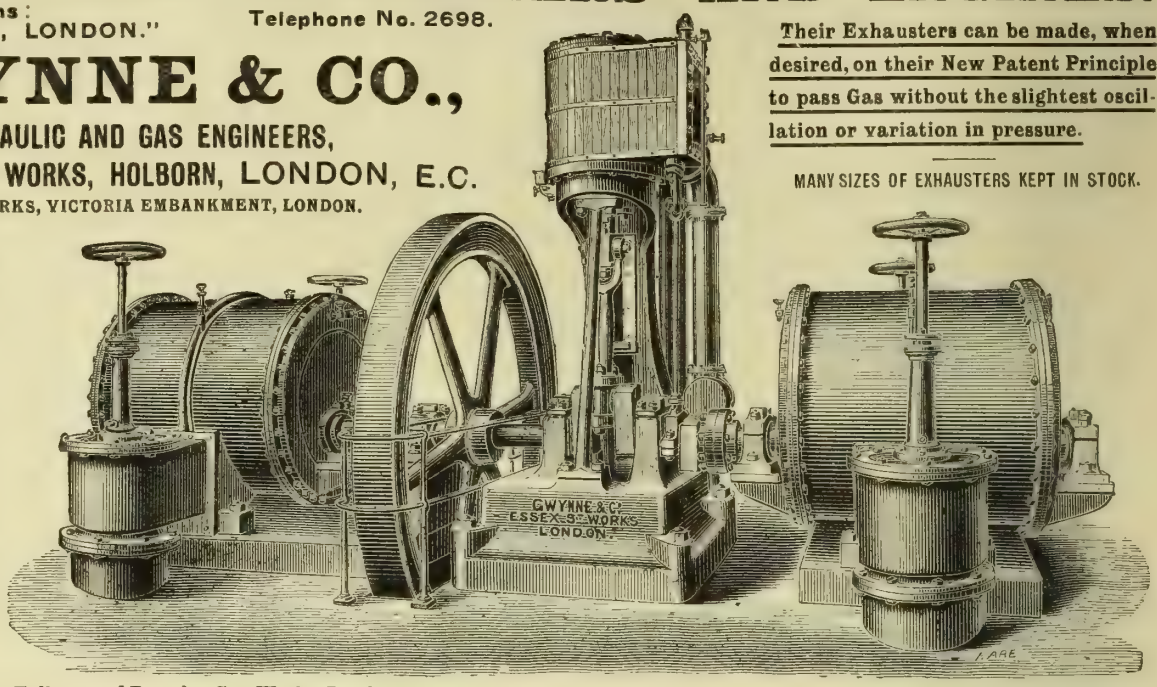

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

The Elementary Question of Gas Finance.

WHEN, a fortnight ago, we drew the attention of our readers to the elementary question underlying the difference between the conditions upon which the capital employed in gas manufacture in this country is raised by statutory companies and local authorities respectively, we did not expect to raise a very lively controversy upon the subject. So far, the only public notice that has been taken of our remarks upon this head appeared in an article in a financial journal, which did not throw any light upon the question, but merely observed that the conditions referred to had existed too long to be disturbed. Of course, we are perfectly well aware that the systems in question form part of the foundations of the British gas industry, and that any alteration of the status of gas companies' capital in the direction of redeeming it may be deprecated by arguing that if such a change is considered expedient in this instance, it should also be extended to railway and other capital similarly circumstanced, which would be a very "large order" indeed. All the same, there are special reasons why the case of gas companies' capital should be studied in the light afforded by the practice established for local authorities; and one of these we will very briefly mention. It is that whereas the capital employed, for example, by the three London Gas Companies stands in their books at the average figure of £5 16s. 2d. per ton of coal, the capital burden in the instance of Glasgow is actually only £2 10s. 10d. per ton. The London figure would be considerably more than doubled in the event of the undertakings being taken over by a public authority; and by the time such a transfer could be completed—even supposing the idea to be a point of practical Metropolitan politics, which is not the case—the Glasgow gas capital would be yet further reduced by the automatic repayment process which has been in operation in this undertaking during so long a period. Actually, the total charge for capital paid by the London gas consumer averages 13d. per 1000 cubic feet of gas sold; while in Glasgow, it is only a fraction over 4d., "all in."

What does this mean? In the first place, it signifies that the London gas consumer has still to pay for every penny of capital raised in the dawn of the industry, and to a very large extent unrepresented by assets—though, of course, the capital value of the undertakings, as computed from their dividend-earning capability, covers all this and very much more. Next, it means that the Metropolitan consumer is burdened with a charge for capital which appears on the face of it disproportionate to that levied upon his fellow of the "second city of the "Empire;" and this disproportion will inevitably increase with the process of time, not only in regard to a single instance, but in respect of any two gas undertakings of which one is owned by a company and the other by a municipality. Consequently, gas companies will be put to a growing disadvantage as compared with municipalities, which may work undeserved injury to the former.

This is all very obvious. But the query will arise how to relieve the gas company's consumer without putting him to additional expense; and, further, how to pay off the gas shareholder without inflicting sensible hardship upon him. We believe that both these ends could be attained, without real difficulty, by a properly devised scheme for catching and appropriating to the purpose the "unearned increment," or appreciation, of gas property. It would probably first be expedient to effect the conversion and unification of all gas stocks, not merely to a fancy consolidated 5 or 4 per cent. stock, but to the exactly equivalent figure at which the capital would stand if taken over by a public authority, paying interest and redemption charges at the customary rates. Then the consumer would see precisely what the gas capital costs. It is not for us to suggest the profit-basis upon which the computation of capital value should be made, or to offer any other consideration that might tend to prejudice the determination of value. It may be remarked, however, that the stock should stand at a small premium, which would tend to rise for all fresh issues; and the whole or a part of this should go towards redemption. Or the method arrived at by the Corporation of London for checking the accumulation of

the Water Companies' capital might be adapted to gas purposes, if deemed suitable.

These ideas are merely thrown out with the object of reaching round a problem which has many sides, and is complex enough to tax the ingenuity of the keenest expert in solving it acceptably to all the interests involved. The time appears to be fitting just now for the re-examination of the whole bases of gas finance. The expediency of the transfer of the property of any of the remaining great gas companies to the local authority would not be so readily granted now as it would have been some few years ago. Indeed, the difficulty of proving any such expediency in the case of a decently administered sliding-scale company would be enormous. But it appears to some observers of these and other signs of the times, that there is no good and sufficient reason why one of the chief benefits of the municipalization of gas supply—the automatic reduction of the capital burden upon the consumer—should be barred because the whole constitutional change is impracticable. This is, in a nutshell, the case for making all gas capital redeemable.

Mr. L. F. Vernon-Harcourt on Engineering and Science.

The Presidential Address in the Mechanical Science Section of the British Association, by Mr. L. F. Vernon-Harcourt, deals with the subject of the relation of engineering to science, and contains a good deal of suggestive matter, as will be gathered from the abstract published in another column. In the main, Mr. Vernon-Harcourt's observations were concerned with the interesting and difficult question of how the modern engineer should be trained—a problem that possesses absorbing attraction for men who are themselves engineers, and are continually being reminded of their own defects of education. Mr. Vernon-Harcourt rightly states that without an adequate knowledge of mathematics and physics, no person should be able at the present day to enter the profession of a civil engineer. Other sciences, such as chemistry, geology, and meteorology, are declared to be of great importance in special branches of engineering. The bulk of the address consists of proofs of this assertion, in detail. The difficulty in prescribing the educational exercises of an engineer, however, arises immediately the attempt is made to define what is "an adequate knowledge" of any subject in which a member of this all-embracing profession should be instructed. At what point, for example, should the mathematical teaching of the engineering student be stayed, so that he shall have a full equipment of this class of tool, and yet be saved from becoming a mere pedant? How is a youth, delivered over to pedagogues, to learn chemistry without becoming a chemist; to master sufficient geology for practical requirements without becoming a slave to the hammer; to acquire, in short, a grounding in half-a-dozen different kinds of lore, every one of which is "professed" by an almost rabid set of specialists—and still remain an engineer? It can only be done by virtue of his possession of a certain distinguishing quality, to which speakers and writers upon this subject seldom attach sufficient importance—the gift, or genius, for engineering. A real live engineer is not to be compounded of mathematician *plus* physicist *plus* chemist *plus* several other systematized sciences. You may cram with all these things a lad endowed with sufficient receptivity; but unless he can apply his knowledge, of what good is it to himself or to anybody else? And this power of application is a personal quality, which cannot be acquired by study. Wherefore, the only hopeful way of improvement in engineering lies in first catching the engineer—the lad with an aptitude in, and a taste for, engineering studies and practice, especially the latter—and then equipping him with all the tools his mind and hands can be expected to use. Any training institution which should succeed in finding one real engineer a year among any number of aspirants passing through its classes, would amply pay for itself in the long run, whatever its working expenses.

Of the necessity for giving engineers the highest training, nobody entertains the smallest doubt. As Mr. Vernon-Harcourt says, since engineering consists in the application of natural laws and the researches of science for the benefit and advancement of mankind, increased knowledge on the part of the engineer will be constantly needed to keep pace with, and to carry on, the progress that has been made. While it is true, as he likewise observed, that "the remarkable triumphs of engineering have been "due to the patient and long-continued researches of "successive generations of mathematicians, physicists, "and other scientific investigators," neither he nor anybody else who has discoursed upon this subject has laid sufficient stress upon the equally important consideration that the remarkable failures that have marred the record of engineering have, in almost every instance, been due, not to the ignorance, on the part of those responsible for them, of those scientific gains he refers to, but to some oversight, or some piece of rank stupidity or carelessness, by somebody who should have known better. It is idle for a mathematically-minded engineer to calculate the strength of a framed structure to four places of decimals, if he or somebody else does not see that all the bolts are properly put in, and all the rivets truly driven and closed. All the science in the world is nought if he who possesses the key to it puts down a harbour of refuge in a place which ships cannot enter. If there is in the world a scientifically trained engineer, he is to be found in the finished product of French scholastic and technical instruction. Yet things go wrong in such hands, as they do elsewhere—and for the same reason. It is impossible to make more of a man than there is in him. There are plenty of proverbs which testify to the general recognition of this truth by our ancestors; and if our modern educationalists would only keep some of these in mind, we might come to see a little more attention paid to the individual student, and less to the curriculum and the standard.

A Rude Awakening at Sandwich.

A remarkable state of affairs in relation to the gas supply has arisen at Sandwich, as will be gathered from our report in another column of the proceedings at the recent special meeting of the Town Council. It all arose in the first instance over a proposed increased charge of £28 for the year's street lighting—a small enough demand, as one might think, to raise, in the course of the inevitable consequential bargaining, the whole question as to the value of the Company's undertaking, and the expediency of its transfer to the Corporation. Yet such is the way of the world. The Gas Committee of the Corporation felt that, rather than pay this additional charge of £28 a year, they would buy out the Company, and see whether the town could not save this amount, and more, by such a deal. Then, naturally, came the usual difficulty as to the price. The Corporation wished to have the undertaking valued; but the Directors of the Company wanted a definite offer to lay before the shareholders. The normal difference of opinion which is to be expected between the parties to a project of gas transfer is in this instance aggravated by the special considerations that the Company hold the site of their works on lease from the Corporation, for a period of 75 years from April, 1839, and have likewise a licence to open the roads, terminable at the same time as the lease; and that the existing works are condemned by Mr. E. H. Stevenson, the expert engaged by the Corporation to inspect and report upon the property. In these circumstances, the temptation to "bye-pass" the Company altogether, and start an undertaking of their own, is very pressing for the Corporation. Application has been made by the Corporation to the Local Government Board for permission to raise money for this purpose; but it has been refused unless and until the Corporation can procure a Provisional Order authorizing the venture. It has now been decided to take steps to obtain such a Provisional Order; and the issue will be interesting to watch. The Company, it must be conceded, are in a parlous state, and their unfortunate experience illustrates once more the danger of risking gas property upon the faith of an understanding or agreement with a local authority. At any time these fifty years past the Company might have made themselves safe by an Act of Parliament, by virtue of which they would have been able to acquire the freehold of their works site, and the right to make use of the streets for their lawful occasions. Now the opportunity is gone, never to return. The Company may yet make a fight for life; but it will be under disadvantageous conditions. A member of the Corporation unkindly remarked at the meeting that "the result might not be agreeable to the shareholders "of the Company; but, if they felt aggrieved, it should "not be with the Council, who had to study the interests "of the greatest number, but with the Directors, who had "neglected to make proper provision for the time which "had come." This is certainly the truth; but it will

not be more palatable on this account to the victims of the circumstances.

A Lesson in Liberty.

SOMETHING has been heard occasionally of the "wheels "within wheels" upon which the working of the United States gas industry depends; and it has to be admitted that, since the partial municipalization of gas supply in this country, curious and occult influences have in some places been brought to bear here upon the issues of gas-works administration. A bit of news that has recently reached us from Chicago, however, shows that, in this centre of Western civilization and progress, gas politics have developments so far transcending in eccentricity anything this effete country can show, that the cleverest British municipal wire-puller can only stand agape at them. It is stated that the gas powers of Chicago have turned Professor Beamis out of his chair at the local University, on account of his having dared to teach certain doctrines of political economy which appeared to be inimical to the interests of the Gas Trust. This Trust is an appanage of the Standard Oil Company; and the Standard Oil Company is Mr. Rockefeller, who is one of the main financial stays of the University. Mr. Rockefeller and his associates in the oil trade control the gas supply in upwards of forty cities; and these magnates could not endure the idea that a mere University professor should have the audacity to question the economic arrangements which constituted the basis of their business organization. So they refused—as the story goes—to supply the University with gas at cheap rates while Professor Beamis remained in authority there; and when this high-minded policy of boycotting failed, "it was plainly intimated that "Mr. Beamis must go; and he went." After this, who can doubt that the United States is the land of the free? It is clearly necessary, however, that the information taught in schools as to the way in which the United States are governed should be revised to make it accord with the facts of the experience of individual citizens. Instead of burdening the mind of ingenuous youth with the fictions of the United States Constitution, it would be far better to let it be universally understood that the government of that great country is a tyranny, administered in the name of the Almighty Dollar by a few high priests—like Mr. Rockefeller, for instance. Unless the theory is to be accepted that professors at the University of Chicago have no rights which capitalists need respect, it is difficult to otherwise interpret this remarkable revelation of the way in which Professor Beamis is reported to have been made a sacrifice to his opinions. But why not close the University? This is what the Russian Government does when the students appear to be in danger of imbibing opinions obnoxious to the ruling powers. Such a method is less invidious than the Chicago plan.

A Sign of the Revival of Trade.

THERE is something almost pathetic, albeit at the same time bordering upon the ludicrous, in the anxiety with which the newspapers have lately been assuring their readers that there is reason to believe that a revival of trade has actually manifested itself in the United Kingdom. The public are informed, for the general comfort, that British manufacturers are receiving more orders than they have had for years past, and that contracts for work are being given out with a prodigality to which the working community has long been a stranger. For our own part, the steady increase of gas consumption during the past year or two has convinced us that, while many voices were calling out upon the badness of trade, a good deal of business has nevertheless been going on in all parts of the country. If any doubt remained of the fact that trade is reviving in the land, it would have been removed by the intelligence reported last week, that the Operative Bricklayers' Trade Union had thought fit to declare a strike against, and to picket the works of, a prominent London employer. Strikes attend an increase of work as naturally as blight lies in wait for the green growth of spring. This time the stupidity of the Trade Union leaders, upon which we animadverted last week, displays itself in the circumstance that the organized bricklayers have elected to "go out" upon the hackneyed ground of the employment of a non-society man in a select company of good Trade Unionists —a cause which has never yet advanced the principles these geniuses affect to have at heart. They, like the Bourbons, can neither learn nor forget anything. So it has come about that, regardless of the many proofs already given of the fatuity of strikes "for the principle of "Trade Unionism," the London bricklayers' society have gone on the old war-path once more. If the wire-pullers in this affair are not wholly oblivious of the warnings of history, they will close it up as quickly as possible. But since, at the time of writing, there is some prospect of the dispute spreading, it is our duty to record it as an indubitable sign that the building trade is looking up. And when this trade is prosperous—when the cheery ring of the trowel is heard in the land—there is necessarily plenty of other work going on on all sides. Only it is to be hoped that this time building will not be overdone. There is not the charm in building societies that resided in these agencies for the employment of small savings in the pre-Balfourian age. Still there must be a great deal of money waiting to be spent on bricks and mortar and other things. It all makes for increased gas consumption, and is so far good. But at the same time it is bad for a town to be overbuilt, as so many populous places were a dozen years ago.

Mr. J. E. Hughes, late of Bingham, Notts., has been appointed Manager of the Holyhead Gas Company.

Mr. J. H. Silcox, the Manager of the Pembroke Dock and Town Gas Company, has been elected President of the Pembroke Dock and Milford Haven Chamber of Commerce.

Mr. Charles Hawksley has been appointed by the Newport Corporation to examine the trench and site of the reservoir at Llanvaches, forming part of the Wentwood water scheme.

The "Meteor" Incandescent Gas Light.—A Company has just been formed in Berlin, to be known as the Continental Incandescent Gas Light Company, to introduce a new incandescent gas-light known as the "Meteor."

Death of Dr. Blatherwick.—The death is announced of Dr. Charles Blatherwick, whose name will be familiar to many readers as that of the former Chief Inspector of Alkali and Chemical Works in Scotland and the North of Ireland, which position he relinquished some eighteen months ago.

Death of an Old Chairman of the Rotherham Corporation Water Committee.—Mr. Edwin Kelsey, for several years the Chairman of the Rotherham Corporation Water Committee, died last Thursday morning, at the age of 59 years. For some time, he had suffered from cancer of the stomach; and the disease had gradually sapped his strength. Mr. Kelsey entered the Council in 1872. The water-works had been secured to the town by the old Board of Health; but the undertaking involved a considerable annual loss, and Mr. Kelsey directed his energies specially to this question, in order, if possible, to place it on a more satisfactory footing. As Chairman of the Committee, he was mainly instrumental in increasing the revenue by a rapid extension of the mains, and improving the service in other ways. After the appointment of Mr. Moss as Borough Accountant in 1879, it was found that the charges on the water-works account against the revenue were exceedingly heavy. Mr. Kelsey pressed for a re-arrangement of loans; and the result was the obtaining of the Provisional Order of 1880. By this Order, the mode of repayment of the water-works loan was entirely re-arranged. The burden on the ratepayers was relieved by a large annual sum; and the undertaking was placed in such a position that it was very much nearer paying its way than ever before. About the end of 1885, Mr. Kelsey went to reside at Blackpool; and it was there that he died.

The Late Herr Schiele.—In the JOURNAL for July 23, we briefly recorded the death, on the 15th of that month, of Herr Simon Schiele, of Frankfort-on-the-Main. The last number of the *Journal für Gasbeleuchtung* contains a very full obituary notice, to which the initials of a well-known Frankfort Engineer are appended, and from it we take the following particulars of the career of one of the most prominent men in his profession on the Continent. Simon Schiele was born of an old Frankfort family on June 21, 1822, and was educated in his native town and in Switzerland. He began his acquaintance with gas manufacture in a works which his father had started, in conjunction with Herr Knoblauch, in Frankfort. In 1850, he gave his aid to the rebuilding of the Hanau Gas-Works; and then drew up plans for a works at Crefeld, of which he subsequently became manager. In 1860, he obtained one of the prizes offered for the imost suitable plans for the new gas-works at Frankfort; and, n 1861, he gave up the Crefeld appointment to go to the new works in his native city, where he remained to the time of his death. He distinguished himself by his intimate knowledge of the gas-yielding qualities of very many different kinds of coal, cannel, lignite, and shale, to the examination of which he had devoted much of his time. Herr Schiele was one of the founders of the German Association of Gas and Water Engineers, and filled the presidential chair from 1859 to 1882. At the time of his death, he shared with Herr W. von Oechelhaeuser the distinction of being an honorary member of the Association. He was a much respected and active member of several other Continental Associations. On July 4, he contracted a cold, which developed rapidly to inflammation of the lungs.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 646.)

AGAIN last week, as in its predecessor, the march of things was somewhat variegated, and the tendency at the opening was reversed before the close. The general tone showed an improvement at first, with good prices in most markets, especially in that which is the centre of interest where foreign orders to buy came in freely. But the tone changed very soon; and pretty well everything began to droop. This was in some degree owing to the Jewish holidays taking away the members of that persuasion, so that a thin attendance, coupled with a good deal of profit-snatching, put prices well down. The only large department which did well was the American. The Money Market shows no change; but it will have a little help this week from the settlement. In the Gas Market, business kept up to the mark, being quite as active as in the previous week; and everything (with one important exception) was very firm—some considerable advances in price being scored. Gaslight "A" was the exception. It opened well on Monday, and managed to touch the 300 price, which it had just missed the week before; but then it fell back, and weakened appreciably, till on Thursday it was marked at 295½. Just at present, it looks as if it had seen the worst, and should recover. There was not much of any of the secured issues changing hands. But they commanded high figures generally; while some of the debenture stocks had a large rise. Business in South Metropolitans was not extensive. But buyers were ready to give high prices; and all three issues were dearer. Nothing at all was done in Commercials, which were unchanged; holders apparently preferring to wait for the dividend, which will shortly be paid. Not a single transaction was recorded in any of the Suburban and Provincial undertakings; and the only move was an advance in the buying price of British. Among the Continentals, Imperial was pretty active; and prices were steady at about middle figures. European and Union were quiet and unchanged, though the latter seemed ripe for an advance. The other Companies were not conspicuous; and the only variation was a rise in Buenos Ayres. The Water Companies were rather quiet; and, on the whole, they were pretty steady, though Southwark and East London had a slight fall. The latter have to reduce their dividend by ½ per cent. for the half year.

The daily operations were: Gas stocks opened decidedly firm on Monday; and the prices of everything dealt in were good, but they did not rise. Tuesday was quieter; and prices tended to be a little easier. Buenos Ayres advanced ¼. There was greater activity on Wednesday; and prices moved irregularly. Gaslight "A" fell back a point; but the 4 per cent. debenture gained 1. South Metropolitan "A" had a big jump of 7½; and ditto "C" rose 2½. Southwark Water fell 2. Prices were rather poor on Thursday. But Gaslight 4 per cent. debentures advanced 4; and ditto 4½ per cent., 5. On Friday, all the business done was in Gaslight "A," which fell 1; but British was ½ higher. In Water, East London receded 2; and Southwark, 1. Prices on Saturday kept well up generally. South Metropolitan "B" realized 311; the quotation moving up a couple of points.

ELECTRIC LIGHTING MEMORANDA.

The Prospects of Electric Locomotion—Adoption for Kingston of the Brighton System of Charges for Electricity—Troubles of the Brush Company—A New Insanitary Trade.

THERE has been a good deal in the newspapers of late about the prospects of electric locomotion for full-sized railways; and much of this arises in connection with the announcement that a huge "combination"—the word preferred locally is, we believe, "combine"—has been effected of all the electric motor manufacturing interests of the United States. Precisely how much importance to attach to the latter circumstance, we do not know. Such is the fashion in Transatlantic manufacturing circles; the principal object of these arrangements apparently being to provide a few persons at the top of the industrial ladder with ample funds, and leisure to come to Europe to spend them, while a larger number of working people stay at home and mind the shop, secure from any unpleasant competition. Reports have been published concerning the marvellous performances of a mammoth electric locomotive, which is credited with the power of pulling a steam goods locomotive up and down a line of metals at will; and the obvious intention of all this advertisement is to re-awaken public interest in the application of electric traction to railway working, with a view to some ulterior end easily to be guessed at. In this conjunction, it is interesting to hear from Mr. Walter Sprague, who probably knows as much about electric traction upon rails as anybody now living, to the effect that there is no particular reason for these attempts to magnify the electric at the expense of the steam locomotive. In short, there has not been any recent new development or improvement in the methods of electric traction such as would hold out the hope of the system being more successful in the immediate future than it has been hitherto. Mr. Sprague declares positively that the electric locomotive is not going to oust the steam locomotive just yet. Nevertheless, he holds that there is a wide and extensive field for the application of electric power to the purposes of traction upon rails, more especially in regard to light railways and long, straggling tramway lines. This may be so. There is plenty of room in all countries for the extension of the latter means of transit for goods and passengers; but it will be necessary to exercise caution in respect of the reported successes of electric systems of working such lines. Hitherto electric tramways have only been installed in show places, such as the Giant's Causeway and in the Isle of Man. We do not know of a single example of an electric tramway in use for the ordinary accommodation of an undeveloped country district.

The interesting plan of differential charging for electricity supplies devised by Mr. Wright, of Brighton, and known as the "Brighton system," is to be tried as from the beginning of next year by the Corporation of Kingston-upon-Thames, who are almost at their wits' end to know what to do in order to diminish the loss upon their electric lighting undertaking. By this system the consumer, whether of large or small quantities of electricity, receives a rebate upon the current taken over and above that required to keep all his lamps going for a stated minimum daily lighting period—say, two hours. In the Kingston case, the present price of 6d. per Board of Trade unit will be charged until the customer has consumed sufficient electricity to average a daily use for two hours of the number of lamps he has had burning simultaneously, and all further supplies will be priced at a reduction of one-third. The object is to encourage the use of the light for the longest possible period, by making it less expensive in proportion to burn a lamp regularly all day and night than to employ one for uncertain and brief periods.

The announcement by the Directors of the Brush Electrical Engineering Company, to which we gave publicity last week, that the net profit upon the working of the Company for the past year shows a decrease of nearly £20,000, is an indication of the uncertain tenure by which undertakings of this character hold their prosperity. It is further stated that the loss in question arose solely in connection with the execution of a contract with the City of London Electric Lighting Company, and related to certain differences between the two Companies as to the obligations involved under the contract. These differences, whatever they were, are now at an end; and "work under the contract is being again proceeded with." This is doubtless satisfactory so far as it goes. But it is cold comfort for those ordinary shareholders who have lost their dividend, inasmuch as there is no mention of any possibility of recovering the money. The loss must in any case have fallen upon one of the parties to the contract; and since it is the Brush Company who have been constrained to "pay the piper," the shareholders of the City of London Electric Lighting Company are presumably to be congratulated upon their escape. The question may be asked, however, what sort of contract is this which now turns out to have concealed so tremendous a "secret," in the contractors' sense of the word, for one of the parties to it? The general meetings of both these Companies, between whom such a strong bond of common trouble exists, will in future possess an enhanced interest. The heads of the City of London Electric Lighting Company keep very "close" respecting the internal affairs of the undertaking; but it is pretty well known that the Company's experiences since they started in business have been picturesquely varied.

According to some correspondence that has appeared in the pages of an electrical contemporary, the preparation of secondary electric batteries, or accumulators, must be included among the unhealthy human occupations that attend upon the modern development of our material civilization. It appears that workmen engaged in this manufacture are liable to be attacked by "plumbism," while there is risk of another kind from the acid spray employed in "forming" accumulator plates. It may be superfluous to inquire whether or not the use of these batteries is attended with any particular danger to health. One would hardly think so; but unhappily lead is so noxious to handle, especially in connection with the chemistry of the metal, that too great caution can scarcely be exercised by those who, in the course of their ordinary employment, are brought much into contact with any kind of lead preparation.

Presentation.—Mr. W. C. Bennett, who for a number of years was Manager of the Tiverton Gas-Works, has left that town to reside at Bournemouth. Before his departure, he was presented by the members of the local Wesleyan Church with a handsome clock, in recognition of his services as a lay preacher in the circuit for nearly half a century.

Alderman Carter, who, for several years, has taken a leading part, both as Chairman and Deputy Chairman, in the work of the Water Committee of the Wakefield Town Council, has recently passed away. His loss will be severely felt by his colleagues, as his knowledge of the work of the department was very great. During the last few years, the Committee have had to deal with a considerable number of difficulties; and Alderman Carter spared neither time nor thought in mastering any troublesome problem which came before them.

LONDON BY NIGHT.

A GREAT many people come from all parts of the kingdom about this time of the year to see the sights of London; and while very many of the regular inhabitants go away at the same season, a sufficient population remains to preserve an aspect of liveliness for the capital of the British Empire. It may be presumed that, as a rule, both visitors and residents know pretty well what is best worth seeing in town at this particular season; but there is one sight to be had in London in extreme perfection just now, which does not happen to be mentioned in any advertised list of Metropolitan attractions, yet which in some respects transcends the whole of them. This is the view of London itself, by day or night (especially the latter), as it may be observed for the price of an omnibus fare for a journey in any direction, north to south, or east to west. It has been reserved for the present generation, during the last few years, to discover that the roof of an omnibus is the best possible "coign of 'vantage" wherefrom the wonderful creation of human necessities and tastes called London—the great wonder of the world to-day—can be conveniently inspected at the least possible expense. There is an infinity of things to be seen in and around London, as everybody knows; but by far the most marvellous and impressive of these is the panorama of the streets. The monuments, buildings, institutions, and places of business and amusement of London, are striking to the visitor, and are held in something very nearly akin to affection by the citizen. But London itself is more than any or all of these things; and what London is can better be understood from observation of its great thoroughfares at all hours of the day than by any other equally simple, cheap, and generally available means of inspection. Seated on the top of his omnibus, the observer, for a sum varying from one penny to threepence, can have unrolled before him a moving scene such as could not be arranged to order for the most puissant potentate. No Royal or Imperial procession can possess a fraction of the living interest of that which London offers at any hour of the day, and far into the night, to him who has eyes to see the striking in the commonplace, the great in the ordinary, the marvellous in that which is of everyday occurrence; and whosoever has not this happy faculty cannot enjoy London, as the philosopher doth. He may come to London, and may live in it; yet will he never be able to say truly that he has seen it.

Our present intention is not to attempt a description of London as visible by day, but to draw attention to one of the night, or rather evening aspects of London which should appeal with peculiar attractiveness to readers of the JOURNAL. We mean the artificial lighting, as the omnibus passenger has the opportunity of seeing it. This is what we had in mind when we remarked upon the extreme perfection in which the streets of London are now to be seen. It is indeed only about the equinox that the evening aspect of London is so very well worth seeing, for obvious reasons. In summer, the places of business are shut before dark; and in winter the elements are rarely propitious for night drives in the open. The March equinox is an uncomfortable season; but now, and possibly for several weeks to come, the evening wayfarer through the London streets will be able to feast his eyes upon the unique spectacle without running much risk of personal inconvenience. If, therefore, any reader of these lines to whom the idea has not suggested itself, and who has the opportunity, will forthwith take our advice, and ride a few miles, some fine dark night, on the top of an omnibus in any part of London—crossing one of the Thames bridges for choice—he will enjoy one of the most interesting sights which the world has to offer, and we shall be quite willing to give him an opportunity for recording his technical impressions of the experience.

Very impressive is the passage from the semi-obscurity of the wide residential thoroughfare into the glare and seeming confusion of the bustling commercial centre. Here shops after shops present a blaze of light; there a corner tavern makes the street-crossing like day; yonder an empty church or public building accentuates by its darkness and silence the living torrent that roars by its closed doors. By-and-bye comes the majestic river, outlined and crossed by line upon line of lights that twinkle in myriads of broken reflections in the black stream. Coloured railway and carriage lights vary the picture, which is filled in with an almost painfully vivid suggestion of human need being at the bottom of it all. That is the most striking thing about the whole vision—it is no ornamental device, no fanciful piece of illumination; but every spark of light is where it is because somebody wants it just so.

Now, what is the quality of the lights of London in this particular season? How does London see to do its work and go about its pleasure after dark? Well, it must be conceded that, in the matter of lighting, London is very much better served than was the case twenty, or even ten, years ago. Every year marks an improvement in this respect; and it is perfectly true that the capital was never so bright as it will be through the coming winter. If a non-technical person who remembers how London was lit twenty years ago were to be told that the gas which does far and away the most of the same work to-day is of precisely the same quality still, so far as illuminating power is concerned, he would not quite believe the assertion. The residential and small streets would help him to realize the truth of the statement, if he only regarded the public street-lamps; but the first well-to-do shop or busy public-house he saw would tend to upset his mind again. The fact is that London is twice as brightly lit to-night as it was a quarter of a century ago; and though more gas is burnt, the effect is not wholly, or indeed principally, due to this cause. If any main thoroughfare is looked at during the business hours of the evening, hardly one source of light in a hundred will be found to represent the gas lights of the period when the nominal quality of London gas was settled by law. Incandescent, regenerative, albo-carbon lights will be observed in shop after shop; and outside, the huge coupled or tripled flat-flames in their massive lanterns indicate a scheme of lighting to which the framers of this law were strangers. Not once in a mile, if so frequently, will be found anything like the statutory burner by the use of which the Londoner might be supposed to be reminded that he is still supplied with 16-candle gas. What is this to him—who but the professional examiner and the gas manager thinks or talks of 16-candle gas? It is a convention—a name. It has no part in determining the degree of brilliancy which London shall exhibit at night.

It is impossible for a gas engineer to pass of an evening along the line of thoroughfare (say) from Brompton to the Elephant and Castle, without receiving many deep impressions from the examples of lighting he will see on his road. In the first place, for all the progress that other means of lighting have made during the past ten years, he will see little else besides gas all the way. In point of fact, there is no room for anything else, except here and there, for the fancy. The incandescent burners in the shops and taverns tell out brilliantly, if somewhat coldly, to those who like a ruddy light upon things in general after the sun has gone down. It is quite a mistake to think that people are specially fond of a white light, as the partisans of electric arc lighting have learnt to their cost. For some special purposes, an artificial light of the same colour, or nearly so, as daylight is required. But for the generality of evening uses, quite a different coloured light is favoured; and with reason. The admirers of what is elegant in gas-fittings will be pleased to observe that the graceful albo-carbon clusters are still patronized by tailors, boot-makers, and other merchants of intrinsically dull and non-reflecting commodities. Regenerative lamps, albeit mostly of one make, are also far from having lost their ascendency. The one system of gas lighting that will be sought for in vain in a modern thoroughfare is the Argand—the one chosen to determine the illuminating power of London gas. Let us hasten to remark, lest the observation should be misunderstood, that we have no intention of disparaging the virtues or the utility of the Argand, as a gas-burner *de luxe*, for office or study use. All we say upon this head is that the burners which are employed by the great gas-consuming public—those consumers who make the most show in the world—are anything rather than Argand. The popularity of the Argand burner twenty years ago, it is safe to say, was proportionately much greater than it is to-day; and this not by reason of any defect of the system, but because it has been far surpassed in respect of that quality of yielding a good duty in illuminating power for the gas that it consumed which constituted its sole original recommendation.

As for the common flat-flame gas-burner, except in its improved or glorified form as an element of the albo-carbon system, or as the basis of a cluster of burners in a high-power street-lamp, it never appears in a front place; being the "maid of-all-work" of the lighting service, and as such kept in the background. All the same, it is probable that nobody who uses these hard-working and in their degree indispensable burners thinks about the illuminating duty they afford. They are responsible for all the complaints of "bad gas" that reach the gas manager's ear—complaints that usually mean anything but what the words imply; and the gas manager knows full well that when the consumer raises this moan, he has simply been burning by means of one burner a gas that is legally rated in terms of another, and has probably also been the victim of the careless fitter, who is quite capable of fixing a No. 3 burner where a good flame is required, and a No. 9 in a small back passage, to equalize matters. Save in the street-lamps, however, in our typical London main thoroughfare, the simple flat-flame burner has no place. All this means that the people have helped themselves, not merely to the burners, but through them to the quality of gas they required. It is a little difficult for the technical mind to grasp the significance of this phenomenon, and the semi-technical mind of the professional gas examiner is probably unable to entertain the idea at all. It means simply that as the nominal rating of illuminating gas did not enter into the conception of consumers during the long period after 1860 when it represented an ideal far beyond the attainment of the average shopkeeper or householder, so it does not concern the same order of the community when the average consumer has it within his power to obtain anything from 10 to 50 candles illuminating power from the same quantity of gas, according as his tastes and circumstances dictate. Consequently, it is little better than sheer pedantry to impute to the gas itself a quality which is only determinable by means and by the employment of apparatus which has few analogues and no parallels in ordinary experience.

THE LITTLE DON WATER SCHEMES.

Not long since, we drew attention in the Journal to the serious uneasiness which is being felt in South Wales, in consequence of the various schemes that are likely to affect its watershed. But not in South Wales alone does this feeling of disquietude prevail. The report of the proceedings in the Lords on the Barnsley Corporation Water Bill, an instalment of which we published on the 10th inst., and the remainder of which will be found in the present issue, serves to show how keenly—not to say jealously—suppliers of water are watching the available sources of supply. Nor can it be doubted that, as the population of the larger towns increases and time goes on, the competition for special rights over the various watersheds will become more and more acute. All this is but the natural outcome of what has gone before. In the first place, a large corporation fight for possession of the property of a water company. In course of time, the corporations will fight among themselves for control of those sources of water supply in which they have, or conceive that they have, a rival interest. Already it may be said, indeed, that the fight for the watersheds has begun; and it is probable that the evidence and arguments put forward in the Barnsley case will be heard again and again, on future occasions, when the contest is of a similar character.

The Sheffield Corporation objected strenuously to the Barnsley Corporation obtaining the command of the waters of the Little Don—a tributary of the River Don itself, which passes through Sheffield and Rotherham, and on to Doncaster. Mr. Pope's answer, as leading Counsel for the promoters of the Bill, was that Sheffield would not require a further supply of water for many years to come, because the Corporation still have unexhausted powers, which will be available for at least as long as the works Barnsley seeks powers to construct—that is to say, for some fifteen or twenty years to come. The population of Barnsley, it was urged, increases more rapidly than that of Sheffield, and justly claim as much right as the Sheffield people to tap the extensive drainage area of the river in question. The difficulties of such a position are certainly great, and likely to become greater; but they are not likely to be solved by the sanction of anything in the nature of a dog-in-the-manger policy. So far as possible, there should be a fair field and no favour. The smaller towns assuredly have a right to be considered, as well as the big cities; though this is a proposition that "municipal statesmen," who loudly condemn monopolies in water supply when such supply is in the hands of a company, are apt to forget or qualify when the supply passes into their own control.

The Lords Committee have taken a broader view of the situation than that for which the Sheffield Corporation contended; and, in fact, they adopted Mr. Pope's argument that Barnsley was as much in the valley of the Don as any of the other towns and districts whose representatives made such vigorous efforts to shunt the Barnsley Bill. The suggestion was put forward that Barnsley only wanted these further powers in order that it might do profitable business by selling water to its needy neighbours. But the Chairman of the Water Committee answered that, apart from this element in the Bill, Barnsley would soon be short of water for its own requirements unless the Bill were passed. Indeed, in the course of the inquiry, there were some highly instructive encounters between witnesses and Counsel, more particularly in the course of the evidence given by Mr. Charles Hawksley, the Engineer of the pending scheme. Mr. Bidder, who opposed the Bill on the part of the Rotherham Corporation, suggested that if his clients were in difficulties as to supplying water, they would be right to increase the supply temporarily in any way they could. Yes, was Mr. Hawksley's answer; and that was just what Barnsley was doing at the present time. Then there came a little war of words as to the circumstances in which a clause in the Rotherham Bill which aimed at getting exclusive rights in the Don watershed for a term of years, had been eliminated. Mr. Balfour Browne, cross-examining in the interests of Sheffield, wanted to know where his clients were to go for more water in twenty years' time. The answer that this would be a consideration in twenty years' time was hardly calculated to quite satisfy the learned gentleman; and the witness supplemented it by suggesting that Sheffield will be a large place by that time, probably with 600,000 inhabitants, and may (like Liverpool or Manchester) enter upon some ambitious scheme for bringing its water supply from afar off. But, too evidently, Sheffield clings to the belief that it has special rights in the valley of the Don. It is too much, however, to suppose that Parliament would ignore the needs of other towns which (if the watershed of the Don is to be taken as a whole) have equal claims to consideration. In short, as we have suggested, the net result of these proceedings is to discourage a dog-in-the-manger policy on the part of any town, however populous or important. It is not at all likely that the Legislature will allow the valley of the Don to lie idle for many years in order that Sheffield may do what it likes with it at the end of that period.

Incandescent Gas v. Electric Lighting for Hotels.—Instructions have been received by the Incandescent Gas-Light Company, Limited, to remove the electric lights from the Tavistock Hotel, Covent Garden, and substitute incandescent gas-lights for them.

NOTES.

Architectural Dilettantism.

A curious example of the perversity of architects in looking backwards, and, while pretending to the possession of artistic feeling and culture in a high degree, ignoring the actual requirements of their clients and the needs of the age, is furnished in a paper read by Mr. Harry Sirr before the Discussion Section of the Architectural Association—recently published in the *Builder*. The subject of the paper was "Domestic Metal Work," and its object was apparently to assist in the improvement of the taste of the inferior order of people who employ architects to design buildings, in the matter of selecting such domestic fittings and furniture as are commonly made of metal. Among these, lamps naturally occupy a prominent place; and the author of the paper described, with enthusiasm, the beautiful Greek and Roman lamps. "Many are dolphin-like in form; some have their ends worked up into the form of a shell; and others are embellished with animal forms. I call to mind a specimen in the British Museum ornamented with lions' heads and satyric masks. The usual support was an independent candelabra. Much ingenuity was exercised by both Greeks and Romans in the construction and ornamentation of these supports, which combine lightness with elegance. The shafts are ornamented with climbing ivy and the graceful acanthus; or they have perfectly plain stems—sometimes fluted; and frequently the stems represent the throwing-out of buds, or they are in the likeness of a reed or cane. What is noteworthy is the general striking resemblance of all the examples, while the details of the ornaments are of infinite variety, and the profusion of the latter is remarkable in the elaborate examples. This kind of support was either surmounted by a socket to receive a wax candle or a disc for a lamp to stand upon. The base was generally a low tripod of lion's feet or griffin's claws." And so forth, and so on. In another part of the paper, Mr. Sirr discourses learnedly about brass candlesticks; and he appears to take much comfort from the reflection that "many people now give the light of candles the preference." But he has not a word of help for the wretched modern-minded householders who find it more convenient to employ gas, or oil, or electricity to light their residences withal. It is so much easier—not to say more artistic—to prattle about the good taste of the ancients than to make oneself useful to the moderns; and this is why so many householders, who could well afford to pay for good metal work in useful forms, are driven to the ironmonger's shop, instead of resorting to the architect's office.

A Future for Tall Chimneys.

An American engineer, Mr. Barnet le Van, entertains the opinion that tall chimney-stacks have yet a great part to play in connection with the sanitary improvement of large towns and centres of manufacture. He goes so far as to assert that men who ought to be fully conversant with the subject, are far from realizing the connection between the employment of tall chimneys and the possibility of using the cheapest and lowest grades of fuel. In building chimneys for factories, Mr. le Van recommends that what, according to the usual practice, would be an excessive height, should be deliberately accepted. There is no fear of a chimney not answering its purpose on this account; and if the draught is too strong, it can always be regulated by a damper. Mr. le Van deprecates the modern fancy for low chimneys, the draught being forced by the employment of a fan or blower. He insists that low factory chimneys should never be permitted in cities, inasmuch as they discharge their noxious gases and unburnt carbon into the lower strata of the air, whence they easily enter dwelling houses and the lungs of those who live in them. The author cites the example of the city of Carlisle, as showing the application of tall chimneys as sewer ventilators; and he declares that high chimneys are calculated to be of great advantage to city populations. The municipality should pay part of the cost of building chimneys to a height of 250 feet and upwards, in consideration of using them in aid of the ventilation of the sewers. Carrying out this idea, it becomes clear that the use of tall chimneys for the collection of smoke from domestic fireplaces would be simply a matter for arrangement between the municipality and the landlords; and, pushing it still farther, it points to a means whereby at last the Eiffel Tower could be made of some use to the locality in which it stands—it would only be to enclose it within an iron sheeting, and make it convey all the odours of Paris to the upper air, where they could offend nobody.

Monazite and Incandescent Gas Lighting.

It is reported by an American journal that, though there has been of late years a greatly increased demand for minerals containing the rare earths which are used in dressing the mantles used in incandescent gas-lamps, the business of mining these minerals, which are found in different parts of the United States, is by no means a prosperous or money-making concern. The principal source of the rare earth metals in question is the mineral called monazite, or "the lonely one," as the term is freely translated, on account of its supposed rarity. This was originally discovered in Norway; and it consists essentially of a phosphate of cerium, lanthanium, and didymium, containing also silicon and thorium in variable proportions—"probably," says the narrator, "as impurities.' If this is the case, we are

confronted in this case with an example of an accidental "impurity" being worth more than the main constituent of the material; and the reader of modern fiction is reminded of the gruesome conclusion of the story of Dr. Jekyll and Mr. Hyde. At first, the preparation of the rare metals named, and their earths, from monazite was a curiosity of the metallurgical laboratory; but when the mineral was converted into an article of commerce, it was speedily discovered in other parts of the world besides Norway. In North Carolina, especially, where considerable deposits of monazite sand exist, great excitement on the subject of the new mining industry prevailed for some time. The monazite occurs here as a resinous-looking substance in the sand of river bottoms; and fabulous stories of its value were circulated and freely believed on the spot. It, however, soon appeared that, although the purified and reduced metals contained in monazite might be expensive, it was hardly worth while to wash so many tons of sand as went to a single ton of the mineral. Consequently, monazite—from being the rarest of natural minerals—became a drug in the market; and it is now reported to be hardly worth getting at the price.

Small Combination Gas Plant.

Mr. R. D. Wirt, of Independence, U.S.A., has addressed his ingenuity to the solution of the interesting problem of making illuminating water gas upon a small working scale; and he has patented an apparatus for this purpose, which is described from the specification in the *American Gaslight Journal*. It is a combination arrangement for producing either a water or fuel gas, or an illuminating gas, or a mixture of both. The patentee observes that ordinary gas manufacturing plants now in use in small towns produce about 5000 cubic feet of gas per hour; and since towns of small size use only from 5000 to 15,000 cubic feet of gas per day, it is manifest that there is considerable waste in intermittently running plants of this capacity. It is this that he seeks to obviate. His device consists of a setting of one or more coal gas retorts over a gas generator which has a superheater placed behind it; the ascension-pipes from the retort and the superheater having a common hydraulic main placed in the usual position. The idea is to carbonize bituminous coal in the retorts by the heat of the generator furnace, which at the same time heats the superheating chamber by the products of combustion passing through. At the proper stage, steam is admitted to the generator, and water gas is made. When the charge in the retort is carbonized, the coke is fed into the generator. The intention is to occupy the day in the manufacture of water gas, and to leave a charge of coal in the retort to be carbonized at night, and provide a supply of hot coke to start the generator with in the morning.

East London Water Company.—The Directors of this Company recommend a dividend of 3½ per cent. for the half year ended Midsummer (less income-tax), carrying forward £2915, as against 4 per cent. for the corresponding period of last year, when a sum of £10,086 was carried forward.

The British Association Grants.—Among the grants made by the General Committee of the British Association for scientific purposes are £5 and an unexpended balance to Professor Carey Footer, for investigations into the question of electrical standards; and £5 to Dr. T. E. Thorpe, for inquiries into the action of light upon dyed colours.

North of England Gas Managers' Association.—The 36th half-yearly meeting of this Association is to be held at Hexham on the 5th prox., under the presidency of Mr. Herbert Lees, the Engineer and Manager of the Hexham Gas Company. According to the circular issued by the Hon. Secretary and Treasurer (Mr. W. Hardie, of Newcastle-on-Tyne), the members will first inspect the gas-works, where light refreshments will be provided by the President. A visit will then be paid to Hexham Abbey, whence the members will be conveyed to the Tynedale Hydropathic Mansion, where the business will be disposed of. The President will deliver an address; and Mr. J. Holliday, of Scarborough, will read a paper "On the Encouragement of Small Consumers." Two new members will be proposed for election. In the afternoon, the members will be invited to dinner by the Chairman and Directors of the Gas Company.

American Gaslight Association.—The last number of the *American Gaslight Journal* to hand contains an official notice by the Secretary of the above-named Association (Mr. A. B. Slater, jun.) in reference to the forthcoming annual meeting, which will be held in Philadelphia on the 16th, 17th, and 18th prox., under the presidency of Mr. Walton Clark, of that city. Five papers are set down for consideration; and there would have been one more had not the serious illness of the author caused delay in its preparation. "Retort-House Design and Practice," and "Bench Firing with Soft Coal," will be dealt with by Mr. A. E. Forstall, of Newark, and Mr. E. G. Pratt, of Des Moines; and Mr. F. Egner is to contribute a few notes on "The Storage of Oil at Gas-Works." In the distribution department, Mr. Irvin Butterworth, of Columbus, will take up the subject of "The Ventilation of Gas-Lighted Rooms;" and Mr. W. H. Rogers, of Paterson, will discuss the question of "The Creation of a Healthy Public Sentiment towards the Gas Company in the Locality in which it Operates." These preliminary particulars give promise of an interesting meeting.

TECHNICAL RECORD.

THE RELATION OF ENGINEERING TO SCIENCE.

At the recent Meeting of the British Association, the President of the Mechanical Science Section, Mr. L. F. Vernon-Harcourt, M.A., M.Inst.C.E., chose the above subject for his Inaugural Address.

After a few introductory remarks, Mr. Harcourt considered the question of mathematics in relation to engineering. He said the pre-eminent importance of this matter might be accepted as fully established; and a President of the Institution of Civil Engineers would not now tell a pupil, at their first interview, that he had done very well without mathematics—a remark which had been made to himself by a justly celebrated engineer more than thirty years ago. Having mentioned some of the branches of engineering specially requiring a knowledge of mathematics, Mr. Harcourt remarked that hydrostatics and hydrodynamics provide the foundation of hydraulic engineering; though, owing to the complicated nature of the flow of water, observations and experiments have been necessary for obtaining correct formulæ of discharge. Electrical engineering depended very largely upon mathematics and physical problems, guided by the results of practical experience. All branches of applied mathematics had been utilized by engineers to their benefit; but graphic statics would probably gradually supersede analytical methods for the calculation of stresses, as being more rapid in operation and less subject to errors, which were more easily detected in graphic diagrams. Pure mathematics, in its higher branches, appeared to have a less direct connection with engineering; but applied mathematics was so largely dependent upon pure mathematics, that the latter, including the calculus and differential equations, could not be safely neglected by the engineer, though some branches—for instance, probabilities, the theory of numbers, the tracing of curves, and some of the more abstruse portions of the subject—might be dispensed with.

Dealing next with physics in relation to engineering, Mr. Harcourt said: Physics has been placed after mathematics, as many physical problems are determined by mathematics. But in several respects physics, with its very wide scope in its relation to the various properties of matter, is of equal importance to engineers; for there are few problems in engineering in which no part is borne by physical considerations. The surveyor avails himself of physics when heights are measured by the barometer, or by the temperature at which water boils; and the spirit-level is a physical instrument adapted by the surveyor for levelling across land. Evaporation, condensation, and latent heat are of great importance in regard to the efficiency of steam-engines; and the expansive force of the gases generated or exploded, the diminution of friction, and the retention of the heat developed, are essential elements in the economical working of heat-engines. Allowance for expansion by heat and contraction by cold has to be made in all large structures; and deflections due to changes in temperature have to be taken into account. The temperature, also, which decreases with the elevation above the sea-level and the distance from the equator, limits the height to which railways can be carried without danger of blocking by snow; while the temperature, by increasing about 1° Fahr. with every 60 feet below the surface of the earth, limits the depth at which tunnels can be driven under high mountain ranges. Congelation of the soil is employed in excavations through water-bearing strata. The illuminating power of different sources of light is of great importance in determining the distance at which the concentrated rays from a lighthouse can be rendered visible, as well as in relation to the lighting of streets and houses; and the refrangibility of the rays emitted, or the nature of their spectrum, should not be disregarded, as upon this depends the power of a light to penetrate mist and fog, which cut off the rays at the violet end of the spectrum, and have comparatively little influence on the least refrangible red rays. The effect also of the colouring of lights on their visibility is of interest in determining the shades of colour to be used for signal and ship lights; and also the relative power of the lights required for different colours to secure equal illuminating power. Electrical engineering is very intimately connected with physics; for it really is the application of electricity to industrial purposes. The very close relation between electricity and magnetism, discovered by Oersted in 1820, and further established by the remarkable researches of Faraday, has led to the present system of generating electricity by the relative movement of coiled conductors and electro-magnets, in dynamo-electric machines worked by a steam-engine or other motive power. The electrical current thus generated can be transmitted to a distance with little loss of energy; and it can either be used directly for lighting by arc or incandescent lamps, or be reconverted into mechanical power by the intervention of another dynamo. The convertibility of heat and energy, indicated by Mayer, forms the basis of thermodynamics; and the mechanical equivalent of heat—a physical problem of the highest interest, determined by Joule in 1843—furnishes a measure of the amount of work that can be possibly obtained by a given expenditure of heat in heat-engines. The foregoing summary indicates how the discoveries of physics are applied to many branches of engineering; and a knowledge of the laws of physics, and of the

results of physical researches, appears, therefore, essential for the successful prosecution of engineering works.

Considering next the subject of chemistry in relation to engineering, Mr. Harcourt pointed out, at the outset, that gas-making is in reality a chemical operation on a large scale, consisting in the destructive distillation of coal, the purification and collection of the resulting carburetted hydrogen, and the separation and utilization of the residual products. Chemistry, accordingly, he said, held a very important place in the requirements of the gas engineer. He went on to show that the manufacture of iron, steel, and other metals, and the formation of alloys, are essentially chemical operations; and the Bessemer and Gilchrist processes—by which steel is produced in large quantities directly from cast iron, by eliminating a portion of the carbon contained in it, and also the injurious impurities, silicon and phosphorus, in place of the former costly and circuitous method of removing the carbon from cast iron to form wrought iron, and then combining a smaller proportion of carbon with the wrought iron to form steel—are based on definite chemical changes, and necessitate chemical knowledge for their development. Chemical analysis is needed for determining the purity of a supply of water, or the nature and extent of its contamination; and Dr. Clark's process for softening hard water, by the addition of lime water, depends upon a chemical reaction. The methods also of purifying water by filtration, shaking up with scrap iron, and aëration, are chemical operations on an extensive scale; and their efficiency has to be ascertained by chemical tests. Cements and mortars depend for their strength and tenacity, when mixed with water, upon their chemical composition and the chemical changes which occur. The value of Portland cement requires to be tested quite as much by a chemical analysis of its component parts as by the direct tensile strength of its briquettes; for an apparently strong cement may contain the elements of its own disruption, in a moderate proportion of magnesia or in an excess of lime. The utilization of sewage belongs to agricultural chemistry; and the deodorization of sewage, as well as its conversion into a commercial manure, are chemical processes. The disposal of sewage by irrigation is a branch of agriculture; and the innocuous character of the effluent fluid discharged into the nearest stream or river, has to be ascertained by chemical analysis. Chemists have the opportunity of benefiting the community, and at the same time acquiring a fortune, by discovering an economical and efficient process for converting sewage on a large scale into a profitable saleable manure, so that inland towns may not have to dispose of their sewage at a loss, and that towns situated on tidal estuaries or the sea coast may no longer discharge their sewage into the sea, but distribute it productively on the land. In closing his remarks on this part of his subject, Mr. Harcourt pointed out that the purifying of the atmosphere from smoke, rendered increasingly expedient by the growth of population, and the prevention of the dense fogs caused by it, by some practical method for more thoroughly consuming the solid particles of the fuel, still await the combined efforts of chemists and engineers.

Geology and meteorology in relation to engineering were next considered. In connection with the former subject, Mr. Harcourt explained that a knowledge of the superficial strata of the earth is important for all underground works, and essential for the success of mining operations. Geology is indispensable in directing the search for coal, iron ore, and the various metals; and the existence of "faults" or other disturbances may greatly modify the conditions. The value of geology to the engineer is not, however, confined to the extraction of minerals; for it extends, more or less, to all works going below the surface. The water supply of a district, in the absence of a suitable river or stream, is dependent on the configuration and geology of the district; and the spread of London before the extension of water-works, as pointed out by Professor Prestwich, had to be confined to the limits of the gravel subsoil, in which shallow wells gave access to the water arrested by the stratum of underlying London clay. The sinking also of deep wells for a supply of water, and the depth to which the wells should be carried, are determined by the nature of the formation, the position of "faults," and the situation of the outcrop of the water-bearing stratum. A geological examination, moreover, of a site proposed for a reservoir, to be formed by a reservoir dam across a valley, has to be made to ascertain the absence of fissures and the soundness of the foundation for the dam. In the driving of long tunnels, the nature and hardness of the strata and their dip, the prospects of slips, and the possibility of the influx of large volumes of water, are geological considerations which affect the designs and the estimates of cost. Turning to meteorology, it was pointed out that the maximum pressure that may be exerted by the wind has to be allowed for in calculating the strains which roofs, bridges, and other structures are liable to have to bear in exposed situations; and continuous records of anemometers for long periods are required for determining this pressure. Mr. Harcourt remarked that the continuous records of rainfall, as collected regularly by Mr. Symons from numerous stations in the United Kingdom, are extremely valuable to engineers, for calculating the probable average yield of water from a given catchment area, the greatest and least discharges of a river or stream, the size of drainage channel needed to secure a low-lying area from floods, and the amount of water available for storage or irrigation in a hot, arid district. The loss of water by evaporation at different periods of the year, and under different conditions of soil and climate, the effect of percolation in reducing evaporation, and the influence of forests and vegetation in increasing the available rainfall, while equalizing the flow of streams, are subjects of equal interest to hydraulic engineers and meteorologists.

Having briefly reviewed the benefits conferred by engineering upon pure science, Mr. Harcourt passed on to consider it as an experimental science, and to cite instances of failures of works as the result of neglect of scientific considerations. These remarks naturally led up to a few observations on the training of engineers. He reminded his audience that, in most professions, preliminary training in those branches of knowledge which are calculated to fit a student for the exercise of his profession is considered indispensably necessary; and examinations to test the proficiency of candidates have to be passed as a necessary qualification for admission into the Army, Navy, Church, Civil Service, and both branches of the Law. Special care is taken in securing an adequate preliminary training in the case of persons to whom the health of individuals is to be entrusted, not merely by experience in hospitals, but also by examinations in those branches of science and practice relating to medicine and surgery, before the medical student can become a qualified practitioner. If so much caution is exercised, remarked Mr. Harcourt, in protecting individuals from being attended by doctors possessing insufficient knowledge of the rudiments of their profession, how much more necessary should it be to ensure that engineers are similarly qualified, to whom the safety and well-being of the community, as well as large responsibilities as to expenditure, are liable to be entrusted. The duty of the engineer is to apply the resources of Nature and Science to the material benefit and progress of mankind; and it therefore seems irrational that no guarantee should be provided that persons, before becoming engineers, should acquire some knowledge of natural laws, and of the principles of those sciences which form the basis of engineering. The Institution of Civil Engineers has, indeed, of recent years required some evidence of young men having received a good education before their admission into the student class. But some of the examinations accepted as sufficient for studentship, such as a degree in any British University, afford no certainty in themselves that the persons who have passed them possess any of the qualifications requisite for an engineer; and it is quite unnecessary to become a student of the Institution in order to become an engineer. The Council have, no doubt, been hitherto deterred from proposing the establishment of an examination in mathematics and natural science, as a necessary preliminary to becoming an engineer, by the remembrance that some of the most distinguished engineers of early days in this country were self-taught men. But since those days engineering and the sciences upon which it is based have made marvellous advances; and, in view of these developments, and the excellent theoretical training given to foreign engineers, it is essential that British engineers, if they desire to retain their present position in the world, should arrange that the recruits to their profession may be amply qualified at their entrance in theoretical knowledge, in order to preserve the standard attained, and to be in a position to achieve further progress. No amount of preliminary training will, indeed, necessarily secure the success of an engineer, any more than the greatest proficiency would be certain to lead the medical student to renown as a physician or a surgeon. But, other conditions being equal, it will greatly promote his prospects of advancement in his profession, and his utility to his colleagues and the public. The engineers of the past achieved great results in the then early dawn of engineering knowledge by sound common sense, a ready grasp of first principles and of the essential points of a question, capacity for acquiring knowledge, power of managing men and impressing them with confidence, and shrewdness in selecting competent assistants. These same qualities are still needed for success in the present day, coupled with an opportunity of exhibiting them. But far more knowledge of mathematics and other sciences is required now, owing to the enormous advances effected, if the progress of engineering science is to be maintained. A qualifying examination for engineers would usefully stop persons at the outset from entering the profession who failed to evince the possession of the requisite preliminary knowledge; it would indicate, by the subjects selected, the kind of training best calculated to fit a person to become a useful engineer; and it would protect the public, as far as practicable, from the injuries or waste of money that might result from the mistakes of ill-qualified engineers.

Specializing in engineering was the next subject taken up; and the value of congresses on special branches was enforced. Engineering literature was then glanced at; and Mr. Harcourt brought his address to a close. In doing so, he said he had, in his address, endeavoured, though very imperfectly, to indicate how engineering consists in the application of natural laws and the researches of science for the benefit and advancement of mankind, and to point out that increased knowledge will be constantly needed to keep pace with, and to carry on, the progress that has been made. In engineering, as in pure science, it was impossible to stand still; and engineers required to be ever learning, ever seeking to appreciate more fully the laws of Nature and the revelations of Science—ever endeavouring to perfect their methods by the light of fresh discoveries, and ever

striving to make past experience and a wider knowledge stepping stones to greater achievements. Engineers had a noble vocation, and should aim at attaining a lofty ideal; and, in the spirit of the celebrated scientific discoverers of the past, such as Galileo, Newton, La Place, Cavendish, Lyell, and Faraday, should regard their profession, not so much as an opportunity of gaining a pecuniary reward, as a means of advancing knowledge, health, and prosperity. The remarkable triumphs of engineering had been due to the patient and long-continued researches of successive generations of mathematicians, physicists, and other scientific investigators; and it was by the utilization of these stores of knowledge and experience that engineers had acquired renown. A higher tribute of gratitude should perhaps be paid to the noble band of scientific investigators, who, in pursuit of knowledge for its own sake, had rendered possible the achievements of engineering, than to those who had made use of their discoveries for the attainment of practical benefits. But they must both be regarded as co-workers in the promotion of the welfare of mankind. The advancement of science developed the intellectual faculties of nations, and enlarged their range; while the resulting progress in engineering increased their material comforts and prosperity. If men of science, by closer intercourse with engineers, could realize more fully the practical capabilities of their researches, and engineers, by a more complete scientific training, could gain a clearer insight into the scientific aspect of their profession, both might be able to co-operate more thoroughly in developing the resources of Nature, and in furthering the intellectual and material progress of the human race.

AN IMPROVED PORTABLE PHOTOMETER.

By W. H. Preece, C.B., F.R.S., and A. P. Trotter, B.A., Assoc.M.Inst.C.E.

[A Paper read before the Mechanical Science Section of the British Association.]

When light falls upon a surface, that surface is said to be illuminated. The illumination depends simply upon the light falling upon the surface, and has nothing to do with the reflecting power of the surface, just as rainfall is independent of the nature of the soil. As a rain-gauge receives the full amount of rain when it is placed horizontally (disregarding wind), and receives less when it is tilted, so the surface is fully illuminated when it faces the source of light, and is less fully illuminated when the light falls upon it at an angle. The proportion between the full rainfall or illumination and the measured rainfall or illumination varies as the cosine of the angle of incidence of the rain or of the light. The angle is 0° and the cosine is 1, when the rain-gauge is placed horizontally, or when the light falls perpendicularly upon the surface. It would perhaps be unnecessary to call attention to these very elementary matters, were it not that difference between the photometry of illumination and the ordinary photometry of candle power is often confused.

The lighting of streets and of buildings may be specified by the maximum and minimum illumination. The primary purpose of an illumination photometer is to measure the resulting illumination produced by any arrangement of lamps, irrespective of their number, their height, or their candle power. Illumination photometers containing sub-standards of light have been designed by Professor Weber, Professor Mascart, and others. One of us described an illumination photometer before the Royal Society in 1883.* This consisted of a box blackened within. Over the end was stretched a Bunsen screen of paper, on the middle of which was a grease-spot. At a distance of 12 inches was another screen, of drawing-paper. The grease-spot was so screened that no light fell upon it, except that which was reflected from the drawing-paper screen. At the end of the box opposite the Bunsen screen was an eye-piece, consisting of a plain tube. Within the box a small glow lamp was fixed; and in order to make a measurement of the illumination of the drawing-paper screen, the current through the lamp was varied through a rheostat until the grease-spot was invisible. The readings were recorded in "luces"—a "lux" being suggested by one of us at the Paris Electrical Congress, 1889, as the name for the illumination due to a Carcel lamp at 1 metre, and equivalent to a British standard candle at 1·058 foot. The only defect of this photometer was the yellowish and reddish colour of the lamp when dimmed for low readings.

In 1884, we designed a portable photometer,† in which the lamp could be moved towards, or withdrawn from, the Bunsen screen; and mechanism was provided by which, when a pointer moved a certain distance over a uniformly divided scale, the displacement of the lamp was as the square of that distance. The Bunsen spot was viewed by Rudorff mirrors, in the usual way. This instrument worked well; but the range was small, and could not be easily increased. The lamp would have to be moved to a considerable distance from the screen, for measuring the feeble illuminations met with in street lighting.

Eight years later, one of us experimented with modifications of this instrument, and found that, in ordinary street lighting, the illumination is often only equal to that due to 1 candle at 14 feet distance. A large number of different methods of reducing the light were tried. Many combinations of lenses, the eclipsing device used in dissolving views, photographically shaded glass screens, and other devices were employed. Finally, a white reflecting-screen was inclined at different angles to a small electric lamp; and on this principle a photometer was constructed in February, 1892. It was found that the Bunsen screen could be replaced with advantage by a simple white cardboard diaphragm, pierced with one or more holes. The illumination of this diaphragm, generally in a horizontal position, was the illumination to be measured. Below this was the reflecting-screen, enclosed in a box about 2 ft. by 6 in. by 5 in., with a pair of small glow lamps and a secondary battery. The screen could be inclined towards the glow lamps by means of a chain wound up on a cam mounted on a spindle; the cam being formed so as to give an open scale. A hand or pointer indicated readings on a dial. Many measurements and a number of photometrical surveys of different streets and public buildings in London were made in 1892, and are recorded by means of plans with isophotal contour-lines and otherwise.*

During the present year, an improved form of this photometer has been constructed. The chain and cam, which allowed the instrument to be used only in a horizontal position, have been replaced by a system of levers. The object of these levers is to give an open scale. If the motion of the pointer were proportional to the angular movement of the screen, the scale would be approximately a scale of cosines. The instrument is shown in fig. 1, with the lid open and the front let down. It measures 1 ft. 3¾ in. by 5½ in., and is 9½ inches high. On the end to the left, there is a red glass window, and immediately within are two 12-volt lamps (one of which is shown in fig. 2)—one of about 1-candle power, and the other of 2-candle power. It can be seen through the window if either or both of the lamps are alight. The lamps are held in special lamp-holders, capable of adjustment as to height by clamping-screws. These screws and the base of one of the lamp-holders are shown in fig. 1. A switch on the top of the instrument enables either or both of the lamps to be turned on or off. At the other end of the box, the reflecting-screen is hung. The middle of the screen is about

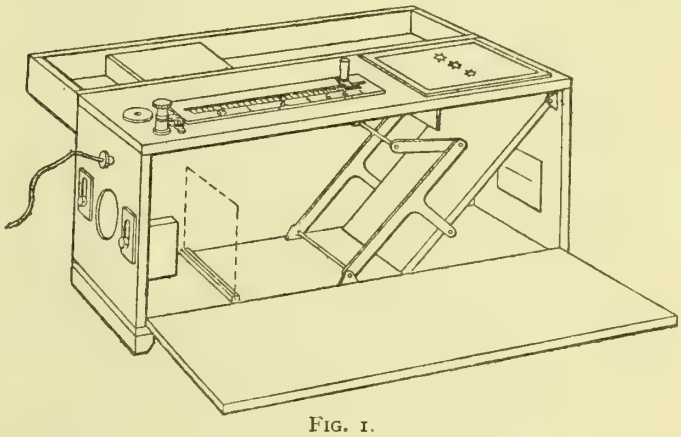


Fig. 1.

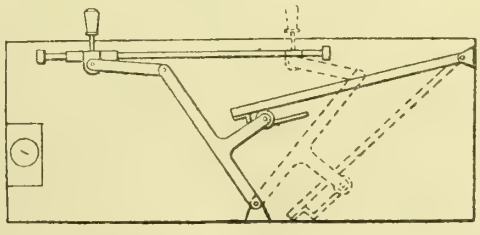


Fig. 2.

11 inches from the lamps. It is shown in fig. 1 in its lowest position. In fig. 2 the screen and one of the levers, together with one of the rollers on which the screen rests, and the handle by which it is moved, are shown with the screen in its highest position by full lines, and in its lowest position by dotted lines. In its highest position, the filaments of the lamps are a little below the plane of the screen. No direct light from the lamps then reaches the screen; and it is only faintly illuminated to about 1-200th of a candle at a foot, by stray light, which is excluded as much as possible.

The diaphragm is placed horizontally immediately above the hinged screen. Three small star-shaped holes are cut in it; and through them the illuminated reflecting-screen can be seen. A handle carrying a pointer, moving over a graduated scale, controls the inclination of the screen by means of the levers and links. A guide attached to the back of the screen (shown in fig. 2) allows the instrument to be turned on its side without interfering with the working. In order to take a measurement, one or both of the lamps are turned on, and the handle is moved

* Proceedings Roy. Soc., 1883, Vol. XXXV., p. 39; and Proceedings Inst.C.E., Vol. CX., p. 98.

† Proc. Inst.C.E., Vol. CX., p. 101.

* Proc. Inst.C.E., Vol. CX., pp. 42-51.

till the screen seen through the holes in the diaphragm matches the diaphragm in brightness. If the colour of the light outside is about the same as that of the lamps, the middle hole may be made to disappear. The observer should stand approximately in the vertical plane passing through the three holes, so that he may see that part of the screen through them which lies immediately beneath them.

Various substances have been tried for the diaphragm and screen. Thin metal, painted with a whitewash made of magnesia and isinglass, is perhaps the best. The diffused reflection practically follows Lambert's cosine law; but the material is easily soiled, and cannot be cleaned. Bristol board from which the glaze has been removed by a damp cloth, closely follows the cosine law within the angular range required in this case. It is important that there should be no glaze on the surface of the hinged screen, since the inclination of the lamp to the screen, and of the screen to the eye for maximum illumination, is about 45°. But as the scale is graduated by experiment, a slight departure from the cosine law does not matter. On the other hand, it is of greater importance that the screen should be very smooth and flat. Under very feeble illuminations, the light from the small lamp making an angle of incidence very nearly 90°, minute irregularities are easily seen, and make accurate readings difficult. For ordinary street lighting and for general industrial photometry, a slight departure from the cosine law on the part of the diaphragm is of no practical consequence, so long as there is no perceptible glaze; for it is always observed nearly vertically, and never at a large angle.

The colour difficulty is reduced, in the first instance, by the freedom of motion of the levers. The handle may be quickly moved to and fro on each side of the true reading, and the middle position may be estimated. In measuring the illumination due to arc lamps, the colour difficulty becomes troublesome. The colour of the glow lamp in the photometer should be approximately a mean between the colour of the standard of light wherewith the instrument is calibrated and that of an arc lamp. This halves the difficulty, which can never be entirely removed, since differently coloured lights are not physically comparable. It may, however, be relegated entirely to the laboratory by the use of a coloured screen and diaphragm.

If the hinged screen be tinted pale blue, some of the yellow rays of the lamp in the photometer are absorbed, and the reflected rays approximate to grey—that is, to feebly illuminated white. On the other hand, if the diaphragm is tinted yellow, the white light from electric arcs or of daylight may be reduced to approximately the same colour as that of the lamp in the photometer. In the first case, the brilliance of the hinged screen is reduced, and a brighter lamp would have to be used to restore the true value of the scale readings; and in the second case, the brilliance of the diaphragm would be reduced, and the scale readings would be too high. But, by tinting both screens, the calibration of the instrument need not be disturbed. The screen being coloured pale blue and the diaphragm pale yellow, there is no difficulty in obtaining disappearance of the hole in the diaphragm when illuminated by arc light, or even by daylight. The selection of the colours suitable for obtaining a true measurement is based upon the mean of a number of measurements. White screens are used; and the comparison should be made in a building illuminated with a number of arc lights. A number of measurements are made with quick oscillations of the handle, and the mean is taken. Several screens and diaphragms of different tints being in readiness, pairs are tried, and a selection is made of a pair which give a good colour match, and, if possible, the mean reading given by the white screens. A slight departure from the mean could be corrected by the use of a coefficient. It is not suggested that strongly coloured lights can be scientifically compared in this manner, but only that the yellowish light of a glow lamp may be compared with the whitish light of an arc or of subdued daylight. We employed this device in 1884; and Messrs. G. W. & M. R. Patterson, the translators of Palaz's "Industrial Photometry," who have used it in connection with a Lummer-Brodhum photometer, remark that "it can, of course, give no additional absolute accuracy to the photometric measurements. It, however, adds greatly to the comparative accuracy of the results, as it makes it possible to measure relative intensities under various conditions with great precision." But it should be observed that the selection of the tints may be made at leisure, and under favourable laboratory conditions; and by thus avoiding all colour trouble during the ordinary use of the photometer, a very considerable gain in precision is secured.

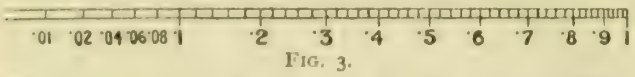


Fig. 3.

The scale is 5½ inches long, and is shown in fig. 3. With the smaller of the two lamps, the highest reading is equivalent to one candle at a foot; with the larger lamp, it is twice this illumination. The oscillations of the handle generally extend, at first, over two scale divisions; and after three or four oscillations, their amplitude may be reduced to about one scale division. The half of a scale division may be estimated except at the highest part of the scale, which is slightly contracted. The precision is about 2 or 3 per cent. The contraction of the upper part of the scale is intentional, and is caused by the arrangement of the levers.

In case of renewal of the lamps, it is very important that other lamps should be placed in exactly the same optical position in the photometer; otherwise the scale would have to be re-calibrated. In order to fix the height of the lamps, which is the only adjustment necessary, a sheet metal screen (shown by dotted lines in fig. 1) is placed in a holder attached to the floor of the photometer. Two small holes are drilled in this screen; and a white paper screen, having a black horizontal line, is fastened to the end of the box (see fig. 1) opposite to the lamps. The hinged screen being lifted by the levers out of the way, "pin-hole images" of the filaments are thus thrown on to this screen; and the lamps being set (see fig. 2) so that the single horse-shoe filament appears nearly closed up, the dark line between its two limbs is made to fall on the black horizontal line. The images being magnified, considerable accuracy is possible.

Although the principal object of this photometer, as of those which preceded it, is the measurement of illumination, it is sometimes desirable to measure the candle power of a lamp in the street without removing it from its position. By the use of a graduated arc, such measurements can be made with the present photometer. A quadrant is fastened to the side of the photometer; and a pin at the centre, from which the quadrant is struck, acts as a gnomon. A spirit-level on the top of the instrument being adjusted, the angle of incidence may be read in degrees on the quadrant; and at the same time the cosine of this angle may be read on an adjacent scale. It is necessary to find the slant height or direct distance from the source of light to the photometer.

To measure the vertical height of the light, set the photometer so that the shadow falls on 45°. Measure the distance from the pin to the lamp horizontally, and from the pin to the ground vertically. The sum of these distances is the height of the actual source of light. This can be measured to about 2 per cent.—say, 3 inches in 12 ft. 6 in.

To find the slant height at any distance, the height of the light being known, divide the height of the lamp above the photometer by the cosine of the angle of incidence; the quotient is the slant height required. Or the horizontal distance may be measured, and the square of this distance added to the square of the height of the light. This gives the square of the slant height.

To find the candle power, the illumination in units of a candle at a foot being observed, the light from other lamps being carefully screened, and the slant height being known. Multiply the illumination by the square of the slant height, and divide by the cosine of the angle of incidence.

On hilly ground, it is necessary to know the height of the lamp above the photometer at each point of measurement. It is best, in that case, merely to record the angles, and afterwards to find the tangents. The horizontal distance between the photometer and the lamp-post, divided by the tangent, gives the required height.

It may be observed that, when the square of the slant height in feet is equal to the cosine of the angle of incidence, the scale graduated in units of a candle at a foot becomes a scale of candle power; and when the square of the distance in feet is 10, or 100, or 1000 times the cosine, the multipliers 10, 100, or 1000 may be used to convert it into a scale of candle power. The square of the slant height being known, the photometer may be tilted until the required cosine is indicated by the shadow of the pin. If the slant height is measured by the sum of the squares of the horizontal distance and the height, the square is at once obtained.

We have calibrated our photometers either by standard candles, or by sub-standard glow lamps supplied from secondary batteries, or by the amyl-acetate standard lamp or Hefner unit. This standard (which is well recognized in physical work) is 0·877 of a standard candle; or a standard candle is 14 per cent. more than an amyl-acetate lamp. Placed at 1 foot distance from, and perpendicular to, the diaphragm, the photometer being placed on its side, the illumination is 0·877 of a candle at a foot. If it is brought to a distance of 11¼ inches ($\sqrt{0{\cdot}877}$ foot), it is equivalent to 1 candle at a foot. But this distance and position are inconvenient. If it is placed at a distance of 1 foot, and at an angle of 55° 10′, the illumination on the diaphragm is one-half of a candle at a foot, since cosine 55° 10′ = 0·57, and 0·57 × 0·877 = 0·5. A mark is therefore made at this angle on the quadrant, and inscribed "H.U. = ½ c.p."

Considerable experience with the use of small glow lamps supplied from portable secondary batteries has given us great confidence in this kind of secondary standard of candle power. The battery is always freshly charged before each evening's work, and is discharged for half an hour before use. The lamps are only turned on while an observation is being taken.

The 1893 photometer was arranged to be held in the hand; our 1884 photometer stood on a tripod about 2 ft. 6 in. from the ground. The street measurements in 1892 were all made with a photometer placed on the ground; the diaphragm being about 6 inches from the pavement. The proper height for an illumination photometer is a matter of opinion. When the photometer is placed on the ground, the large number of measurements required for a thorough photometric survey of a street or an empty building can be quickly made. For some purposes—for example, in an exhibition or a church—a stand is necessary. The calculations of candle power then become rather more tedious.

The various observed and computed quantities may be expressed as follows: D = horizontal distance from photometer

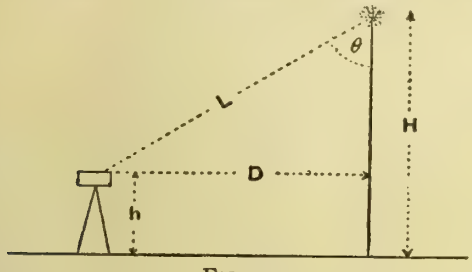


FIG. 4.

to lamp-post (see fig. 4); L = slant height from photometer to light; H = height of light above the ground; h = height of photometer diaphragm from the ground; θ = angle of incidence; c/f^2 = illumination of units of a candle at a foot; c.p. = candle power. Then—

$$H - h = D \div \tan\theta;$$
$$L = [H - h] \div \cos\theta = \sqrt{D^2 + [H - h]^2};$$
$$\text{c.p.} = (c/f^2 \times L^2) \div \cos\theta.$$

The following is an example of the measurement of the illumination and candle power in the case of a street-lamp :—

D	θ	c/f^2	tan θ	cos θ	H–h	H	L	L^2	$c/f^2 \times \cos\theta$	c.p.
20	66°	0·025	2·25	0·407	8·9	11·9	21·8	475	0·0614	29

FOGARTY'S CYANIDE PROCESS.

Dr. Francis Wyatt discusses in the *Engineering and Mining Journal* the commercial production of cyanides and of ammonia from atmospheric nitrogen. He remarks that, theoretically and in the laboratory, the problem has long been solved; and if it has not been so industrially and on a large scale, this has been due not only to mechanical difficulties, but also because the negative and unstable properties of nitrogen itself have not been properly understood.

The author observes that the first to realize the fact that the most essential condition of the combination of nitrogen with carbon is that at least one of the two elements should be nascent, and endowed with the chemical energy appertaining to the nascent state, was Mr. Thomas B. Fogarty, of New York. This experimenter now uses in his process no fixed carbon for any purpose other than the manufacture of a highly superheated producer gas, consisting chiefly of oxides of carbon, free hydrogen, and nitrogen. He passes this gas into, and through, a suitable retort, and simultaneously drives in with it in the same direction a measured volume of hydrocarbon vapour derived from fuel oil. The mixed gases are brought into contact with a measured quantity of finely-powdered lime, made incandescent, and showered down from the top of the retort. The gas at this stage contains no free oxygen or carbonic acid; and the hydrocarbons are therefore ultimately decomposed into acetylene, free carbon, and hydrogen—all of which may combine with nitrogen and the lime to produce calcium cyanide, and subsequently ammonia and fuel gas. As to the manner in which the combinations take place in Fogarty's furnace, Dr. Wyatt considers that they mainly depend upon, and are subservient to, the series of transformations or "crackings" undergone by the hydrocarbons at high temperatures. That acetylene is really produced, Dr. Wyatt says there is no doubt; and that this acetylene readily combines, at the temperature of its formation, with nitrogen and calcium, to form cyanides, is equally certain. Dr. Wyatt therefore believes that the reactions go on in the retort in two phases—first, a combination of the nitrogen and the earthy metal with acetylene; secondly, if the acetylene is further cracked up into nascent carbon and hydrogen, a direct combination of the nascent carbon itself with the nitrogen and the earthy metals.

The experimental operations which have been conducted under the new Fogarty process have justified this hypothesis, and have developed some interesting phenomena. The most favourable temperature for the formation of cyanides is from 2200° to 2300° Fahr. In seeking to maintain this temperature in Fogarty's furnace, there was noticed a constant loss of heat, for which there was no apparent cause. It was found that, shortly after the commencement of a run, the temperature of the gases fell to between 1700° and 1800° Fahr., which fall was always coincident with the appearance of small proportions of acetylene—doubtless due to the cracking of the hydrocarbons. After a time, the heat would go up to about 1900° Fahr., when all trace of acetylene disappeared, although the atmosphere of the furnace showed no increase of free hydrogen or free carbon. When means were devised for bringing up the internal heat to between 2200° and 2300° Fahr., the gases were found to contain large quantities of acetylene; and simultaneously cyanides were formed very plentifully. When the temperature was carried beyond this point, the acetylene was again reduced to a minimum quantity; but cyanides continued to be formed. Here, therefore, lies the *crux* of the Fogarty process. The whole secret consists in obtaining and maintaining a furnace temperature of about 2300° Fahr., with entire absence of free oxygen and carbonic acid gas, and in presence of an excess of free carbon. The fuels employed must be burnt to carbon monoxide only; and ample provision must be made for the large amount of heat absorbed by the reactions, which is computed to be 810 British thermal units for the production of 1 lb. of calcium cyanide. The initial experimental difficulty in the Fogarty process lay in the maintenance of the necessary temperature; but this was overcome by following the methods of working of the modern blast furnace. It is only just possible with burning fuel oil to carbon monoxide, in previously heated air, to attain the temperature required.

The question of heating being disposed of, Dr. Wyatt believes that the thermal and chemical conditions required by the new Fogarty process are well established. The remaining condition involves the construction and arrangement of certain mechanical details connected with the new furnace which is now about to be erected; and of these he does not feel competent to speak with authority. If the difficulties in this direction can be successfully overcome (as it is claimed they easily can be), the production of cheap cyanide and ammonia from the fixation of atmospheric nitrogen will be at once placed upon an industrial and commercial basis.

The Combination of Russian Petroleum Producers.—The details of the agreement as adopted by the Association of Russian Petroleum Producers provide that the export and sale of Russian petroleum products abroad shall be entirely in the hands of a Committee, selected from the members of the Association, which shall operate for the joint account of all members. The home market is open to all individually. The Committee consists of representatives of fourteen large firms, and has the right to test the quality of the petroleum products; it further has the right to conclude an agreement with the Standard Oil Company in case such an agreement should be of advantage to Russian interests. The Association has made an offer to smaller firms, who are not members, to buy their products at a reasonable figure, and sell to the foreign markets—one-half of the profit to go to the smaller operators. The agreement is to be in force until April 1, 1899.

Combustion in Gas-Furnaces.—The Société d'Encouragement pour l'Industrie Nationale of Paris has lately issued a list of competitive subjects for which premiums are to be offered during the years 1896 and 1897. One bears upon combustion in gas-heated furnaces. The Society find that since the classical researches of Ebelmen on the use of gaseous combustibles, no complete experiments have been made in France in connection with this important matter. Considering that it would be useful to have particulars of a series of complete analyses relating to the gas produced under determined conditions, both as to the chemical composition of the solid from which the gas is obtained, and the temperature of the gas producer, &c., it has been decided to offer a premium of 2000 frs. for such a work, to be awarded next year. Analyses of products of combustion must be made, compared with the length of time the flame is contained in the furnace, the temperature of the latter, the relative rate of inflow of the gas, and the sections and relative positions of the emission flues. More importance will be attached to accuracy of analysis than to the number of experiments made.

A New Practical Heat Standard.—This subject was dealt with by Mr. E. H. Griffiths in a paper read by him at the recent meeting of the British Association. He said that since the year 1879, when Rowland published his monumental work on the mechanical equivalent of heat, there could be little doubt that Regnault's expression for the capacity of heat (at all events at temperatures below 30°) could not be regarded as trustworthy. The author's object was to show how vague and uncertain was present knowledge of the changes in the capacity for heat of water as its temperature varied. He was guided by one general principle—viz., that, however admirable the methods of experiment, or however sound the theories on which they were based, the numerical results were useless unless the observer had devoted sufficient attention to the measurement of the temperature. The second portion of the paper was in relation to the consideration of certain thermal units other than those dependent on their capacity for heat of water. The third part consisted of practical suggestions; and the author laid it down that the ideal thermal unit should be a rational, and not an arbitrary one, and have some real relation with other units of energy (in the absence of further reasons, the educational value of such a relation is sufficient to establish this proposition). Moreover, it should not be dependent on the observations or conclusions of any one investigator. Any such dependence must certainly result in further corrections and changes. It should also be of convenient magnitude, and cause as little disturbance as possible in the numerical values resulting from the present system of thermal measurements. In conclusion, the author expressed the opinion that further individual effort would avail but little. What was necessary, in his opinion, was the decision of some body having authority whose conclusions would command the respect of the scientific world.

REGISTER OF PATENTS.

Gaseliers.—Smith, C., of Sparkhill. No. 15,575; Aug. 16, 1894.

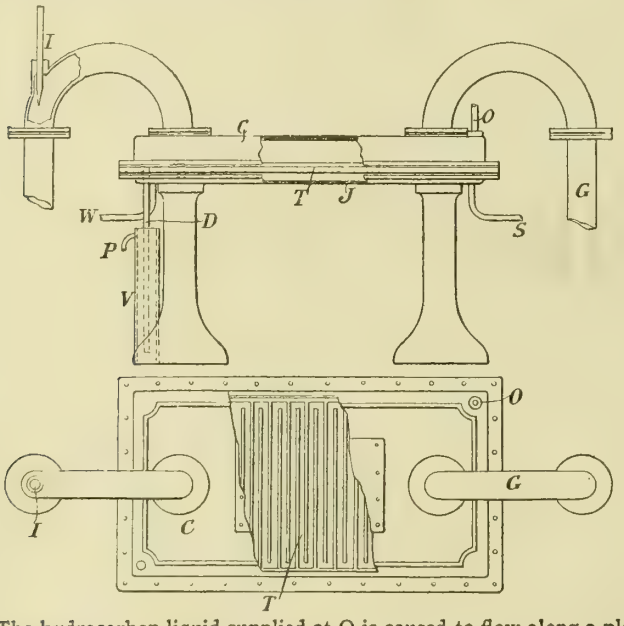
The inventor constructs a telescopic tubular slide for a gaselier in such a manner as to dispense with the water-slide and to enable it to be lengthened or shortened by the aid of one weight instead of two or more, or a rapid pitch or "Archimedean" screw or its equivalent may be formed on the telescopic tubular slides for the same purpose.

In carrying the invention into practice as applied to a gaselier, an external tube is made to depend from an ordinary ceiling joint; and along the length of the tube and at equal distances from each other, grooves are formed. There is fitted telescopically into the tubes an internal tube, carrying the gas brackets or arms with the burners and fittings attached; the connection between the two tubes being formed with a stuffing-box or other device to prevent the escape of gas. To the ceiling joint or to the top of the external tube are attached two small pulleys; and there is an ornamental balance-weight encircling the external tube, and capable of sliding thereon. To a convenient part of the weight are attached two chains—one on either side—which pass along the grooves and over the pulleys. The end of each chain is attached to part of the lower end of the internal tube. It will thus be apparent that the lights may be raised or lowered, and retained in any desired position, by a slight pull downwards, or a pressure upwards; the balance-weight compensating for the weight of the fittings on the internal tube.

Gas-Carburettor.—Price, W. E., of Hampton Wick. No. 20,066; Oct. 20, 1894.

This arrangement of apparatus, "for carburetting coal gas or other gaseous fluid by charging it with vapour of suitable hydrocarbons," was described in the JOURNAL for March 12 last (p. 535).

The accompanying illustration shows a side elevation of the apparatus and a plan with part of the cover removed.



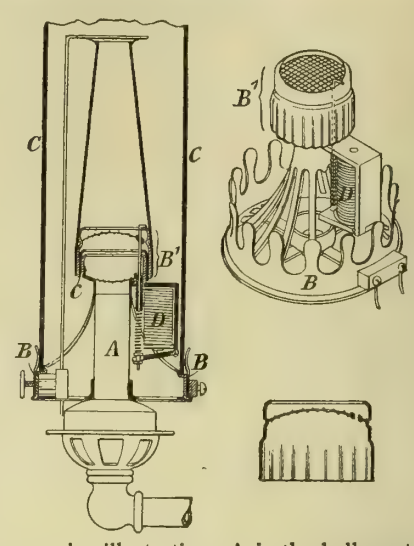
The hydrocarbon liquid supplied at O is caused to flow along a plate or table T (preferably inclined) in a zig-zag course; while the gas to be enriched, supplied at G, is caused to flow through a casing C of which the table T forms the bottom. Under the table, there is a jacket J, heated by circulation of steam or other hot fluid through it; the steam entering at S, and the water of condensation escaping at W. The apparatus is preferably placed as part of the gas-main. It may, however, form a bye-pass to the main, in which case, if necessary, a steam-injector I is employed, to cause "a considerable volume of the gas to flow through the casing, in which it takes up the hydrocarbon vapour generated by the heat of the jacket below the table along which it flows." The casing C may also have a heating jacket. Any overplus of oil flows by the pipe D into a vessel V, in which the liquid forms a seal, and from which there is an overflow P.

Gas-Motor.—Shillito, T. R.; a communication from the Leipziger Dampfmaschinen und Motoren Fabrik, of Leipzig-Plagwitz, Germany. No. 20,123; Oct. 22, 1894.

This invention relates to a gas (or petroleum) motor, in which two pistons reciprocate in a single cylinder with the combustion space between. The movement of each piston is transmitted through a piston-rod and oscillating double lever to a crank-shaft located below the cylinder; the two cranks being connected together by a rod. The cylinder has an inlet and outlet for the gases. The cylinder and the working parts are enclosed in a casing, closable at the two ends by means of covers; and when these are removed, the cylinder and working parts are accessible. The bottom part of the casing is supplied with a lubricant so driven about by the working parts as to lubricate automatically these parts and the cylinder; while the escape of any disagreeable smells into the surrounding space or engine-room is prevented.

Electric Gas Lighter.—Grier, H. G. & A. G., and Hottle, A. S., of Philadelphia, U.S.A. No. 13,635; July 16, 1895.

This automatic electric gas lighter is particularly adapted for "Welsbach" burners. It may be carried wholly by the shade-holder, and can be made detachable with the shade-holder from the fixed portion of the gas-burner. A further object of the invention is to so construct the burner that the screen will be below the internal flange of the crown.



In the accompanying illustrations, A is the hollow stem of the gas-burner, communicating with the gas-supply pipe, and having an enlarged portion provided with valved openings, so that the gas will be combined with a certain proportion of air in its passage to the crown. B is the shade holder, adapted to support the shade or chimney C, and the crown B^1. This is shown as made in two sections—one insulated from the other by a ring of non-conducting material. A flange extends inwards around a portion of the crown; and situated some distance below this flange is a screen, arranged at such a distance away from the flange that a channel is formed between the screen and the flange, in which the gas that escapes can circulate. The screen is preferably supported upon a rib made on part of the crown. D is an electro-magnet secured to the shade-holder; and pivoted to the frame of the magnet is an armature. Extending from the armature is a rod, having a bent-over portion forming a moveable terminal. This rod passes through a guideway provided in the crown; and it may also be secured in the frame of the magnet D. The armature is connected to its rod through a sleeve fixed to it and flattened on each side so that it will fit in a slot in the armature, and thus prevent the turning of the terminal at the end of the rod. Between the sleeve and the slideway is a spring, which tends to push the armature away from the magnet D, and to hold the terminal down upon the flange of the portion of the crown which is the fixed terminal insulated from the body of the shade-holder by insulating material. By utilizing the turned-in flange of the crown as one terminal, and by lowering the screen within the crown so as to form an annular channel, the proper lighting of the burner as soon as the spark is made, is insured. The gas, as it escapes from the tube to the screen, circulates first within the channel, so that, as soon as the spark is made, there is sufficient gas in the channel to ignite at once.

APPLICATIONS FOR LETTERS PATENT.

16,814.—WIGHAM, J. R., "Producing recurring and intermittent lights for lighthouses, beacons, buoys, and other lights." Sept. 9.

16,821.—JANSEN, C. G., "Incandescent gas-lamps." Sept. 9.

16,844.—DEMOLDER, F. F., "Preventing the formation of ice in water-pipes." Sept. 9.

16,846.—CAMPBELL, J. E., "Manufacture or preparation of materials for the purification of gas or the like." Sept. 9.

16,867.—TEMPLETON, J., and ROBINSON, H. J., "Testing gas, water, and the like pipes or fittings." Sept. 10.

16,875.—KENT, H. A., "Self-lighting gas-burners." Sept. 10.

16,878.—HILL, T., "Gas and oil engines." Sept. 10.

16,891.—WHITE, C., and MIDDLETON, A. R., "Gas-engines." Sept. 10.

16,927.—GULDLIN, O. N., "Oil atomizing and carburetting apparatus for gas-generators." Sept. 10.

16,945.—MILES, J. H., DIMON, J., and JONES, J., "Pipe or similar couplings." Sept. 10.

16,956.—CURLETT, W., and JOST, W. R., "Pipe couplings." Sept. 10.

16,983.—HIRCOCK, A., "Water taps and valves." Sept. 11.

17,024.—JACKSON, T. W., "Coupling pipes together, and connecting taps and valves with pipes." Sept. 12.

17,042.—MARRIAGE, T. S., "Supporting and retaining in position lanterns or the like for gas lighting." Sept. 12.

17,152.—WORMALD, A. H. & J. A., "Increasing the illuminating power of gas." Sept. 14.

17,182.—SUGG, W. T., "Burners for gas-fires." Sept. 14.

17,207.—WERCK, W., "Filtering gas produced from liquid fuel." Sept. 14.

The Finances of the Leeds Corporation Gas and Water Departments.—In the abstract of accounts of the Leeds City Accountant (Mr. W. Derry) for the year ended March 25, it is shown that the income of the Gas Department was £327,270; and the expenditure, £282,674—making the net profit of £44,596. Out of this £10,878 was paid for sinking-fund purposes; leaving a surplus of £33,718 on the year's trading, which, after clearing off the deficiency standing against the account of £31,188, gives a net surplus of £2530. From the capital account it is seen that the debt secured on the gas-works is £1,120,481; and the expenditure, £1,210,178. The water revenue account shows an income for the year of £107,242; and an expenditure, including interest on the debt, of £82,713—leaving a profit of £24,529. Out of this, there has been paid for sinking-fund purposes, £17,165; leaving a surplus for the year of £7364. The capital account shows the secured debt to be £1,618,623; and the expenditure, £1,783,092.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Politics or "Tammanyism" at Bradford.

SIR,—In your issue of the 17th inst., you have an article under the heading of "Political Oil-Gas in Bradford;" but I think the heading would be much more correct if you were to call it "Tammanyism in Bradford." This I hope to prove by the following facts.

The history of the introduction of my system in the Bradford Corporation Gas-Works is, unfortunately, known only to a very small circle of the Bradford Council; and if it were more widely known, I am quite sure that the oil-gas question would have been settled a year ago, when my experiments proved a great success.

At the beginning of 1894, a proposal was brought by Messrs. Smith, Shaw, and myself before the Bradford Corporation to erect plant for the production of oil gas at the Thornton Road works. The conditions on which we offered our system to the Corporation, as I explained in my letter to them of Jan. 4, 1894, were to be as follows:—

(1) 100 gallons of oil should produce 8000 cubic feet of gas of 60-candle power, and, in addition, 37½ gallons of bye-products.
(2) The bye-products obtained should be separated into 25 gallons of heavy oils, and 12 gallons of benzol, toluol, &c.
(3) The 25 gallons of heavy oils should be gasified in the water-gas plant erected.
(4) The price of the oil should be taken as 3½d. per gallon.

This proposal has met from the beginning great opposition from the Vice-Chairman of the Gas Committee (Mr. Kay) and a member of the Committee (Mr. Akroyd). Both these gentlemen tried to get the Huddersfield process into the Bradford Gas-Works. But as my condition was "No cure, no pay," it has been very difficult for them to bring in the system. After cornering their co-members in the Gas Committee, they have succeeded in carrying a resolution in the Committee by which it has been decided to introduce the Peebles process into the Valley Road works, and the Huddersfield process into the Birkshall works. The adoption of such proposals would mean an outlay of £2000 for the Peebles process, and £4000 for the Huddersfield process. Apart from this, about £4000 per annum would have to be paid to the patentees for royalty alone.

Mr. Dixon, who was not then the Chairman of the Gas Committee, tried to show that the Huddersfield system is the best that has yet been invented; but fortunately for the Bradford ratepayers, the proposal of the Committee was not accepted by the Council. Then the Committee, seeing that they could not introduce their own system, decided not to allow my process to be worked in the Corporation works; and, on the 9th of November, all the councillors who were with the defenders of the Huddersfield process, came in as members of the Gas Committee, and elected as Chairman Mr. Dixon, who has been my chief opponent from the beginning.

The policy Mr. Dixon has adopted has been as follows: Publicly he has always stated that I am asking for further trials of my apparatus; but privately he has insisted that the Corporation Engineers should prolong those experiments as much as possible. Seeing that by such policy the experiments will never end, I have called upon the Editors of the local papers to report with regard to my apparatus. The description and working of the apparatus have been given in both papers very fully; and therein my statements have been that 17,000 cubic feet of gas are produced from a ton of oil, and about 40 per cent. of bye-products are obtained. These bye-products have a much higher enriching value than the original oil used. Naturally, Mr. Dixon has been very angry that his policy of keeping in the dark the result of my experiments has not succeeded; and in a speech made by him at a meeting of the Council on the 8th of January, he stated that the quantity of gas produced is less than 12,000 cubic feet per ton. Apart from this, he made a number of misstatements, which have been proved to be utterly misleading by the report of the Corporation Gas Engineer presented to the Committee on the experiments made from September, 1894, to Jan. 19, 1895. In this report, Mr. Wood shows that the cost per candle, if we take the average result obtained from the oil gas and the bye-products, will be 0·25d. per 1000 feet-candles; but when he takes only the enrichment by oil gas alone, and the cost of the bye-products at 6d. per gallon, the cost for enrichment is 0·35d. per candle.

This report naturally was not favourably received by the members of the Committee; and, without going into the merits or demerits of my process, they decided that another month's trial should be made with my plant, and that a second report should be presented to them. I must state here that the chief reason for making another trial has been given that a certain amount of oil, in the opinion of Mr. Dixon and his friends, has not been accounted for; and therefore it was agreed that a fresh quantity of oil should be ordered, and that, when it had been entirely used up, a report would be presented. The experiments were conducted for 33 days continuously day and night. In these experiments, together with the oil gas, a certain percentage of the bye-products obtained has been used for enriching the coal gas. The results of these experiments have entirely corroborated those previously arrived at.

But, as I have already stated, the Committee was formed for the special purpose of throwing out my apparatus, even if it showed the greatest success; and therefore, without discussing the results of this test, which was made according to their own decision, and under their strictest control, they decided to find somebody who could help them, in spite of the favourable results obtained, to condemn my process. For this purpose, they communicated with Messrs. Frank and Lewis T. Wright, who, after studying the report of Mr. Wood, made a statement that the Corporation Engineer's figures as to the cost should be multiplied by 5; and in this way the cost of enrichment by oil gas would be five times more than the Engineer's. It took us more than three months to prove that the statements of these gentlemen are entirely wrong and misleading; and I have proposed to the Chairman of the Gas Committee that somebody should be called in to show that they are entirely incorrect.

The Committee, seeing that the adoption of my process could not be delayed much longer under the pretence of multiplying by 5, decided to engage the very same gentlemen to try, if possible, to condemn my process. The Committee officially communicated with Lord Kelvin and some other authorities, and requested them to recommend to the Corporation some experts for making experiments with my apparatus; but unofficially the majority of the Committee decided, in spite of all our protests, to select Mr. Lewis T. Wright. On the 4th of July, according to the decision of the Committee, Mr. Wright and myself started the experiments with my apparatus.

The very first step of Mr. Wright was to protest against enrichment by oil gas and bye-products together; and he insisted that experiments should be conducted on quite a different line to that adopted in the experiments extending over 33 days. Mr. Wright gave as the reason why they should be conducted on different lines, that the carburettor was too near to the photometer-house, and that therefore he would be bound to state, in his report to the Committee, that he could not guarantee the tests made and the permanency of the gas enriched. I explained to him that he could see, from the report of Mr. Wood, that a photometer had been put up 1¾ miles from the works; and, in spite of the exceptionally cold weather which prevailed in the month of February, no difference in candle power had been found. I made the offer to Mr. Wright that a photometer should be put up wherever he liked, and experiments should be conducted the same way as during the 33 days. Mr. Wright then promised that the next day he would start the experiments in the same way as before—*i.e.*, to use a certain quantity of the bye-products for carburetting purposes. The next day I gave orders to start the carburettor; but Mr. Wright, after a long consultation with Messrs. Dixon and Kay, refused, in spite of his previous promises, to allow the carburettor to be worked. Being unwell, I left the works for a few hours; and, on returning, I found that the coal gas did not show any enrichment at all, notwithstanding that the quantity of oil gas produced was nearly the same as on the previous day, when the oil gas had shown very good results. In the meantime, the unenriched coal gas itself was of the same candle power as the enriched gas. I told Mr. Wright that something must be wrong in the testing of the unenriched coal gas; but his explanation was that the coal gas with the higher candle power could not be enriched by the same quantity of oil gas to the same extent as a coal gas with a low candle power.

After such theories as these, I thought it was of no use to go on with the experiments, especially having in view the fact that the valve for regulating the standard burner in the photometer had been put in such a position that it could be regulated *ad libitum*. In addition to this, Mr. Dixon sent a man of his own, not in the service of the Corporation, and without the knowledge of the Manager, to the workman who was looking after my apparatus, requesting that the experiments should be conducted according to Mr. Wright's orders. Seeing this, I decided to stop the apparatus till arrangements should be made, first, to remove the valve out of reach; and, secondly, I determined to withdraw altogether, and leave the matter in the hands of Messrs. Newbigging and Son, who should represent me at the further trials.

The result of these experiments is known. The report presented by Mr. Wright was still too favourable; and therefore the Committee decided to get him to make an additional report, wherein he should try to show that the cost of enrichment by my process was not favourable at all. But even in the second report, a saving of £1000 per annum is shown by my process.

Your readers have had before them nearly all the documents in connection with the Bradford experiments; but the most important one is that of Mr. Wood on the working of my apparatus for 33 days continuously. This report shows that 13,910 gallons of oil were gasified in the course of that period. This means an average of 421 gallons per 24 hours. The quantity of oil gas produced was 17,725 cubic feet per ton; and the amount of bye-products obtained was 5190 gallons, or equal to 37·31 per cent. of the oil used. The enriching value of the oil gas produced, together with 7 per cent. of the bye-products used in the carburettor, was 111 candles. Two samples of the bye-products were sent to Messrs. Read Holliday and Sons for analysis, with the result that 20 per cent. of these products are valued by them as worth 1s. per gallon, and 70 per cent. are worth from 1d. to 2d. per gallon. The average value of the products is therefore about 3½d. per gallon. I must remark here that some mistake has been made in this calculation, as, according to the first analysis made by Messrs. Read Holliday and Sons, 27 per cent. of the valuable light oils were obtained, and the loss of 7 per cent. by distillation is rather an unusual one.

Now with regard to the results of Mr. Wright's experiments. As I have already said, those experiments have been conducted on quite different lines from those which should have been followed. First, the oil gas has not been used together with a small quantity of the bye-products, which was the case with the experiments made in the 33 days' test. Secondly, the quantity of oil gasified has, in my opinion, been purposely diminished. Instead of gasifying not less than 420 gallons per 24 hours, as was done in the 33 days' test, Mr. Wright gasified only 289 gallons; and therefore naturally the oil gas itself should show a lower candle power, for the reason that the temperature in the retorts was too high for the quantity of oil gasified. Thirdly, the photometrical tests made by Mr. Wright are absolutely unreliable. We find that on the 22nd of July, the *unenriched coal gas* varies from 13·31 to 17·59 candles; on the 23rd of July, from 13·26 to 17·80 candles; and on the 24th of July, from 15·10 to 17·30 candles. But what is most curious is the variation in the enriching value of the oil gas added to the coal gas. As Mr. Wright himself admits that the heats of the retorts are well under control, and it is a fact that the quantity of oil gas made per hour varies very little, it is rather strange to see that, by adding the same amount of oil gas to the same bulk of coal gas, the enriching varies on the 21st and 22nd of July from 1·02 to 2·68 candles, and on the 23rd from 0·53 to 2·64 candles. But the strangest of all is the enriching value on the 24th of July, when the quantity of oil gas added to the coal gas was over 4 per cent. Even then we find that the enriching value is as low as 0·72 candle. I would ask any of your readers if such variation is due to my apparatus or to the unusual tests made by Mr. Wright.

With regard to the bye-products obtained, as will be seen from Messrs. Newbigging and Son's report, they have been analyzed, and

have shown that they contain 23 per cent. of benzol and 12½ per cent. of naphtha; while the value of the undistilled products is about 5d. per gallon. With respect to the carburetting tests made by Mr. Wright, here again he has tried to use the bye-products in a manner which *à priori* should produce a worse result; and he himself admitted to Mr. Newbigging that he would base his calculation, not on the carburetting tests, but on the analysis of the bye-products. I am quite certain that such analyses have been made by him; and I should like to know the reason why he does not publish them. Is it that the instructions of Messrs. Dixon and Co. are such that he has nothing to publish which will show favourable to my process? I do think the tests made by Mr. Wood with 33 days' continuous working are more reliable than those made by Mr. Wright.

In my opinion, only one honourable course is left to the Corporation—a course which would involve them in very little expenditure—this is, to invite two or three gas engineers of high standing to form a Committee to consider all the reports and statements made. I am quite sure that the decision of such a Committee would be not less favourable to my process than the opinion of Messrs. Newbigging and Son and the Corporation's own Gas Engineer.

P. DVORKOVITZ.

16, *Bishopsgate Street Without, E.C.*, *Sept.* 20, 1895.

[In sending the foregoing letter, Dr. Dvorkovitz asked us to publish Mr. W. Wood's report on the working of the process in the 33 days referred to—viz., from Feb. 4 to March 9—with certain explanations furnished by the Doctor in regard to the period from Feb. 18 to the end of the trial. This we shall do next week; and, in order to make the record of these experiments complete, we purpose at the same time giving Mr. L. T. Wright's first report, dated Aug. 1 last. We would here point out that, in the reproduction of Messrs. Thomas Newbigging and Son's report in last week's issue of the JOURNAL, what are given as the fourth, fifth, sixth, and seventh paragraphs of the report were accidentally misplaced as the seventh, eighth, ninth, and tenth—that is, the portion beginning "This is taking Mr. Wright's figure," &c., down to "margin of profit in favour of the oil process" should have appeared after the paragraph (on p. 591) ending with the words "would be £3616 per annum."—ED. J. G. L.]

Regulating Incandescent Burners.

SIR,—Mr. H. E. Jones, of the Commercial Gas Company, deserves great thanks from all for drawing attention to the necessity of perfectly regulating incandescent gas-burners. The information is most important—more especially for public lighting, with always varying pressures. It shows that the present lamp regulators must be kept in good order to obtain efficiency with economy.

For private lighting, a better check can be kept on incandescent lights; but the report shows the necessity for using governors therewith. In my own house I have two incandescent lights in use, regulated by Sugg's "Christiania" governors. Those using "Christiania" burners, can with an "adapter" (given with each of the incandescent burners) easily fix the incandescent light to the "Christiania" governor and have the advantage of using *the same globes*. The "Christiania" burner governors can be adjusted to pass 4 feet per hour at 10-10ths pressure, which Mr. Jones shows gives the best results.

MAGNUS OHREN.

Garlies Road, Forest Hill, Sept. 14, 1895.

Mr. Whimster's Retirement.

SIR,—In your issue of Sept. 17, I find in your "Notes from Scotland," a compliment paid to our respected Gas Manager, Mr. Whimster, on his retirement. That compliment is well deserved; but I am afraid that the innuendoes added as to the cause of the retirement, will detract very much from its value.

Permit me to inform your correspondent, and also your readers, that no pressure whatever has been brought to bear on Mr. Whimster as to the selection of a site for the proposed new works. The new site proposed—viz., Lower Friarton Farm—was never heard of in public; although Mr. Whimster considered it previous to reporting on the Sand Island, as the most convenient and suitable site for the new works. Mr. Foulis, of Glasgow, an independent authority, has also reported on the Sand Island, as suitable; and, like a thorough engineer, he suggests methods by which it will be made perfectly safe even for gas-works. Mr. Whimster has resigned entirely because of advancing years, and to enable the man who is likely to be the new Manager having something to say in reference to the designing of the new works. Had Mr. Whimster resigned because a section of his Commissioners sought to press their opinions on him, and compel him to do anything which was contrary to his will, the blame might have been laid at the door of the promoters of the new site on Friarton Farm, who have not only hatched their project during the last month, but are likely to succeed in preventing the Perth Gas Commissioners from taking that immediate action which the urgency for more light in Perth so pressingly demands.

Before writing this, I have received the authority of Mr. Whimster to give the insinuations referred to his most unqualified denial.

ALEX. WRIGHT,
Convener of the Perth Gas Committee.

Perth, Sept. 21, 1895.

The Consumption of Water in New South Wales.—The average consumption of water supplied last year per estimated head of the population in New South Wales was 34·23 gallons, as against 32·12 gallons for the previous year. The average daily supply was 13,739,000 gallons; and the estimated population served, 401,380. There were 2333 houses connected during the year; making a total of 83,621 houses supplied. Upwards of 46½ miles of new mains were laid in 1894; making the total length of mains now laid in the city and suburbs, exclusive of trunk mains, 792 miles.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS COMMITTEE.

(*Before the Earl of* JERSEY, *Chairman; Earl* GREY, *the Earl of* DARTMOUTH, *Lord* CALTHORPE, *and Lord* KENRY.)

BARNSLEY CORPORATION WATER BILL.

At the close of the promoters' case, as reported in the JOURNAL for Sept. 10, evidence was given in support of the various petitions against the Bill.

Sir *F. J. Bramwell*, F.R.S., was called by Mr. WORSLEY TAYLOR on behalf of Messrs. S. Fox and Co., Limited, umbrella frame makers, of Stocksbridge. He stated that the proposed water scheme would abstract such a quantity of water flowing into the Little Don, which was used by Messrs. Fox in connection with their works, that a serious injury would be done to the firm. It would greatly interfere with the present works, and with any attempt to extend or further develop the industry with which they were associated. He remembered in 1874, when there was a proposal before Parliament to take a portion of the water from the Little Don for the supply of Wakefield, he gave evidence on behalf of Messrs. Fox against the scheme; and the Bill was thrown out. If Messrs. Fox's works were of importance in 1874, they were doubly so at the present time. They had been largely extended, at vast expenditure; and abundance of water power was of vital importance to them.

Mr. WORSLEY TAYLOR said he had other engineering witnesses who could support the evidence of Sir F. Bramwell; but he did not think it necessary to call them. He proceeded to address the Committee on behalf of Messrs. Fox, whose interests were, he said, seriously endangered, and for whom the Bill, in its present form, did not, he contended, provide adequate protection.

Mr. BAGGALLAY, who appeared for the opposing millowners, intimated that he would not have to address the Committee on the preamble, as his clients and the promoters had, by mutual concessions, arrived at an agreement as to the quantity of compensation water to be sent down in the event of the Bill passing. It had been agreed to make the quantity 7½ inches instead of 7 inches as provided in the Bill. While withdrawing all opposition to the preamble, however, he might find it necessary to raise questions on the clauses.

Mr. PEMBROKE STEPHENS then addressed the Committee on behalf of the West Riding Rivers Board and the West Riding County Council. He explained that, though their opposition was in form against the preamble, it had not for its object to prevent Barnsley getting an improved water supply. On the contrary, they very much desired it. What they wanted was to take care that, if a new supply were sanctioned, it should be under proper terms and conditions, in the absence of which, instead of proving a benefit, the scheme might be a disastrous one for the district. It must be remembered that the more pure water they withdrew from the heads of rivers or streams, the greater became the evil effects of pollution in the lower waters. Then in regard to compensation water, a great deal depended on the quantity restored and the method of restoring it. Another important point he wished to impress upon the Committee was as to the danger of lead-poisoning. The West Riding County Council had been in communication with the Local Government Board on the subject; and the latter body agreed that it was of great importance to watch the matter in connection with all proposed new supplies of water.

Mr. *Milnes-Gaskell*, the Chairman of the County Council, gave evidence in support of the learned Counsel's statement.

At this stage of the proceedings,

The CHAIRMAN put it to Mr. Pembroke Stephens, whether, after the evidence of Mr. Milnes-Gaskell, the opposition of the West Riding County Council was not merely on clauses. He said Mr. Gaskell appeared to be desirous that the Bill should pass subject to proper safeguards and conditions.

Mr. PEMBROKE STEPHENS said the Council had no objection to the Bill, provided their conditions were complied with in respect to the lead-poisoning difficulty and to the question of compensation water.

The CHAIRMAN said they had better go on with the opposition of other parties.

Mr. CRIPPS then addressed the Committee on behalf of certain owners of works at Sheffield and in the district. He said his clients were in the unique position of representing a population of 100,000, which was larger than that of Barnsley and the districts proposed to be added for the purposes of the water supply. Several of the firms for whom he appeared had more than £1,000,000 of capital each; and their rental was estimated at £200,000 a year. As regarded the horse power they employed in their works, it was estimated at 18,500 nominal; but the Committee would understand that the actual power was enormously greater. There was no doubt the River Don was of vital importance to the industries of Sheffield; and he would go the length of saying that one of the largest industries in England would be seriously injured if the Bill were passed. They had no desire to interfere with the needs of Barnsley—that was a matter for the Corporation. They were desirous that every other district should have the same facilities for water supply as the Sheffield people enjoyed at present; but they decidedly objected to people from another district coming in and depriving them of the water supply to which they were physically entitled. He characterized the scheme in this respect as nothing more nor less than a system of poaching. Their point was that Barnsley could, in their own drainage district, obtain all the water they required; and that it was altogether unnecessary that they should go to Midhope. Out of the 66,000 acres of watershed in the district, the promoters proposed to take the best part—viz., the head water. There was in the district at present an ample supply of water; and it was of vital importance that they should not be deprived of the freshets which came from the best part of the watershed, and which, under the existing scheme, would go into the Midhope watershed. It was manifestly unfair that the Barnsley Corporation should come out of their own district and take 26,000 acres out of the total area of 66,000 acres, and also secure the very best part of the existing watershed. The industries he represented included one which was responsible for the manufacture of nearly all the armour

plates made in England. He was instructed that it would cost one of these firms £10,000 a year if there was not a sufficient supply of water from the River Don. The Committee had it upon the authority of the late Mr. T. Hawksley that the Barnsley Corporation could obtain their supply from another district without interfering with the Little Don. In other words, Barnsley was proposing to take water which Sheffield declared was absolutely necessary for itself. The Committee could not give Sheffield any protection if they once let Barnsley come inside the drainage area which properly belonged to Sheffield, and take the waters which formed the life of the industries associated with the town. If the Bill passed as it stood, there was no provision by which Sheffield could be safeguarded; and he asked the Committee not to jeopardize the interests of the important industries he represented by giving their sanction to such a scheme.

Witnesses having been called to support these statements,

Mr. Freeman, on behalf of the Corporation of Wakefield, stated that this body objected to Barnsley having powers to supply, at a profit, places east of Barnsley which Wakefield could readily serve.

Alderman *Booth*, the Chairman of the Wakefield Water Committee, said they considered this a great hardship. Like all other waters in the West Riding, their water was a little turbid last year; but it was of first-class quality, and there was plenty of it.

The case of Rotherham was then taken.

Mr. *Parker Rhodes*, the Solicitor and Secretary to the South Yorkshire Coalowners' Association, gave evidence to show the prospect of a great development in the coal industry in and around Rotherham, which he said must have water from somewhere in order to go on. In the meanwhile, they were on short supply; and what they had they were told was not fit to drink. The Little Don was their natural and apparently only source.

Mr. *H. H. Hickmott*, the Town Clerk of Rotherham, said the Local Government Board Inspector reported against the water drawn from the Ulley reservoir; and after his report the Rotherham Corporation decided to cut off the supply. The scarcity of water was so great, however, that they were obliged to re-open it. The Corporation then considered the desirability of obtaining a supply from the moors above Sheffield. The only unappropriated ground was the Little Don Valley; but, after some discussion, it was thought it would be better for one large authority like Sheffield to impound the whole of the waters of the Don, and supply the towns below it. The representatives of Sheffield, Rotherham, and Doncaster came to an understanding to act together; and Rotherham, at the request of both Sheffield and Doncaster, withdrew their proposal to investigate the Little Don Valley. They came to an agreement that, if Sheffield obtained possession of the Little Don Valley, they would supply both Doncaster and Rotherham. The Town Council of Rotherham discussed the Little Don Valley scheme, as outlined in their Bill, before they heard of the Barnsley Bill.

Evidence was given as to the population and growth of Rotherham, and as to the advantageous situation of the town for profiting by the growth of the iron trade. The moors around Sheffield were, it was stated, the only convenient places for getting a good supply of water for Rotherham.

Mr. *C. B. Newton*, Assoc.M.Inst.C.E., the then Gas and Water Engineer of Rotherham, in answer to Mr. Bidder, said the present population supplied with water was 61,500, including Rawmarsh. By their Bill, the Corporation would increase their supply to a population of 69,000. They had 436,000 gallons of their daily supply from Ulley, or about half of their entire yield. Twenty years hence, he estimated the population of the Rotherham water district at 90,000—that was at the rate of 1000 persons increase yearly; and with 25 gallons per head per day, they would then require a total daily supply of 2,225,000 gallons. At present they were unable to give a full and proper service; and they must get additional water from elsewhere.

Mr. *F. Fowler*, Engineer and Surveyor, of Sheffield, said the head waters of the Rother were not available for Rotherham. They were required for Chesterfield; and the only place he knew to which Rotherham could go for its additional supply was the watershed of the Little Don.

Professor *H. Robinson*, M.Inst.C.E., said the present water sources of Rotherham would only yield a million gallons a day, which was quite insufficient. It was proposed to sink a well at the Rotherham Red Rock; but this he regarded as only a stop-gap. The Ulley and Morthen streams could not be relied upon as regards pure water. The Aldwarke stream was a pure source. Having regard to the present position of Rotherham, and the probability of an increasing population, the town was in a most serious position. At the present time the supply was insufficient. Generally speaking, the Little Don was the best part of the entire water-gathering area, and the only area upon which Rotherham could properly depend for its water supply. Even if the gathering-grounds were cleared from all sources of pollution, they would not have enough water for the supply of Rotherham.

Sir *F. Bramwell* said he thought the proper thing for the Rotherham Corporation to do was to look to the Sheffield Corporation as the owners of the Don watershed. The case of Barnsley differed from those of Liverpool, Birmingham, and Manchester. He thought the various towns interested could hardly keep fighting out the question as to the possession of the remaining rights of the Don watershed. He had always regarded the water of the Don as of high quality until he heard it impugned in that room. The valley of the Don lent itself to the construction of water-works at moderate cost. Barnsley had a very reasonable supply at present—about 20 gallons per head per day in a normal year. There was no doubt Barnsley would have a supply sufficient to last them forty years if the late Mr. Hawksley's scheme were adopted. He (witness) would raise the dam of the Ingebirchworth reservoir by 3 feet, which would give an increase of 20 days' supply.

The case for the Rotherham Corporation then closed.

The Chairman asked if he was correct in assuming that no agreement had been come to between the three towns of Sheffield, Rotherham, and Doncaster.

Mr. Worsley Taylor replied that negotiations had been going on between the authorities of the towns referred to; and as soon as anything definite was agreed upon, their Lordships would be placed in possession of all the facts.

Mr. Littler (interposing) said he wished the Committee to be under no misapprehension with regard to Sheffield, Rotherham, and Doncaster. Though there was no seal to the agreement between these three towns, he considered it absolutely binding; and when it was finally ratified, he would be happy to bring it to the notice of the Committee.

Mr. *B. S. Brundell*, formerly the Borough Surveyor of Doncaster, gave evidence generally in favour of a joint scheme of water supply for Sheffield, Doncaster, and Rotherham. He said he considered that by such a scheme a better class of water supply would be yielded, and that it would be to the advantage of all the areas supplied. He did not think Doncaster would have gone to the Don for water except in conjunction with Sheffield and Rotherham; but that was the only watershed of which they could avail themselves. He advised the Doncaster Corporation last year to go to the Don Valley for water, as they were in great want of it; and he knew that the Don scheme would take a long time to carry out. In conclusion, he said he knew nothing of the agreement as to the joint scheme between the three towns as regarded its history or terms.

Mr. *T. Sugden*, the Town Clerk of Doncaster, gave some particulars in regard to the proposed joint scheme of water supply. He said he first saw the Town Clerk of Sheffield with reference to the agreement in December, 1894. The original proposal was that the three towns should form a kind of Joint Water Board; but, by the terms of the agreement, Doncaster was bound not to ask for a larger supply from Sheffield than 800,000 gallons per diem. Doncaster, however, rather regretted that they made the provision, as he thought 800,000 gallons would not be sufficient to supply the whole district. They had been in communication with Sheffield with a view to increasing the supply to 1,000,000 gallons a day.

Mr. Worsley Taylor then addressed the Committee on behalf of the Doncaster Corporation. He said that Doncaster was worse off than Barnsley for water; and even if they were equal, Barnsley should not take away the water of the Little Don. The needs of Doncaster were likely to increase in the future. It was a fact that they were unable to provide for their present population. Barnsley was seeking to take water in order to supply its own needs, and to accommodate towns which it had at present no statutory obligation to serve. Doncaster now failed to supply 12,000 people, which it had parliamentary powers and obligations to provide with water. Even if the present population of Doncaster were not to continue to increase, apart from the question of parliamentary obligations, Doncaster would have still a deficiency of water for its purposes. The present scheme was a doubtful one. He believed it was far better that Doncaster should get a good supply of water from the sources suggested.

Mr. Erskine Pollock addressed the Committee on behalf of the Duke of Norfolk, who, he said, really represented Sheffield, as he was the principal property-owner in the town. The Duke had not only his own interests to consider, but those of his trustees, who had privileges in Sheffield, and rights of user on the River Don. The view of his client shortly was that the sources of the Don should be developed with the view of serving Doncaster as well as Barnsley. His client not only objected to the taking of the water of that river, but also to the way in which the promoters suggested taking it. They proposed to appropriate the best part of the watershed which physically belonged to other districts.

Mr. *Mundella*, M.P., in answer to Mr. Balfour Browne, said that during the past ten years the population of Sheffield had grown by 60,000, notwithstanding a period of bad trade. There was great objection in Sheffield to the scheme of the Barnsley Corporation, because it took from the inhabitants their natural watershed, and would put them to very serious expenditure in view of a future supply. The prosperity of Sheffield depended, in his opinion, upon a good supply of water. He did not think it fair that Sheffield should be driven into another watershed in order that Barnsley might have a proper supply of water. He thought Sheffield was entitled to its own drainage district.

Alderman *Gainsford*, examined by Mr. Balfour Browne, said he had been Chairman of the Water Committee of the Sheffield Corporation since 1887. After detailing the history of the Sheffield Water Company, witness said the present available water supply of Sheffield was 8,465,000 gallons a day; but this did not include the yield from the authorized (but not constructed) reservoirs at Ewden, which, when completed, would give a supply of 4,624,000 gallons daily. If Sheffield supplied Rotherham and Doncaster with water, the present quantity would be exhausted by 1917, without taking into account the growth of the district. If the present scheme were sanctioned, Sheffield would soon have to apply to Parliament for authority to carry out a new and expensive scheme of water supply. As an experienced manager of water-works, he was of opinion that Sheffield was in a position to supply both Rotherham and Doncaster.

Further evidence having been given,

Mr. *E. M. Eaton*, Assoc.M.Inst.C.E., the Chief Water Engineer of the Sheffield Corporation, said the population of the Don Valley in 1851 was 200,000; and in 1891, more than 504,000. It was estimated that in 1901, on the same basis of increase, the population would be 592,000; in 1911, 645,000; and in 1921, 815,000. Witness expressed the opinion that Barnsley ought to utilize its own watershed, and not poach upon the natural supply of Sheffield. There was sufficient water from the drainage area to supply both the Ingbirchworth and Scout Dyke reservoirs. If Barnsley would adopt his suggestions, the town would have a supply for the next twenty years.

Mr. *F. Fowler*, examined by Mr. Littler, said he approved of the scheme shadowed forth by Mr. Eaton for increasing the water supply of Barnsley. He would release the Ingbirchworth reservoir from giving out compensation water, and allow this water to be sent from Scout Dyke. He had never seen anything so good in water-works construction as the Ingbirchworth reservoir, the raising of the bank of which would cost £24,000.

The Chairman: You would have to come to Parliament for power to do that.

Witness: Yes; but the works could be constructed in about half the time that the Midhope works would take.

Sir *J. Fowler* was next called by Mr. Littler. He said the Midhope drainage area was one of great purity. It had a very small population

upon it, and was altogether most suitable for purposes of water supply. He was of opinion that all suitable drainage areas should be economically conserved, as the supply of water to the great towns was one of the problems of the future. If the 680,000 gallons compensation water now sent from the Ingbirchworth reservoir were furnished from Scout Dyke, Barnsley would get an additional supply of 680,000 gallons; and the arrangement seemed to him to be a reasonable one. He supported the view of Alderman Gainsford that the waters of the Don should be appropriated by Sheffield for the benefit of Sheffield and the other towns of the valley on equitable terms to all.

This closed the evidence on behalf of the Sheffield opposition.

Mr. LITTLER then addressed the Committee on behalf of the Sheffield Corporation. At the outset he referred to the report of the Duke of Richmond's Commission, in which it was stated that groups of towns situated in the same water area should be encouraged, if not compelled, to combine for the purpose of availing themselves of the natural supply. The position of the Sheffield Corporation in this matter was exactly upon the same lines as were laid down by the report of the Commission. Their Lordships had had it put before them, in the course of the present inquiry, that there was an agreement binding upon the Corporation of Sheffield to go to Parliament with the view of obtaining an additional water supply, not only for itself, but for the towns of Doncaster and Rotherham. That agreement must be regarded as definite and binding; and no attempt had been made by the promoters to show that Sheffield was not prepared to act upon it at the earliest possible moment. The scheme, however, could not be carried out if the present Bill passed. Their Lordships had had it before them that both Rotherham and Doncaster were at present without a sufficient supply of water. What encouragement would there be for Sheffield to go to Parliament to carry out the policy directed by the Duke of Richmond's Commission, if the Corporation of Barnsley were to be allowed to appropriate this watershed? It would be a serious thing for Sheffield if their Lordships were to sanction this scheme. He could assure them that the Sheffield Corporation fully intended to utilize all the sources of water supply afforded by the River Don, not merely for themselves, but for the other important towns of Doncaster and Rotherham. If the present Bill were passed, what would be the position of Sheffield in regard to its future requirements, and what would be the position of Doncaster and Rotherham? If they were to have an additional supply, they would have to go trespassing upon some other community's water area. His case was, briefly, that Sheffield had no right to be deprived of its legitimate water area for the benefit of Barnsley. There had been no evidence placed before their Lordships that Barnsley was *in extremis* as regards its water supply. On the other hand, they had had evidence of persons representing gigantic industries in Sheffield, to show that, if the water proposed to be abstracted under this scheme were to be taken away, it would mean disaster to the industries which had made the name of Sheffield famous. The Committee were asked to do this in the interest of a community like Barnsley, which was not, like Sheffield, one of growing importance, but one which, when the coal was worked out, would probably cease to exist. Their decision was one of the most serious gravity to Sheffield; and he had every confidence in asking them not to allow the Bill to proceed.

Mr. PEMBER then replied on behalf of the Barnsley Corporation. He characterized the opposition of the various petitioners as one of conflicting jealousies. Messrs. Fox's claim to the whole of the water of the Little Don was an impossible one, and could not be sustained for a moment against the interests of Barnsley and the community in the valley of the Don. It was absurd that it should be urged that Barnsley should be prevented from going to Midhope for an additional water supply because of a little ridge of hills that intervened. Barnsley was naturally and geographically more associated with Midhope than Sheffield, Doncaster, or Rotherham. He asserted that there was no guarantee that Sheffield would proceed with a Bill for the purpose of furnishing a supply of water to Rotherham and Doncaster. On the other hand, it had been admitted by Sheffield witnesses that Barnsley would be sooner in need of an additional supply than Sheffield. He asked the Committee to leave the Little Don to the minor communities as the source of their water supply, and not allow the Sheffield Corporation to play the "dog in the manger" with regard to water which by Nature was intended for the minor populations in the valley.

The CHAIRMAN intimated that the Committee found the preamble of the Bill proved, subject to certain modifications as to clauses. The Committee considered that Messrs. Fox were entitled to special treatment. They also considered that the manner of the filtration of the water should be expressly stated. They also thought that one clause in the Bill should be amended in the direction of allowing local authorities taking water from Barnsley to have it on partnership terms. They also considered that the clause which prevented the local authorities obtaining water from any other authority should be struck out.

The Committee subsequently considered the clauses of the Bill.

Mr. PEMBER remarked that, in clause 29, the promoters proposed to reduce the charge for the outside districts from 17s. 4d. to 13s. a house—in other words, from 4d. to 3d. per week.

The CHAIRMAN asked if 2d. per week was not the usual charge.

Mr. PEMBER said he could not answer the question; but his instructions were that it was not. He did not see what right the West Riding County Council had to interfere with the cost of water to districts within Barnsley's own limit of supply. He promised, on behalf of the promoters, that the clause relating to the filtration of the water should be inserted in the Bill. The promoters were also prepared to meet their Lordships' requirements in reference to the supply of local authorities. They would strike out the provision preventing the authorities from taking their supply from any other Corporation but Barnsley; and they would insert a clause giving those districts power to obtain their water on partnership terms, as directed by the Committee. They would also frame conditions for the payment of the costs on proportionate terms. They had altered the charge of £2000 per annum for a daily supply of a million gallons to the outside districts, to £3000 per annum for the same daily quantity. The reason for this increase was that it was much more costly to supply water in small quantities than in large. Sheffield proposed to charge Rotherham and Doncaster £2000 per annum for a million gallons daily; but Rotherham and Doncaster took large quantities—from 800,000 to 1,200,000 gallons a day—while in the outside districts he believed that some of them were so small that they would only require 50,000 gallons daily, and even less. The promoters had no intention of abandoning the clause in the Bill which provided for the extension of their present limits of supply: and they were prepared to keep to the clause dealing with the manner in which the compensation water would be supplied. The promoters proposed to discharge from the Midhope reservoir, between the hours of 6 p.m. and 6 a.m., 780 gallons a minute, and at the rate of 1457 gallons a minute during the day, after the catchwater was completed.

Dr. *Whitelegge*, the Medical Officer of Health for the West Riding County Council, was called to give evidence on this subject. He said it was obvious that the condition of the lower waters of the River Don would be affected by the way in which the purer waters farther up were abstracted. It was important, in consequence of the formation of the bed of the river, that there should be a constant flow of water, to prevent further impurities. The more they diminished the source of supply, the more foul foreshore they would have. It was eminently desirable that the flow should be continuous. From the point of view of public health, he thought that what had been done in every similar case in the West Riding since 1890 ought to be insisted upon—viz., the sending down of a continuous and uninterrupted flow of compensation water. He attached the greatest importance to this; and on these grounds he asked the Committee to insist that the compensation water should be sent down during the whole 24 hours instead of 12 hours during each working day, as proposed in the Bill.

Mr. *Lipscombe*, Agent for the Saville Estates, Wakefield, supported the statements of the preceding witness as to the importance of having the supply of compensation water made continuous. He said there had been no alteration of the continuous supply of compensation water in the West Riding district, so far as the decisions of Parliament in recent years were concerned. In his opinion, it would be disastrous to the interests the West Riding County Council represented before the Committee if any scheme were sanctioned that would lead to further pollution of the water.

Mr. *Patterson*, a civil engineer with large experience of the waters of the West Riding, expressed the opinion that the continuous flow of the stream should be insisted upon, from the point of view of public health. There was, he said, nothing exceptional in the circumstances of the Don to entitle it to different treatment. There were considerations, apart from the interests of the millowners, that made it necessary to insist upon a continuous flow.

Mr. *J. Newton*, M.Inst.C.E., of Manchester, was then called on behalf of the millowners. His evidence was to the effect that all Acts of Parliament relating to water taken from the River Don provided that the compensation water was to be supplied intermittently. In the Dewsbury Act, however, there was, he said, a provision specifying that the compensation water should be sent down both day and night—1,700,000 gallons in the day, and 300,000 gallons at night. As a sanitary engineer, he held that a large intermittent supply was more effectual for sanitary purposes than the same quantity of water discharged continuously during the full 24 hours. He was confident that in this case there would be no danger arising from the failure to end down any compensation water on Sundays.

Mr. *E. M. Eaton*, Assoc.M.Inst.C.E., the Water Engineer of the Sheffield Corporation, stated that only the small lateral streams, and not the main body of the Don, were used for agricultural purposes. He approved of an intermittent discharge of compensation water. If the supply were to be continuous, the millowners would only get something less than 500,000 gallons in the twelve working hours, instead of 1,048,000 gallons which they would receive if the supply were intermittent. The millowners would, therefore, lose nearly 600,000 gallons of water a day if the discharge were to be made continuous. In this event, the only alternative would be for the millowners to raise their dams, and impound the water.

Mr. PEMBROKE STEPHENS then summed up on behalf of the West Riding County Council; urging that the interests of the community should not be sacrificed for the benefit of the millowners.

The CHAIRMAN said the Committee had determined to let the clause remain as it stood—viz., to give a 12 hours' supply. The Committee had also decided that they would not bring the County Council or the Rivers Board into the arrangements for inspection of the compensation water.

Mr. FREEMAN, on behalf of the Corporation of Wakefield, submitted that there was a further point to be carried out; and in striking out the words debarring local authorities from going elsewhere, he understood that the Committee meant to enable those authorities to take water from other authorities. This, he said, was not sufficient. By clause 27, Barnsley brought in numbers of places; and when they were included they would not be enabled to take water from other districts, inasmuch as express terms were given in the Bill.

The Committee decided that it should not be obligatory upon any local authority under the Act not to go elsewhere for a supply. They thought the time the authorities took to make their decision should be limited. That term should be one year from the passing of the Bill. They also thought partnership terms should be given to places already being supplied, if that was desired.

Mr. J. D. FITZGERALD brought up a protection clause preventing the Barnsley Corporation from supplying water, directly or indirectly, within the Wakefield Rural District Council's water area.

The CHAIRMAN said the Committee declined to insert a special clause; there being sufficient protection at present under their Acts and the general law of the land.

On the clause providing for filtering arrangements for preventing lead poisoning,

Mr. PEMBROKE STEPHENS urged that the clause did not give adequate protection.

The CHAIRMAN intimated that the Committee did not consider the County Council had the right to argue this question against Barnsley. It was not a part of the duty of the County Council, and they could not expect the Committee to extend their powers.

Some other modification of clauses, with a view of carrying out the decision of the Committee, were made; and the Bill was passed.

LEGAL INTELLIGENCE.

Alleged Theft of Gas.

At the South-Western Police Court last Friday, Roger Weeks, of 168, Earlsfield Road, Wandsworth, builder, was charged with stealing gas, the property of the Wandsworth and Putney Gas Company. Mr. H. R. Jones, who prosecuted, said the case was a serious one. The officials of the Company had noticed a decrease in the consumption of gas; but when the inspector called the meter was quite right. On the 4th inst., two servants of the Company called to see to the water-line of the meter; and they found that both the inlet and outlet pipes had been disconnected—another piece of pipe connecting the Company's service with the defendant's fittings. When an inspector called later, the meter was properly connected. Evidence bearing out this statement having been given, Mr. Hoskins, for the defendant, said the latter would reserve his defence. Mr. Cluer committed the defendant for trial; offering to accept bail in one surety of £50.

An Interesting Water Supply Question at Cardiff.

At the Cardiff Police Court yesterday week, the Deputy Stipendiary (Mr. Morton Brown) gave judgment in a case which raised an interesting point in connection with domestic water supplies. Briefly the facts of the case are that a man named Haines, who owned 111, Cowbridge Road, became bankrupt; and on account of this, coupled with the fact that he had not paid the water-rate, the Corporation officials cut off the water from the house, which was occupied by Mr. J. J. Newman, as tenant. Thereupon Mr. Newman sued the Corporation for illegally cutting off the supply. The Deputy Stipendiary, in giving judgment, said the summons was taken out under section 4 of the Water Companies (Regulation of Powers) Act, 1887. The section was materially to the effect that, where the owner and not the occupier is liable for the payment of the water-rate by law or by agreement, no water company shall cut off the water supply for non-payment of the rate. In this particular case, he did not think the owner liable in law, or by law, to pay the rate; and the question remained whether he was liable by agreement with the Water Company (the Corporation) to make the payment. It appeared that the usual custom in Cardiff, when the Corporation desired to bind the owner by express contract, was to get him to sign a printed agreement. In this case no express contract, written or printed agreement, was signed by Mr. Haines; but what he (the Deputy Stipendiary) had to consider was whether, on the evidence that had been adduced before him, there was any implied contract between Haines and the Corporation. Unquestionably the agreement between Mr. Haines and Mr. Newman was that Newman should pay a certain rent for the house to Haines, and that the burden of the rates and taxes of all kinds was to fall on Mr. Haines and not upon Mr. Newman; but no agreement entered into between Haines and Newman would, of course, be binding on the Corporation, unless they had knowledge of it, and were assenting parties to it. Since he purchased the premises seven years ago, Haines had paid the water-rate. His money had been received by the Corporation, and the demand notes for the water-rate had been invariably sent to Haines. He was the person who, in the books of the Corporation, was debited with the rate of this particular house; and the name of the tenant did not appear there at all. Under these circumstances, could it be said there was no implied agreement between the Corporation and Haines? He thought not. The Corporation were wrong in cutting off the water in the manner they did; and such cutting off was in contravention of section 4 of the Act quoted. It therefore remained for him to adjudge to the plaintiff such penalty as would meet the justice of the case. In dealing with this portion of his duty, he wished it clearly to be understood, that he did not think it was the intention of any servant of the Corporation to act illegally, much less was it the intention of any servant of the Corporation to act maliciously. The worst that could be said was that they acted erroneously. No particular or special damage had been shown to have accrued to Mr. Newman; and, under the circumstances, he did not think it necessary for him to inflict the full penalty which section 5 of the Act empowered him to do. He imposed a penalty of 10s. to cover the whole of the time that the water was cut off, nd the costs that had been incurred in the summons.

Proposed Extension of the Guildford Gas-Works.—At the close of the annual meeting of the Guildford Gas Company last Thursday, an extraordinary meeting was held, when the Chairman (Mr. Mark Smallpiece) and the Consulting Engineer (Mr. Corbet Woodall) explained the necessity for an extension of the works being undertaken, in order to meet the increasing demand for gas. A resolution was passed, authorizing the Directors to purchase additional land, and to take steps to promote a Bill in Parliament to raise additional capital, and to obtain such further powers as may be found requisite.

The Price of Gas at Clitheroe.—At last Thursday's meeting of the Clitheroe Town Council, some discussion took place with regard to the price of gas. Mr. J. A. Parker introduced the subject by moving a reduction to the extent of 6d. per 1000 cubic feet. He argued that there ought to be a limit to the provision of new plant out of the profits; and he held that the present consumers were entitled to have what he called the "sweets" as they went on, rather than to have them hoarded up for posterity. He went on to prove by figures that the proposed reduction would only mean a loss of £20 on the year, presuming there was an increase in the consumption of gas upon the previous return. Mr. Whiteside, who seconded the motion, expressed the belief that, with a reduced price, the consumption would increase by about 3 million cubic feet. Alderman W. Garnett moved an amendment to the effect that the price be not reduced; urging that the proposed reduction would only mean a raising of the rates. The amendment having been seconded and supported, the question was put to the vote, and the motion was carried by a majority of one.

MISCELLANEOUS NEWS.

THE SANDWICH TOWN COUNCIL AND THE GAS COMPANY.

A Novel Proposal—Competition Contemplated.

A Special Meeting of the Sandwich Town Council was held last Thursday week—the Mayor (Mr. Lass) presiding—to consider a report by the Gas Committee in which was contained a proposal of a somewhat unique character. The Committee were appointed at the latter end of last year to consider the subject of the renewal of the then existing contract with the Sandwich Gas Company for lighting the town, and also to discuss generally the future lighting of the district. After considerable negotiation, they recommended the Council to accept an arrangement with the Company for lighting, cleaning, and repairing the public lamps for one year up to Dec. 31 next, at the sum of £242; being an increase of £28 for the year. They felt very strongly that the enhanced price was unwarranted; but, under the circumstances, there appeared no option but to accede to the increase. The Committee met the Directors of the Company as to a suggested purchase by the town of their interest in the lease, works, and property; and, in the result, they decided to make an offer to the Company for the purchase of the property by valuation in the usual way. The Company declined to entertain any proposal for sale by valuation, but stated that, if the Corporation were prepared to offer a definite sum for the property, the Directors were willing to lay the proposal before the shareholders. From their interview with the Directors, the Committee gathered that they would not be disposed to sell at a less sum than £4500 (the amount of the share capital); and, having regard to the condition of the works and plant, the Committee were of opinion that it was undesirable to offer any definite sum for the property. The Company's works are erected upon land which they hold under lease from the Corporation, dated July 12, 1839, for a term of 75 years from April 6, 1839, at a ground rent of £1 per annum. Under this lease, the Company are bound, on the determination of the term, to leave the buildings erected by them for the benefit of the Corporation; the buildings to be kept and left in proper repair. At the expiration of the present contract, the licence from the Corporation to the Company to enable the Company to take up the streets for laying and repairing mains, &c., will cease; and the Company will then no longer have any power to open up the streets against the will of the Council, though the Committee are advised that the Corporation could not order the removal of pipes originally laid down under their licence and authority. Messrs. Stevenson and Burstal, of Westminster, were engaged in June to make a survey of, and report upon, the works, and to advise as to the best method to be adopted for public and private lighting. Mr. Stevenson presented a report to the Committee, in which he advises the adoption of gas as an illuminant. His report, however, is adverse to the acquisition of the Company's property; Mr. Stevenson having found that, with very few exceptions, the whole of the apparatus and plant is in a dilapidated condition, and unsuitable for even so small a make as that of the Company at the present time. The total length of the main pipes within the district is 4428 yards; and of this about one-third is of 1½ inches diameter, or less, some of the pipes being as small as ¾-inch in diameter. Messrs. Stevenson and Burstal advise, for reasons stated in their report, the erection by the Corporation of other works at a more suitable site on the Gazen Salts, or adjacent thereto, and are of opinion that new works complete in every respect for a make of 6 million cubic feet of gas per year could be erected for about £4500, including mains, service-pipes, and meters in the district, and that gas could then be delivered to the consumers at a price not exceeding 3s. per 1000 cubic feet, and probably, when everything was in working order, there might be a balance of profit. After carefully considering the report, the Committee directed the Town Clerk to communicate with the Local Government Board, and inform them of the circumstance, and inquire whether the Board would (upon being furnished with proper plans and estimates of works) be prepared to favourably entertain an application for sanction to the requisite loan to enable the Corporation to undertake and carry out works for supplying the district with gas for public and private purposes. It was explained to the Board that the Corporation were not at all desirous of being saddled with the inefficient and unsatisfactory buildings and plant of the Company, as, whatever sum might be awarded to the Company on a valuation, the Corporation felt would be, in effect, so much money thrown away, inasmuch as the works would require so much renovation and alteration to adapt them to modern requirements as practically to amount to setting up new manufacturing premises, while the distributing-mains would require renewal throughout the district, as, in recently laying water-mains, it was ascertained that the gas-mains were in a nearly worn-out condition. The Local Government Board have replied that they will not be prepared to entertain an application for enabling the Corporation to carry out works for supplying their district with gas, unless and until such powers as may be obtained by means of a Provisional Order under the Gas and Water Works Facilities Acts have been conferred upon the Town Council. A Provisional Order is not a necessity, though it is desirable that the Corporation should be furnished with the powers which would be conferred by such an Order. Inconveniences and difficulties might arise unless the Corporation were vested with such powers. But the existing Company have hitherto managed without them; and it was felt that, as the streets were vested in and under the control of the Corporation, they might well go on without the powers. The Local Government Board have, as stated, however, made it a condition that they will not entertain an application for sanction to a loan to enable the Corporation to set up their own gas-works until the Corporation first obtain the powers which a Provisional Order under the Gas and Water Works Facilities Act would alone confer. The Committee recommended that the Council should at once take the necessary steps for obtaining an Order, empowering them to erect gas-works of their own.

Alderman Mate proposed that the report and recommendation be adopted.

Alderman Hughes seconded the proposition. He remarked that the Committee had gone closely into the question, and were satisfied that

the town could be well supplied with gas at a considerably less cost than at present. He believed that gas could be supplied at 3s. per 1000 feet, and even then leave a surplus. He was ready to prophesy that, in three years after they had started, they would be supplying the inhabitants at a considerably reduced rate, and handing over a handsome profit. It must not be forgotten that before deciding to apply for a Provisional Order, they had offered to take over the present works as a going concern at a fair valuation; but the Directors had declined to do anything of the kind.

Alderman WATTS supported the resolution—observing that the result might not be agreeable to the shareholders of the Company; but, if they felt aggrieved, it should not be with the Council, who had to study the interests of the greatest number, but with the Directors, who had neglected to make proper provision for the time which had come.

The resolution was unanimously carried.

LABOUR TROUBLE AT THE PLYMOUTH GAS-WORKS.

Another difference has arisen between the management of the Plymouth Gas-Works and a portion of the men employed there. This time it is the coke-wheelers. From a statement of their case prepared by Mr. H. Brabham, the Bristol District Secretary of the Gas-Workers' and General Labourers' Union, it would appear that the men simply asked to be put upon the eight-hour system, and that they were offered an alternative which they refused to accept, because it meant more work in less hours, and that, as the result, they received a week's notice. Thereupon they asked the Bristol District of the Gas Workers' Union to intercede for them; and on this becoming known, they were at once paid their week's wages, and sent off the works. As may be imagined, a very different story is told by the other side. Mr. John West, the Consulting Engineer for the works, says the men have been discontented for some weeks, notwithstanding that their wages were 8d. per hour, and that the work allotted to them is the least of its class in the kingdom. They really only worked six hours out of the twelve; and as they wanted, besides the eight-hour shift, a voice in the selection of their nominees to do certain work, the Directors declined to accede to their demands. Mr. West, on his own account, made a suggestion to the men by which the work might have been performed in eight hours during the greater part of the year. But this they would not have, and sent in an *ultimatum* in writing, which led to steps being taken to fill their positions. Subsequent statements show that the trouble is in part due to a claim of the coke-wheelers respecting promotion to stoking. One of the stokers had left at the beginning of the summer; and on his returning a week or so ago, the coke-wheelers protested against his going to work at the furnaces instead of being one of their body. From a letter by Mr. Brabham, it would appear to be a dispute as to whether the stoker had really left to better himself, and came back to the works when he failed to do so, or whether he received leave of absence for the summer with the understanding that he should have his old post in the busy season. In the former case, the coke-wheelers say he should take his place amongst the younger hands. All the men dismissed are said to be old servants of the Company. Mr. Brabham now appeals to Mr. West and the Directors to reinstate them.

COLONIAL GAS COMPANIES.

Recent mails have brought to hand the reports and accounts of a few Colonial Gas Companies. Two of the Companies, it will be seen, are suppliers of electricity as well as of gas; and it may be said regarding the whole of them that there are indications that the Directors are using the latest means for bringing gas into extended favour.

The Directors of the Hobart (Tasmania) Gas Company reported, at the recent half-yearly meeting of the shareholders, that there was a balance of £5531 to the credit of profit and loss; and, on their recommendation, a dividend of 18s. per share on 5424 shares was declared, and £404 carried to the reserve fund.

The report of the Launceston (Tasmania) Gas Company shows that, in the half year to June 30, in comparison with the corresponding period of last year, there was a decrease in the sales of gas. However, there was a good increase in the number of meters; while, as the result of reduced working expenses and strict economy, the profits for the past year show a marked improvement over the preceding year. The decrease in the sales of gas by meter is attributable mainly to economy on the part of consumers generally, and to fine weather during the early part of the winter. Since the cold weather set in, there has been a good demand for gas-fires, and there are now more in use than at any former period of the Company's existence. During the half year, the penny-in-the-slot meter, for small shops and cottages, has been introduced with complete satisfaction. Respecting the accounts, after writing off £108 for bad debts, £720 for depreciation of plant, buildings, &c., and £240 for depreciation of gas-fittings in stock, there remains to the credit of profit and loss account £2532, from which a dividend of 6 per cent. has been declared. The quantity of coal carbonized during the half year was 2262 tons of Newcastle, and 64 tons of shale. The gas manufactured amounted to 23,553,800 cubic feet, which was equal to 10,125 cubic feet per ton. The illuminating power of the gas was 18·90 candles. The quantity of gas used in the six months was 18,920,000 cubic feet, against 20,702,000 cubic feet in the June half of 1894.

The Maryborough Gas and Coke Company, Limited, report a profit for the half year ending June 30 of £984, including the unappropriated balance from the preceding half year. Deducting the dividend-tax, amounting to £37, £947 is left at the credit of profit and loss account; and of this £750 has been expended in paying a dividend at the rate of 6 per cent. per annum. The sale of gas, fittings, &c., in the six months produced £2926, and the residual products, £136.

The operations of the Perth (Western Australia) Gas Company, Limited, in the twelve months ending May 31, resulted in a net profit of £4614, after writing off £276 for the loss on the installation of the electric light. This, with the balance of £789 brought forward from the previous year, leaves a surplus of £5403, out of which a dividend has been declared at the rate of 10 per cent. This will absorb £2000; and of the balance £2000 has been transferred to the reserve fund (increasing it to £7000), and leaving £1403 to be carried forward. The Directors, in their report, state that they have every reason to anticipate that the business from the supply of the electric current will eventually return a profit; and, in view of the demand for this illuminant, which is beyond the capacity of their present plant, they have invited tenders for machinery which will produce more than double the quantity now supplied. A reduction of 1s. 3d. per 1000 cubic feet in the price of gas (which in May last was 12s. 11d.), and a discount of 10d. per 1000 cubic feet for cash payments, is recommended. The Manager (Mr. E. Wigglesworth) reports that during the year 40 meters were fixed and 46 additional street-lamps. The sale of gas was 16 per cent. more than in the preceding year; and with the view of giving every facility to intending consumers, the Company keep in their stores a large stock of gas and electric fittings, which they sell or fix at the lowest prices. Although, he adds, the Company have extended the electric light almost to the limit of the present machinery, they have also increased the gas consumption nearly equal to any previous year; and with the present demands, and the prospects of a continued increase, the Company will, at an early date, require to make arrangements for extensively enlarging both plants.

The Directors of the Rockhampton (Queensland) Gas Company, Limited, reporting upon the working of the concern during the half year ending June 30, state that the consumers still continue to economize in their gas lighting. The consumption has consequently fallen very considerably; and the revenue has suffered proportionately. The Directors remark that they will endeavour to meet this shrinkage by holding out every inducement to persons residing on the lines of gas-mains to become consumers. The operations of the gas undertaking show a profit of £1618. On the electric supply, there is a profit of £303, from which has been paid £300 interest upon the whole of the Company's debentures; leaving an unappropriated balance of £3 13s. 9d. to the credit of the profit and loss account of this section of the Company's business. The net profit for the whole of the business is £1622. During the half year, some additions, improvements, &c., have been made to the gas and the electric lighting plant and buildings; and the Directors have charged the cost of this work to the reserve for maintenance and improvement of plant. Tar and coke are selling very readily; indeed, for the latter product the demand continues to be in excess of the supply. A dividend at the rate of 7 per cent. per annum upon the ordinary shares, and 9 per cent. per annum upon the preference shares, has been declared. These amount to £1656.

The South Australian Gas Company had a satisfactory increase in the sale of gas in the twelvemonth ending June 30 last (indeed, it exceeded that of any former year); and, although owing to the further reductions in the prices charged for gas and residuals, the net profit was smaller than that of the preceding year, there remained to carry forward to the credit of profit and loss a balance of £9800. Referring to the public lighting, the Directors mention that, on Dec. 1 last, a poll of the citizens was taken by the Adelaide Corporation as to whether the street-lamps should be lit by electricity or gas; and, in every ward, there was a large majority in favour of gas lighting. The agreement made with the City Corporation in October, 1893, to light the street-lamps at a reduced rate until March 1, 1896, has been cancelled; and another contract entered into—further reducing the cost of street lighting—to expire in September, 1898. Efforts will be continued towards lessening the cost of gas, which, during the last ten years, has been reduced to consumers in the city, the suburbs, Port Adelaide, and Glenelg by an average of nearly 34 per cent.; and the Directors hope, before the close of the present financial year, to still further lessen the prices. A number of Welsbach incandescent gas-burners are now being successfully used in some of the lamps in the principal streets of the city. Regarding the plant, larger station meters have been fixed at the Brompton and Glenelg works; and a bigger exhauster and engine at the Port Adelaide works. The Engineer reports that it is desirable to enlarge the governing plant and the trunk main at Glenelg. From the accounts, it is seen that the sales of gas, residuals, &c., produced £76,718; and, after deducting all expenses, there remained a profit of £29,079. On the credit side of the profit and loss account, there is shown a total of £39,800, of which the dividend for last year takes £30,000.

ELECTRIC LIGHTING NOTES.

It may be remembered that some time ago a scheme of electric lighting was propounded for Folkestone; but it met with such vigorous opposition from a section of the Town Council, headed by Mr. Daniel Baker, that it was rejected. Mr. Baker was of opinion that a suitable installation could be provided at a more moderate outlay than the original scheme; and, on his initiative, a Special Committee was appointed to consider the question of a scheme on a smaller scale. The Committee chose as their expert adviser Mr. F. H. Medhurst; and, under his guidance, a second scheme was prepared. The plant which, according to the new plan, it was proposed to put down at the generating station (exclusive of ample spare machinery) was calculated to be sufficient to maintain 4500 lights of 8-candle power, together with 22 arc lamps of 2000-candle power each on the Leas, all simultaneously alight; so that it was assumed that 6000 lamps of 8-candle power could, with safety, be connected. Steam power was proposed for dealing with the maximum load; but the machinery included a 16-horse power gas-engine as an economical method of meeting the day requirements. Reckoning a connection of 6000 lamps, it was computed that there would be an average consumption of 20 units per lamp, giving a revenue, at 6d. per unit, of 10s. per lamp per annum. The total cost of the installation was put at £11,970; but some contemplated extensions of mains would bring the outlay up to £12,910. The working expenses, including 5½ per cent. on £13,000 for interest

and redemption, were estimated at £2936. The revenue from private lighting, on the above assumption, was placed at £3000; and from 22 arc lamps for public lighting, at £730. The total income would therefore be £3730; leaving a profit-balance of £794. A special meeting of the Council was held on the 10th inst., at which Mr. Baker moved that the report, recommending the scheme at an estimated cost of £12,900, be adopted. He said that he was inclined to think that, as a Corporation, they ought to carry out an electric lighting scheme —in fact, three or four Companies would be prepared to apply for a Provisional Order if the Corporation did nothing. To his mind, the Corporation would have a great difficulty in introducing the light; for there would be a formidable competition from the incandescent gas-light, and there was not the slightest doubt that incandescent gas was very seriously affecting the progress of electric lighting in all directions. In saying so, he was not arguing from the gas shareholder's point of view; but in order to look fairly at the whole question. There was not the slightest doubt a person fitting up a shop with incandescent gas-lamps would pay four or five times less than for electric light; and having this serious competition before them, it behoved them to see that the scheme to be introduced should be such as to be self-supporting. If not, it would be unfair to come upon ratepayers in districts not supplied with electric lighting. The Committee, in their report, had drawn up several balances of expenditure and revenue; and, although they showed a profit, it would not surprise him if, for two or three years, there should be a loss. Therefore it would be necessary for the Corporation to avoid going in for schemes which were certain to become failures. The discussion which ensued was far from amicable; and it ended by the carrying of an amendment adjourning the matter *sine die*.

A full copy has come to hand of the official report of the Electric Lighting Committee of the Swansea Town Council upon the scheme which they have agreed to recommend to the Corporation for adoption. The proposal is to utilize the town refuse in the production of electrical energy; and the preparation of a scheme was confided to Mr. E. Manville. This gentleman estimates that the station proposed by him would require 500-horse power when working at its maximum output, and that, towards this, 200-horse power could be continuously generated by the burning of the ash-bin refuse, estimated to amount to upwards of 13,500 tons per annum. The additional energy (300-horse power) required is proposed to be obtained by erecting cylindrical receivers for the storage of heat generated during the day. Mr. Manville is thus of the opinion that the whole of the power necessary for generating the required amount of electricity could be obtained from the burning of the town refuse. Respecting the electric supply, the Committee favour the high-tension alternating-current transformer system. The scheme which has been planned would entail a total capital expenditure of £56,601, which is divided as follows: Cost of scheme, £33,836; engineering, &c., say 7½ per cent., £2538; public lamps, £1940; purchase of land, £7000; destructor, if combined, £11,287. On the basis that 12,500 lamps are fixed, each consuming 22 units per annum, at 6d. per unit, with the current used for public lighting charged at 2d. per unit, a revenue of £7608 is estimated. Even at the 2d. rate for the public lighting, it is computed that the cost over gas will amount to £395. The total expenditure is reckoned at £5793—giving a credit balance of £1810, to which may be added a saving of £400 in the disposal of the refuse. The Committee are careful to point out that this favourable result cannot be expected during the first two or three years' working. They recommend the adoption of the scheme, and that application be made to the Local Government Board for sanction to borrow £60,000 for the purpose. The expenditure of this vast sum of money is regarded by the *Cambrian* "in the light of an experiment pure and simple;" but, adds our contemporary, "if the County Council has funds to throw away, and possesses that implicit trust in Providence which is said to be the best guarantee of success in most things, there may be some amount of excuse for its disposition to indulge in what the sporting fraternity would term a 'little flutter.' It must be obvious to every intelligent ratepayer, however, that the Council has neither the one nor the other. . . . We are willing to admit (as indeed we have already done on more than one occasion) that Swansea is a badly lighted town, and that it has not been as well treated as it had a right to expect at the hands of the Gas Company. We cannot, however, regard this as full and sufficient excuse for embarking upon a costly undertaking in the direction of public lighting, when there are other and more urgent matters which demand attention."

A Special Committee appointed by the Battersea Vestry to consider the question of electric lighting have presented a report on the subject, in the course of which they state that, after due inquiry and consultation with Dr. J. Hopkinson, F.R.S., they are not prepared to recommend the adoption of a scheme for utilizing the dust destructor in connection with the electric light. After careful consideration, they have resolved to invite competitive schemes for lighting the district, and to offer premiums for the three best.

The Exeter Electric Lighting Company are in a position of considerable financial difficulty; and at a recent meeting of the City Council, a communication was read from the Solicitors of the Company, offering to sell the works and plant for £10,000. The question was referred to the Council in Committee, after the principle had been accepted that the authority ought to possess the works. They, in turn, deputed a Sub-Committee to investigate the details. The result was the latter recommended that £7500 should be tendered for the undertaking; the offer being based upon estimates prepared by the Surveyor (Mr. D. Cameron) and Dr. Fleming. The value fixed by the first gentleman was £7556, and by the latter £7536. The recommendation was considered by the City Council in open meeting last Wednesday; and its adoption was moved by the Mayor. A counter-resolution was proposed by Mr. Munro, who held that, within six months, the Corporation would be saddled with a further expenditure of £3000 to make the works fit to carry on the business. The proposal was, after much discussion, adopted by 21 votes to 10—the offer to be made subject to the approval of the Board of Trade, and to the sanction of the Local Government Board to the borrowing of the money.

At the meeting of the West Cowes Urban District Council on Tuesday last, Mr. Hewitt brought up a report of a meeting of the Water and Lighting Committee at which tenders for a scheme of electric lighting, which had been submitted by various firms, had been fully considered. As the result, the Committee advised the Council to apply for a Provisional Order to enable them to carry out the scheme. The adoption of the report having been moved and seconded, Mr. G. Fellows, sen., supported the proposal in a long speech. Mr. Atkey pointed out that, though Mr. Fellows had said all that was possible with regard to the economy of electricity, it was not always a recognized fact that it was cheaper than gas. It might, indeed, be said by some that gas, if properly burnt, was more economical than electricity. He thought the Council were entitled to know what applications they had had from the people who had been canvassed on the subject of taking a supply of electricity. The number had been stated; but he understood it had not been so encouraging as had been anticipated. Mr. Abraham questioned the right of Mr. Atkey, as being connected with a local lighting company, to take part in the discussion; and the Chairman (Mr. E. White, J.P.) expressed the opinion that anyone speaking or voting in the Council on a matter in which he had a peculiar interest, rendered himself liable to a fine of £100. Mr. Atkey said, with regard to himself, he had no more interest in electric lighting than any other gentleman present. It was electric lighting—not gas or anything else—that they were talking about; and surely, as a representative of various people in Cowes, he had a right to ask for information. Mr. Hewitt said he thought the matter had been fairly put before the Council; and the only thing that required answering was the question as to the canvass. With regard to that, there were between 900 and 1000 lights asked for, which was considered a favourable response. When people saw the light, they would, he believed, soon be pleased to adopt it; and in a place like Cowes it was reckoned that 1000 lights would bring in an income of £500 per annum. The report was adopted.

RULES FOR GAS-PIPING.

The following rules for gas-piping, &c., which have been formulated by the Passadena (Cal.) Gas and Electric Light Company, and issued as a circular, appeared in a recent number of the *American Gaslight Journal*. The Company's Inspector has been instructed to observe them closely:—

Size.	Greatest Length.	Greatest No. of Burners.
⅜-inch, vertical only	15 feet	2
½ ,,	25 ,,	5
¾ ,,	50 ,,	15
1 ,,	75 ,,	30
1¼ ,,	100 ,,	60
1½ ,,	150 ,,	100
2 ,,	200 ,,	200

The number of lights allowed per ⅜-inch opening is two, using the ordinary gas-burner; and no ⅜-inch pipe must be run horizontally. No gas-pipe of less than ⅜-inch should be used in piping buildings. No riser should be less than ¾-inch, and the end of it must be located by the inspector. Openings intended for meter connections must be conveniently located and under the direction of the inspector, as meters will only be set in approved places. All drops must be placed plumb, and well secured by straps soldered to the pipes and screwed to the joist; or drops may be soldered in if preferred. Bracket openings must also be so secured, and run square with the finish. Bends in pipe must not be used for any purpose. The size of drops should be ½-inch; and they should extend through the plaster about 1½ inches, and all be alike in length. Bracket openings should extend through the plaster about 1 inch, and all openings must be closed with iron caps. For hotels, churches, theatres, or public buildings where a large amount of gas is to be used, the pipe must be of increased size; and plans should be submitted to the inspector before the commencement of the work. In making alterations or extensions in a building, or in piping an old building, the same regulations should be observed as in new work. All pipe between the meter and the gas-main will be run by the company only; and fitters must not disconnect nor interfere with any of the company's meters. On the back of this circular, the gas-fitter should make all plans of work, with the length and sizes marked with figures, and submit the same to the inspector before testing is requested. No concealed work will be inspected, and due notice must be given of the time inspection is desired. No charge is made for inspection; and information and suggestions will at all times be cheerfully given. But unnecessary visits must not be requested, except at the expense of the party doing the work. All pipe must be run in a good and workmanlike manner, be well secured, and grade towards the meter. There must be no "traps" nor stoppages of any kind. Unions should not be used in concealed work. Split or broken pipes, or fittings repaired with cement or lead, or "rusted" to stop leaks, will not be passed by the inspector; and no work or alteration should be made to piping after inspection without due notice and reinspection. All testing will be done at a pressure of 10 lbs. per square inch. In making joints, the lead should be put on the male end of pipes and fittings, and not in the fittings, as lead so placed will be pushed forward by the pipe, with the liability of closing it and causing stoppages. It is the intention of the company to adhere to the above rules; and no certificate of inspection will be given when they are not complied with. Parties interested are requested not to allow any bill for gas-fitting, unless accompanied by a certificate of inspection, which is an evidence that the work has been properly done. Particular attention should be paid to piping houses for gas for fuel, as it is rapidly taking the place of other fuels; and the work is best and cheapest done in the original construction of the buildings. At all fireplaces, the pipe should be run to the right-hand side of them, about 2 inches clear of the finish, and 4 inches above the floor; and the same in relation to the position of flue-pipes in rooms without fireplaces, keeping about 15 inches to the right of flue. In rooms having neither fireplaces nor flues, an opening for the gas-stove should be conveniently placed, and about 6 inches above the floor. These openings should be ½ inch in diameter; and pipe to supply them should run from nearest direct feeding-pipe. In kitchens, the pipe should be properly placed for the gas cooking-stove, and should usually be ¾ inch.

METROPOLIS WATER SUPPLY.

The Quality of the Water in the Month of August.

The returns furnished to the Registrar-General by the London Water Companies regarding the water supply in the Metropolis during August, show that the average daily supply amounted to 216,891,923 gallons, as compared with 201,932,606 gallons in the corresponding month of 1894. The number of services being 819,247, the rate was 265 gallons to each service. Of the entire bulk of water sent out, 116,340,508 gallons were drawn from the Thames, and 100,551,415 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·5; New River, 1·1; Colne Valley, 1·3; East London (deep well), 1·5; East London (river supply) and Tottenham, 1·8; Grand Junction, 2·0; Chelsea and Lambeth, 2·1; Southwark, 2·2; and West Middlesex, 2·3. The unfiltered river waters contained the following proportions: Thames at Hampton, 4·4; New River Cut, 2·2; and the Lea at Angel Road, 4·5. The Thames at Hampton was, on Aug. 12, turbid and pale yellow in colour. It was of good bacterial, but rather bad chemical, quality. As delivered by the five Companies drawing from this river, it was in every case efficiently filtered. It was of excellent chemical, and (with one exception) bacterial, quality for dietetic purposes. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 97·09; West Middlesex, 99·27; Southwark, (No. 4 filter) 99·27, (No. 8 filter) 74·18; Grand Junction, (general filter well at Hampton) 95·27, (general filter well at Kew Bridge) 97·45, (south filter well at Kew Bridge) 97·82; and Lambeth, 97·82. The New River Cut, before entering the subsidence and storage reservoirs, was, on Aug. 14, turbid and very pale yellow in colour. It was, for unfiltered water, of excellent chemical and good bacterial quality. By passing through the storage reservoirs, it was greatly improved bacterially; and, after efficient filtration, was of excellent chemical and bacterial quality for dietetic purposes. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 97·27; No. 1 well, 99·55; and No. 9 well, 99·09. The water taken from the Lea by the East London Company at Angel Road on Aug. 14 was turbid and pale yellow in colour. It was chemically of nearly the same quality as the Thames at Hampton, but bacterially much inferior. After storage* it was greatly improved bacterially, and, after efficient filtration, was of excellent chemical and bacterial quality for dietetic purposes; the total bacterial improvement being represented by the following percentage numbers: No. 1 Essex well, 99·63; No. 2 Essex well, 98·26; and Middlesex well, 99·71. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes; but the Tottenham and East London samples were slightly turbid when drawn. The Colne Valley Company's water had been softened before delivery, and thus rendered suitable for washing. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and New River Companies' waters were clear and colourless; the East London (river supply), clear and nearly colourless; the Tottenham and East London (deep-well) waters, slightly turbid and colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters before and after storage, and the supplies delivered by the various Companies and collected on the 12th, 13th, 14th, and 15th of August, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.		Temperature in Deg. C.
Raw and Stored River Waters.			
Thames at Hampton, Aug. 12	1100	..	18·5
Thames at Hampton, after storage for 14·7 days (Chelsea Company), Aug. 12	560	..	18·0
Thames at Hampton, after storage for 6 days (Lambeth Company), passing on to filter No. 5, Aug. 12	620	..	18·3
West Middlesex Company's water (supplying filters Nos. 1–5), Aug. 13	180	..	17·8
Grand Junction Company's water arriving at Kew from Hampton, Aug. 13	160	..	18·8
Grand Junction Company's water at Kew, passing on to filters Nos. 2, 3, and 4, Aug. 13	460	..	19·0
New River Cut, before passing reservoirs, Aug. 14	880	..	16·3
New River Cut, after passing reservoirs, just before filtration, Aug. 14	260	..	16·7
River Lea at Angel Road, Aug. 14	5520	..	17·5
River Lea, after storage for 15 days (East London Company), Aug. 14	1100	..	17·2
Filtered River Water as Supplied.			
Thames—			
Chelsea Company's general filter well, Aug. 12	32	..	18·6
West Middlesex Company's general filter well, Aug. 13	8	..	17·7
Southwark Company's No. 4 filter well, Aug. 12	8	..	17·6
Southwark Company's No. 8 filter well, Aug. 12	284	..	17·7
Grand Junction Company's general filter well at Hampton, Aug. 12	52	..	18·5
Grand Junction Company's general filter well at Kew Bridge, Aug. 13	28	..	18·4
Grand Junction Company's south filter well at Kew Bridge, Aug. 13	24	..	18·8
Filtered River Waters as Supplied.			
Lambeth Company's general filter well, Aug. 12	24	..	18·3
Lea—			
New River Company's general filter well, Aug. 14	24	..	16·3
New River Company's No. 1 filter well, Aug. 14	4	..	16·3
New River Company's No. 9 filter well, Aug. 14	8	..	—
East London No. 1 Essex well, Aug. 14	20	..	16·7
East London No. 2 Essex well, Aug. 14	96	..	16·8
East London Middlesex well, Aug. 14	16	..	16·4
Deep Wells—			
Kent new well at Deptford, Aug. 15	2	..	11·3
East London well at Lea Bridge, Aug. 14	0	..	11·3

* During the late drought, the storage of this water was merely nominal. It passed through the storage reservoir on to the filters with but little delay, and consequently, when Dr. Frankland's July samples were drawn, there was but little bacterial improvement between the intake at Angel Road and the filters at Lea Bridge.

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied to London during August, as ascertained by tests of samples taken daily on behalf of the Water Companies, Messrs. Crookes and Dewar remark: Of the 182 samples examined, two were recorded as "clear, but dull;" the remainder being clear, bright, and well filtered. The rainfall in the Thames Valley during August has been close upon the average. The actual amount is 2·28 inches, and the 25 years' mean is 2·24; showing an excess of 0·04 inch. By far the greater part of the rain fell in the first part of the month; only 0·36 inch having fallen since the 14th. The Thames-derived waters still maintain the high degree of purity we had to record in the reports for June and July. Compared with the waters in July, there is scarcely any analytical difference. Compared with the waters for the corresponding month last year, there is an appreciable diminution in some of the constituents. Our bacteriological examinations of the unfiltered Thames waters and of the clear water drawn from the general wells of the Water Companies show that the microbial life in the river is diminishing; while the Companies' filters continue to work with efficiency. The unfiltered waters contained an average of 1720, and the clear filtered waters flowing into the pipes contained an average of 34 bacteria per cubic centimetre. These were all harmless river microbes.

Coin Meters and the Consumption of Household Coal.—The Manager of a South Yorkshire Colliery Company has informed one of the London representatives of the *Birmingham Gazette* that the condition of things in the coal trade in his district was never so bad as now. The collieries of his Company have been closed for two years; others in the same region are in the same state; and he has no hope of a revival. The falling-off in the consumption in London is one of the main causes of the depression. The rapidly-extending adoption of the penny-in-the-slot system of gas supply for cooking purposes has made an enormous difference in the consumption of household coal in the South London district.

Supper to the Employees of the Ipswich Gas Company.—By invitation of Mr. G. A. Biddell, the newly-appointed Chairman of the Ipswich Gas Company, the officials were last Thursday entertained at supper in the shareholders' room at the Company's offices, in celebration of a double event—his elevation to his new position, and the visit of the British Association to the town. The Secretary and Manager (Mr. J. T. Jolliffe) proposed the health of the Chairman; alluding, in felicitous terms, to his kind and wise counsel and his characteristic energy and skill, which he trusted would stand them in good stead for many years. Mr. Biddell responded, and proposed the health of Mr. Jolliffe. In acknowledging the toast, Mr. Jolliffe said he attributed no little of the success of their undertaking to the fact that he had around him a body of subordinates who at all times were loyal and true, and to whom he felt very much indebted.

Brighton and Hove Gas Company.—The half-yearly meeting of this Company was held on last Friday week, under the chairmanship of Mr. F. E. Webb. The Directors reported that the abnormally low temperatures which prevailed during the early months of the year resulted in an increase of 9¾ per cent. in the rate of gas sold during the six months, with, of course, a corresponding increase of revenue. The sale of residual products had been satisfactory, although resulting in a decrease in the amount realized as compared with the corresponding period of 1894, which was an exceptionally good half year. During the past six months, progress had been made in the construction of a carburetted water-gas plant, from which considerable advantages were expected. The Directors recommended that dividends be declared as follows: On the original ordinary consolidated stock at the rate of 11 per cent. per annum, on the "A" ordinary consolidated stock at the rate of 8 per cent., and on the "B" preference consolidated stock at the rate of 6 per cent., less income-tax. The balance-sheet showed that the total income was £91,860; and the expenditure, £64,726—leaving a gross profit of £27,134. For manufacture of gas, the expenses were £49,546—the items being (excluding shillings and pence): Coal, including material for enrichment, &c., £32,956; wages and gratuities, £7319; salaries of engineers and officers at works, £1172; repairs and maintenance of works and plant, £6969. Other expenses were: Salaries of surveyor, inspectors, and clerks, £1087; repair, maintenance, and renewal of mains and service-pipes, £4602; repairing, renewing, and re-fixing meters, £1064; lighting and repairing public lamps, £1021; rents, rates, and taxes, £2852; management expenses, £4268; Directors' allowances, £1350; and collectors' commission and salaries, £1347. A sum of £36 was written off for depreciation of works on leasehold lands, and £248 for bad debts. The amount of gas supplied was 481,473,600 cubic feet, yielding £71,090; the total rental, with £1619 for meters and £476 for fittings, being £73,985. The residual products produced £17,772. During the six months, 46,218 tons of coal were used; and the following quantities of residual products were sold: Coke, 46,863 chaldrons; breeze, 2296 tons; tar, 550,045 gallons; and ammoniacal liquor, 1,028,475 gallons.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week the proposal to remove the gas-works at Perth to a new site has advanced another stage; and the proceedings bear out the view I have been taking of the whole question—that there is within the Gas Commission a party who are strongly in favour of the removal being to a site which others, with whom I agree, consider a very unsuitable one. I refer to the Sand Island site. There is another in view, upon Friarton Farm, which the Corporation have, or are about to acquire; and Mr. Whimster, the retiring Engineer and Manager, was asked to report upon it. This report was submitted to the Gas Commission at a special meeting last Monday night. In it Mr. Whimster said he had carefully surveyed the farm, and found the ground to be very uneven—varying from 13 to 38 feet above the high-water mark of ordinary spring tides. Accompanied by the Convener (Mr. Wright) and Bailie Young, he selected what he considered a suitable site for the gas-works. It is 300 yards in an easterly direction from the nearest inhabited house outside the farm, about 30 yards from the river side, and extends 150 yards from east to west, and 140 yards north to south. Within this boundary the retort-benches might be built on a satisfactory foundation of strong clay about 15 feet above the highest flood-level; giving ample depth for any style of regenerative furnace, so that all possible risk of moisture interfering with the heating of the furnaces would be prevented. His estimate of the cost of removal to the Sand Island was £25,000. As compared with this, the cost to Friarton Farm would involve £997 less, as a concrete bed for the retort-benches would not be required, and £380 less because of the absence of a concrete floor for the purifiers. This would reduce the cost to £23,622. But then there would come in, as additions, £1000 as the cost of the site on Friarton Farm, and £2100 as the cost of laying 2100 yards of 18-inch mains to the city, which would raise to £26,722 the cost of the removal to Friarton Farm. In this estimate the gas-main would be laid up to the Edinburgh Road, and by the top of South Inch to the new gasholder. If wayleave could be obtained, he would suggest that a causewayed road, having rails laid in it, might be formed along the river bank from the farm to the bridge over the lade, which would form a direct public way with the city by the shore to the farm for wheel and foot traffic, including a branch railway from the shore branch. This would avoid all steep gradients, and also shorten the distance very much. In the case of the gas-main, it would save 800 yards, with less cost for cutting the pipe-track per yard—say, about £900. It could not be overlooked that the distance between the Friarton Farm site and the city was a drawback, and might be the cause of some extra annual expense, as well as loss of time; and anything that could be done to shorten it was desirable.

That is Mr. Whimster's view. It will be observed it is still given without a recommendation, which lends colour to the idea that he has not a free hand in the matter, or considers it useless to give an opinion. The opinion of Mr. Wright, which is contained in a memorandum submitted along with the report, shows unmistakably his leaning. In it, he says: "In considering the removal of the gas-works to a site on the Lower Friarton Farm, not only the cost of removal, but the annual additional cost—because of distance from the city—must be taken into consideration. I may point out, however, that in Mr. Whimster's report nothing additional is allowed for the laying down of a railway; and this must form a considerable item, from the nature of the ground to go through, as well as the extra distance from the main line to the works. Another matter not referred to in the report is the erection of a pier adjacent to the works, for the landing of coals brought by the river. This cannot be done at less than £500; and, in addition, this will necessitate a very large expenditure in putting down a loop-line of railway, because of the low level of the pier compared to the retort-house and coal-stores, or prove an additional annual burden of at least £150 for cartage and not less than £100 for trimming. Mr. Whimster advocates the formation of a road from the site of the proposed works to the holder at the Shore. Were this done, the new gas-main could be laid by this route, and £800 be saved on this item. To make the road by erecting an embankment, filling up, and macadamizing, would take several thousand pounds. Apart altogether from the gas-works removal, this would be a very desirable improvement, and certainly would add materially to the value of the ground proposed to be feued by the Police Commission. To Mr. Whimster's estimate, I would add £3300; and I am not sure that this would be sufficient to complete the extra work necessary, and which Mr. Whimster did not think himself called upon to report. This will bring the capital expenditure up to £30,000." To meet that, he would estimate the annual saving, as compared with the present works, as follows: Cartage of coal, coke, lime, &c., £500; trimming of coal, £100; feu-duty of present works, £44; refuse lime, now given free, £35, in all £679. But from this would require to be deducted £100, as the extra cost of the cartage of coke sold to merchants in the city; making the total saving £579. At 3 per cent., £30,000 would cost £1000 a year; and there would thus be an annual loss of £321. He estimates the annual saving by removal to the Sand Island at £954, made up of £650 upon cartage of coal, &c., £200 on trimming of coal, £44 of feu-duty on the present works, £25 of rent for houses on the Sand Island, and £35 for refuse lime. The annual cost of £25,000, at 3 per cent., would be £750, which would leave an annual saving of £204. To that sum, he adds the £321 of estimated deficit upon the Friarton Farm scheme, and £400 as the loss of taxation to the city if the works were removed to Friarton Farm (being outside the city boundaries); and thus he makes out a total annual loss on the Friarton Farm scheme of £925. At the Commission meeting, Mr. Wright is said to have spoken strongly in favour of the Sand Island scheme. I am pleased to see that he was not generally supported. Lord Provost Dewar, for one, said they wanted to have the gas-works in the best possible place, no matter what the cost was. There was a general agreement that time should be given to consider the subject further, in the light of the new report and the memorandum; and the discussion was adjourned. I would just like to remark, now that the matter may be said to have got on to its merits, that, with reference to the loss of taxation, it could be avoided by extending the city boundaries so as to include Friarton Farm. If the Corporation are to feu out the farm, they had better have it inside the burgh, else they will not derive much benefit from it. This step would do away with the loss of £400 which Mr. Wright estimates on that head. Then there is this to be said about the Sand Island, that it would be a site upon which heavy outlays might be expected from year to year in keeping the water out. A great part of the works would be under flood-level, and constant depredations might be expected, which would be most inconvenient as well as unprofitable. Even the construction of the works might, in shifting sand, cost more than has been estimated. Safety is certainly the first consideration in a question of selecting a site for a gas-works; and when that element is taken into account, as well as the risks of continuous outlays upon repairs, I think there can be little doubt that, whether a suitable site can be found on Friarton Farm or not, the Sand Island site is one which should not be adopted without being closely looked at from more points of view than one.

At the same meeting of the Gas Commission, a letter from Mr. Whimster was read, in which he stated that the unanimity of the Commissioners in the matter of his resignation, and the very kind expressions of approval, were extremely gratifying to him. He stated that he was satisfied with the amount of the retiring allowance which had been voted to him, and he returned to the Commissioners his sincere thanks.*

The Edinburgh gas-works chimney is again in evidence. The Gas Commissioners have applied to the Dean of Guild Court for permission to erect a new chimney in place of the one now in use, which is giving way. The present chimney is 329 feet high, and is a conspicuously ugly feature in the otherwise fair face of Edinburgh. It is proposed to erect a new chimney about forty yards to the eastward of the existing one. The reason for this step is that, on examination, it has been found that not only is the present chimney off the plumb, but the brickwork of it is disintegrating in some places. The height of the new chimney is proposed to be about 160 feet, or less than half the height of the present one. A special meeting of the Dean of Guild Court was held on Thursday, to consider the application of the Gas Commissioners. The Court urged upon the Commissioners the desirability of erecting the new chimney rather to the south than to the east of the existing one, so as to take it more out of the line of sight of the valley. In the position they indicated, the Court were of opinion that the chimney would be backed by high buildings, and the "amenity" of the city (a word which is sacred to the authorities in Edinburgh) would be considerably improved. A visit was made to the ground, after which the Court resumed; and, after discussion, it was resolved to give the Gas Commissioners time to amend their plans by showing the chimney on the southerly site. I am afraid the members of the Dean of Guild Court are not technically acquainted with the science which regulates the construction of flues. The Gas Commissioners only a year or two ago introduced a costly bench of regenerative retorts, the flue of which is built to suit the present chimney, which, in turn, is situated on the central line of the retort-houses. To shift the chimney a little up or down that line would not be a matter of much moment; but to remove it away from the line—say, to the end of the retort-benches—might entail a serious derangement of the working of the draught, or a reconstruction of the whole flue system, which would be costly, and perhaps impracticable. Since Thursday, two persons have written to the local newspaper on the subject, one of whom raises the question of whether the fumes which are sent up the chimney could not be consumed, or, failing that, whether an ornamental chimney should not be erected which would be more pleasing to the eye than a brick factory-chimney. This writer concludes with the remark, which I consider the most sensible, that probably, in view of the unsatisfactory nature of the present site, it would be better to erect a temporary chimney and consider as to the moving of the works to a new site. The other writer is simply, and very foolishly, in favour of having the chimney put anywhere out of sight. I think it would be mistaken policy on the part of the Gas Commissioners to incur a large outlay upon the erection of a new chimney, because there is every probability of the works being removed within a not distant time. A temporary chimney could, at little cost, be made a thing not by any means hideous; and if the Commissioners could oblige the Dean of Guild Court by putting up such a structure, the Court might, I think, taking into account the low chimney which is proposed, be satisfied, without seeking to impose conditions which would be irksome. But, indeed, the Court have no power to impose conditions other than as to stability; and the Gas Commissioners should therefore not put themselves to unnecessary vexation in the matter.

In connection with the Gourock Corporation Gas-Works, the past year's working resulted in a surplus of £720. The Police Commissioners on Monday night fixed the price of gas for the current year at 3s. 7d. per 1000 cubic feet to consumers within the burgh and to themselves for public lighting, and at 5s. 10d. per 1000 cubic feet to consumers outside the burgh. The price is the same as last year.

In connection with the transfer of the services of Mr. J. Donaldson as Manager for the Cambuslang Gas Company, to act in the same capacity for the Tonbridge Gas Company, the Directors of the Cambuslang Company on Thursday night met in a social capacity with Mr. Donaldson, and presented him with a stationery case bearing an inscription and a cheque for a sum of money. Mr. Donaldson, in accepting the gifts and returning thanks, said he would always remember with pleasure the happy associations he had made in Cambuslang. It appears that Mr. Donaldson was offered an advance of £100 a year, to induce him to stay in Cambuslang; but that he refused the offer. The Directors of the Cambuslang Company did well to make an endeavour to retain Mr. Donaldson's services. When he took over the charge of their works, the make of gas was 12 million cubic feet; the quantity per ton, 7700 cubic feet; the leakage, 16·7 per cent.; the price, 4s. 4½d. per 1000 cubic feet; and the annual dividend, 5 per cent. He now leaves the works in excellent condition; having made many improvements on the plant, and in the working results. The make of gas is now 20 million cubic feet per annum; the quantity per ton, 10,400 cubic feet; the leakage has been as low as 5·1 per cent.; the price of gas for lighting is 3s. 6½d. per 1000 cubic feet, and for cooking and heating, 2s. 11½d.; and the dividend is 9 per cent. per annum. Large additions have also been made to the reserve and

* A letter on the subject of Mr. Whimster's retirement appears in our "Correspondence" columns to-day.—ED. J. G. L.

depreciation funds; and the greater part of the extensions have been made out of revenue. As I stated before, Mr. Robert Simpson, of the Tradeston Gas-Works of the Glasgow Corporation, has been appointed to succeed Mr. Donaldson at Cambuslang.

The Police Commissioners of Millport have held their adjourned meeting, to consider as to the adoption of the Burghs Gas Supply (Scotland) Act, 1876; and have unanimously resolved to adopt the Act. The next step is the laying of the proposal before the ratepayers; and arrangements are being made for the holding of a public meeting, at which the proposal will be submitted.

The Directors of the Kilwinning Gas Company have reduced the price of gas from 4s. 2d. to 3s. 11½d. per 1000 cubic feet.

In Dundee this week, several lots of public securities were sold by auction, including the following: An annuity debenture by the Dundee Gas Commissioners of £7 9s. 7d., for £270 12s. 6d.; and another by the Dundee Water Commissioners of £40 15s., for £356 2s. 6d. per £10; a mortgage for £1500 by the Dundee Water Commissioners, bearing interest at 3 per cent., for £1516 11s. 4d.; and portions of £2800 3½ per cent. debenture stock of the Dundee Gas Commissioners, at from £125 to £125 4s. Six shares of the Montrose Gaslight Company were last week sold by auction for £50 each.

The Police Commissioners of Dundee have appointed Mr. Robert Burness to be inspector of lighting in the city, in room of Mr. Veitch, who died a little more than a month ago. Mr. Burness has been in the employ of the Dundee Gas Commission for 29 years, and latterly has been inspector of gas-meters in the city.

Part of the town of Ayr is about to be lighted by electricity; an installation which has been constructed under the advice of Mr. Robert Hammond being almost completed. Steam power is used to generate the electricity; and the plant is intended to furnish light equal to 70,000-candle power. It was expected that the works would have been started this week, which has been the race week, and therefore the leading season of the whole year; but they were not completed in time No one ever saw an electric lighting installation finished at the expected time; and the experience of Ayr is only another of the many illustrations which such ventures have furnished, in more ways than one, that "there's many a slip" between expectation and realization.

The sulphate of ammonia trade at all ports is very quiet; and prices are nominal. The shale miners' threatened strike having passed over, prices have again relapsed, and may be given at £8 15s. The total shipments to date for the present year amount to 69,566 tons—a increase of 846 tons over the same period of last year.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 21.

Sulphate of Ammonia.—The market continues to droop. But quotations have been very irregular; and it is doubtful whether purchasing has, as yet, been practicable at the lowest prices which have been quoted as current values. The dropping of London prices, early in August, to the level of those at other points has been only partially successful in reducing stocks; and, although lower prices have increased the demand, the season of heavier production can scarcely be approached with equanimity by the large holders. Should the negotiations now pending for the combination of nitrate producers to curtail shipments be successful, some improvement in prices may be expected, or, at any rate, any decline in values be prevented; and this could hardly fail eventually to improve the position of sulphate of ammonia, which is now relatively much the cheaper article. At the close, the quotations for sulphate range from £8 15s. to £9 per ton, f.o.b. at the ports. Forward business is being done up to spring months at from 5s. to 10s. per ton premium upon spot prices.

Nitrate of Soda is still quiet, but fairly steady in all positions. Spot is worth 8s. per cwt. for refined quality; and autumn shipments, ordinary quality, about the same.

LONDON, *Sept.* 21.

Tar Products.—Benzols are held firmly by makers at 1s., both for 50's and 90's. There is a steady demand; and buyers offer ½d. less. Solvent naphtha is also in better request; and considerable shipments are being made. There is no marked improvement in the value of carbolic acids. But the market for them is steady; and prices are firm. Creosote oils are moving off a little more freely; but considerable stocks are reported to exist in makers' hands. Naphthalene salts are now worth 25s. per ton; and anthracene is said to be firm at the prices quoted below—outside makers having largely cleared any stock or production they may have had. The following are the prices noted during the week: Tar, 18s. to 22s. 6d. Pitch, west coast, 35s.; east coast, 37s. 6d. Benzols, 90's and 50's, 1s. Solvent naphtha, 1s. 1d. Toluol, 1s. 1d. Crude, 30 per cent., naphtha, 4⅝d. Liquid creosote, 1½d. Naphthalene salts, 25s. Cresylic acid, refined, 1s. 1d.; brown, 10d. Carbolic acid, 60's, 1s. 6½d.; 75's, 1s. 9d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia is in a bad way. There appears to be a conspiracy on the part of dealers as well as buyers to further depress this market. Sulphate has never been sold before at prices now prevailing. The present value of sulphate is all the more remarkable, as there is practically no stock of it in makers' hands outside London. Business has been reported at £8 15s. northern ports; and as low as £8 12s. 6d. has been quoted. There is a slight rally to-day; and prices may be taken at all ports to be about £8 17s. 6d., less 3½ per cent. Gas liquor is offered at 6s. to 7s.

The Forthcoming Water Inquiry at the East-End.—At a special meeting of the Hackney Vestry held last Friday, authority was given to the Water Committee to engage Counsel to represent the Vestry at the inquiry, to be opened in the Town Hall on the 1st prox., in regard to the recent scarcity of water at the East-end. The Committee asked for power to spend a sum not exceeding £100 for the purpose; but an opinion was expressed that the cost of the inquiry would be something like £5000. No specific amount was fixed; but "such sum as may be necessary" was granted.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No appreciable improvement can be reported as regards the coal trade of this district; the business being generally only of the most hand-to-mouth character, while no better prices are obtainable. Pits continue on short time, three to four days per week being the average; and even with this restricted production, supplies are plentiful. The better qualities of round coal, suitable for house-fire purposes, meet with perhaps rather an increased inquiry; but the actual business put through continues only of the most limited dimensions, and prices show no indication of any upward movement. Best Wigan Arley averages 10s. to 10s. 6d. per ton at the pit mouth; Pemberton four-feet and second qualities of Arley, 8s. 6d. to 9s.; and common house coals, 7s. to 7s. 6d. But a very slow demand comes forward in the lower qualities of round coal, suitable for manufacturing purposes; the only increased inquiry being for iron-making requirements. Supplies generally are excessive, and prices extremely low—averaging 6s. to 6s. 6d. per ton at the pit for ordinary steam and forge coals. Engine fuel is in fair request for mill purposes; but supplies are plentiful, with cheap lots coming in from other districts at very low figures. Common slack remains at about 3s. to 3s. 6d. per ton; and better sorts, at 4s. 6d. to 5s. In the shipping trade, only a very limited weight of business is reported to be doing. There is no improvement in prices, which rule extremely low; ordinary steam coals being readily obtainable, delivered at the ports on the Mersey, at 7s. 3d. to 7s. 6d. per ton.

Northern Coal Trade.—There has been a rather varied movement in the coal trade of the north-east during the last few days. The steam coal trade has, on the whole, tended towards ease; but there is now a much stronger demand for gas coal, and the Durham coal trade develops firmness. In the Northumbrian coal, some of the shipments are beginning to fall off. But many of the collieries have orders booked that will take some weeks to complete yet; and for the produce of these collieries, a good price is asked. But generally from 8s. 9d. to 8s. 10½d. per ton f.o.b. is the price for the Best Northumbrian steam coals; while second qualities are obtainable at from 8s. to 8s. 3d., and steam smalls are steady at about 3s. 6d. In the gas coal trade, the chief event is the decision in regard to one of the largest of the local contracts—a decision that is practically, though not actually, arrived at, and is expected to be on a basis of about 6s. 6d. per ton. Deliveries of gas coals are now very satisfactorily increasing; and those for shipment to the south are on a large scale. There is very little alteration in the manufacturing coal trade. In regard to coke, the demand increases; and the price is much steadier just now, being on the basis of 14s. per ton f.o.b., and 13s. per ton delivered at the local blast furnaces. The iron trade maintains the improvement, and thus the coke trade is expecting to benefit also, in time. In regard to gas coke, supplies are much more plentiful; and some of the inland gas-works have increasing stocks. Prices are unchanged.

Scotch Coal Trade.—Trade remains much as it was last week. Improvement is coming slowly in the west. In the east, there is great dulness, with enforced idleness. In the west, there is, for all varieties, a better demand. But prices are not getting up to such an extent as was expected; the foreign trade not advancing so much as the home. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 144,776 tons—a decrease upon the quantity in the preceding week of 20,378 tons, but an increase upon the quantity in the corresponding week of last year of 136,063 tons. For the year to date, the total shipments have amounted to 5,114,296 tons—an increase upon the quantity in the same period of last year of 1,347,783 tons, and a decrease upon 1893 of 11,710 tons.

Rejection of the New Water Scheme by the Ratepayers of Shrewsbury.—With the object of obtaining the opinion of the owners of property and ratepayers in the borough in regard to the proposed new water scheme, the Mayor (Alderman Cross) caused 7500 voting-papers to be issued; and the counting took place yesterday week—the result being as follows: Against, 3215; for, 1633; majority against, 1582. The scheme differs very little from one rejected some years ago, excepting that the service reservoir was to be on more elevated ground. It is calculated that, in the preparation of different schemes, the Council have, the last 25 years, spent about £12,000.

The Falmouth Corporation and the Gas and Water Works.—A suggestion that the Corporation should endeavour to acquire the gas and water works recently came before the Falmouth Town Council; and a Committee was appointed to consider the question. Their report was presented at a meeting of the Corporation last Thursday; and in it they expressed the opinion that it was desirable, in the interests of the borough, for the Corporation to purchase both undertakings. As a preliminary step, the Committee recommended that Mr. A. Silverthorne and Messrs. Sherwood and Co. be consulted as to the procedure necessary to give effect to the resolution; and then the question should be submitted to the decision of the ratepayers. Mr. J. Grose, the Chairman of the Committee, urged the Council to come to a decision at once, and to adopt it. He said that in recent years the movement in favour of the acquisition of gas and water undertakings by municipal bodies had been pressed forward; and Falmouth should not lag behind other towns in this respect. The object of the purchase was to lower the rates charged for gas and water, and to appropriate any surplus in aid of the district rates. The ratepayers of Falmouth already had a right to acquire the gas-works by virtue of section 69 of the Falmouth Gas Act; but it would expire in four years. The resolution having been seconded, Mr. Collins said that, while he agreed with the general tenor of the report, he did not think it necessary to engage a civil engineer at present. Mr. F. J. Bowles strongly objected to the employment of Parliamentary Agents. At the suggestion of the Mayor (Mr. H. Liddicoat), it was decided to expunge the recommendation with reference to the employment of Messrs. Sherwood and Co. at present; and it was finally resolved that, before any further steps be taken, Mr. Silverthorne should be asked to state what his charge would be for laying a complete scheme before the Corporation.

Fire at the Bordeaux Exhibition.—Last Thursday, a fire broke out in the Electrical Palace of the Bordeaux Exhibition; and before it could be subdued, the whole of the suite of buildings was destroyed. The cause of the fire was at first attributed to the explosion of a gas-engine; but a telegram received through Dalziel's Agency says it is now thought to have been a petroleum-engine.

Extension of the Barry Dock Water-Works.—At Barry Dock last Thursday, Mr. G. W. Willcocks, M.Inst.C.E., conducted an inquiry, on behalf of the Local Government Board, respecting a request of the Barry District Council for permission to borrow £2210 for additional works of water supply in the district, under the provisions of their new Gas and Water Act. There was no opposition.

Enlargements at the Heywood Corporation Gas-Works.—At the last monthly meeting of the Heywood Town Council, the Gas Committee submitted minutes the chief item of which referred to the extension of the holder capacity at the works, and the provision of a new scrubber. Moving the adoption of the minutes, Mr. Malden said that, at the time of the incorporation of the borough in 1881, the total holder accommodation was 590,000 cubic feet; and the quantity of gas sold for the year ended March, 1881, was 51 million cubic feet, as against 91 million cubic feet in 1895, or an increased sale of 40 million cubic feet per annum, as compared with fourteen years ago. Previous to the addition of the new lift to the large holder, the storage capacity was only 30,000 cubic feet more than in 1881; while the gas sold represented an increase of 80 per cent. The storage capacity was now equal to 1¼ days' supply, which would be a great relief during the coming winter in enabling the department to meet sudden demands for gas. It was also in consequence of this large increase in consumption, the principal part of which had taken place since 1889, that the Gas Committee had also decided to put down additional scrubbing apparatus—the present scrubber having been in use since 1881, and not being equal to the work required in the winter. The minutes were approved.

High Wycombe Gas Company.—The half-yearly meeting of this Company has been held. The accounts presented by the Directors justified them in recommending a dividend for the six months of 5½ per cent. on the ordinary shares, and of 4 per cent. on the additional shares; making respectively 11½ and 8½ per cent. for the year. The balance also enabled them to repay to the reserve fund £225, and to carry forward £61. The report was adopted. In the course of the proceedings, the Chairman (Mr. T. Wheeler) referred to a recent controversy between the Corporation and the Company with regard to a claim by the former for gas that had not been burned during the severe weather of last winter. He maintained that compensation was given by the moderate price charged to the Corporation, which was "very much lower" than to private consumers. The contract between the two bodies contemplated that occasions might arise when deductions should be made, excepting when failures occurred through the negligence of the Company or their servants. The question had already been judicially settled in the Richmond case, in which the supply to public lamps was also stopped by frost. The decision was that the cessation being due to causes beyond human control, the Corporation were bound to pay. The policy of the Company had always been not how much could they get out of the public lamps, but at how low a rate could they afford to supply them; and their charges were below those of most of the neighbouring towns. They were only compelled by their Provisional Order to supply gas of 14-candle power; but the average was about 16 candles. The Directors, at a meeting held immediately after the above, decided to reduce the price of gas to private consumers from 4s. 3d. to 4s. 1d. per 1000 cubic feet, after the reading of the meters at Michaelmas.

Fatal Gas Explosions.—At the South Hornsey Coroner's Court last Friday, Dr. G. Danford Thomas held an inquest on the body of Mr. William Henry Kirby, who resided at 40, Wilberforce Road, Finsbury Park. On the preceding Saturday night, a telescopic gas-bracket suspended from the ceiling of the kitchen at the deceased's residence fell in the presence of his domestic servant, Ellen Goodchild, owing—as was afterwards ascertained—to its being insecurely fixed and becoming unscrewed. Goodchild at once, as she thought, turned off the gas at the meter; but it was found that she had not done this effectively. When, an hour later, Mr. Kirby was endeavouring to refit the bracket—his servant holding a candle—an explosion occurred, which burnt him so seriously that he succumbed to his injuries last Wednesday. A verdict of "Accidental death" was returned. Last Sunday week, a gas explosion occurred at the residence of Mr. Saul Scott, at Edgbaston, by which his son, Mr. Adolphus Scott, lost his life, and his daughter and the servant received serious injuries. A strong smell of gas had been detected by the deceased, who opened the window, and sent the servant into the cellar to turn the gas off at the meter. After an interval of a few minutes, he struck a match, and the explosion occurred immediately. Last Saturday evening, an explosion, attended with fatal results, occurred at the Savings Bank Department of the General Post Office, Queen Victoria Street. It appears that the premises, which were in charge of the night watchman, had been closed until the usual business hour yesterday morning. In several of the departments, however, a number of workmen were executing repairs; and a gas-fitter named Drake (aged 30) was engaged in the meter-room, on the ground floor at the back of the building. The night watchman and the constable had almost completed their usual round, when they were suddenly alarmed by a terrific explosion proceeding from the part of the premises where Drake was employed. The meter-room was discovered to be in flames; and on the fire being sufficiently subdued as to admit of an entrance to the room, Drake was found lying on the floor almost lifeless. He was immediately removed to St. Bartholomew's Hospital; but he succumbed on the way. Drake, it seems, had completed his work for the day. But he decided to make a final test of a joint he had finished; and, stooping down close to the meter, he applied a lighted candle to the spot, and an explosion occurred almost instantly. From the terrible injuries he sustained, Drake must have had his face close to the joint, for his skull was fractured in a shocking manner. The various rooms on the ground floor also bore evidences of a terrific explosion; but the damage caused by the fire which followed was only slight.

The Gas Question at Ossett.—A Ratepayers' Association has been formed at Ossett; and the members have agreed to support at the ensuing election only those candidates who are in favour of the purchase of the gas-works by the Corporation.

Uncovered Water Reservoirs at Southampton.—The Water Engineer of the Southampton Corporation (Mr. W. Matthews) has advised his Committee to cover the two reservoirs on the Common at a cost of £6000. The water delivered to the reservoirs is of excellent quality; but, after being stored there for a short time, it is condemned by the Medical Officer (Dr. Harris) as being seriously contaminated. The work has been urged upon the Committee at various times since 1887.

Contemplated Purchase of the Gas-Works by the Kidderminster Town Council.—A Committee of the Kidderminster Town Council reported, at the monthly meeting last Wednesday, that, having submitted to a firm of chartered accountants conversant with gas companies' accounts the statutory financial statements of the Gas Company for the last five years, and having received their report, they had formed a favourable opinion with respect to the purchase of the gas-works, if they could be obtained on suitable and amicable terms. The Company, though not disposed to sell, appeared to be not indisposed to treat, and had intimated to the Committee that they were prepared to consider any offer that might be made to them. The Committee, before making any recommendation to the Council, desired to obtain the assistance of an expert to examine and report upon the condition and value of the works; and, at the next meeting of the Council, they proposed bringing forward a resolution with this object. The report was received.

Malvern Link Water Scheme.—A meeting of owners and ratepayers was held at Malvern Link on Monday last week to consider a resolution consenting to the promotion, in the ensuing session of Parliament, of a Bill for providing a water supply. The Chairman of the District Council (Lieut.-Colonel Ottley), in moving the resolution, said that a scheme prepared by Mr. Baldwin Latham was considered to be the best and most economical that could be had. The water would be collected in three reservoirs at different levels; and the whole district supplied by gravitation. The cost would be £29,045 for works of construction, engineers' fees, and superintendence. The necessary land and expense of the Act of Parliament would absorb £6000; making the total cost about £35,000. If this amount was borrowed at 3 per cent. for repayment of principal and interest in sixty years, it would mean a rate of 1s. 3d. in the pound. Speeches followed in support of, and opposition to, the scheme. The opponents urged that application should be made to the Malvern District Council for a supply from their new works; one gentleman stating that he had proof that Malvern would be willing to supply the Link, and that the outlay would not be more than one-half of that contemplated by Mr. Latham. The resolution was defeated by 98 votes to 86; and a poll was demanded and granted.

Water Filtration and Domestic Filters.—In a lecture given at the Chemists' and Druggists' Exhibition at the Agricultural Hall, Islington, on the 11th inst., Dr. S. Rideal, F.I.C., pointed out that at the present time the filter trade is passing from what might be called the mechanical to the bacteriological state. The bacteriological test for the efficiency of a filter had, he said, been brought about by the general acceptance of the germ theory of disease, and our increased knowledge of the important part which impure waters play in carrying pathogenic organisms from place to place. Dr. Drown, the Chemist to the Massachusetts Board of Health, in his last report, had shown that the chief object of water filtration is not the removal of visible suspended matter, and so ensuring a bright filtration, but the removal of the disease-producing germs. Drs. Sims Woodhead and Cartwright Wood had recently stated that out of upwards of thirty filters selected as those most generally used in this country, only two or three of the newer forms failed to allow the passage of bacteria. In America, during the last few years, similar experiments had been carried on by Dr. Drown and his colleagues on a large scale; and town filters had been constructed of sand which would yield 2 million gallons of water per acre daily, while removing 99·5 per cent. of the bacteria in the water. The filtration works of a water company could only be regarded as the first line of defence taken by the community to ensure better water supplies. Contamination of domestic water might be caused by leakage from drains, or by infection of cisterns; and this rendered domestic filtration highly important, even where the public authority had done its best to supply pure water.

A Water Scheme for South Derbyshire.—Dr. Sydney Barwise, the Medical Officer of Health for Derbyshire (who a few months since projected a scheme of water supply for East and Mid Derbyshire), has now prepared an important report on the immense soughs in former lead-mining districts of the High Peak of Derbyshire, showing that these soughs are now valuable sources of water, bringing down into the rivers into which they discharge many millions of gallons a day of pure water. The "Magpie Level," which empties into the River Wye, near Bakewell, yields 9 million gallons per day, and is absolutely free from poisonous metals. The Hill Car Sough, which empties into the Derwent near Rowsley, yields 6 million gallons per day. But the most important is the Merebrook Sough, which was constructed more than 120 years ago, and which pours its water into the River Derwent, near Ambergate. The quantity coming down here is 13 million gallons a day, and contains no lead or other poisonous metals. It has been analyzed about half-a-dozen times; and the results obtained are remarkably uniform. Dr. Barwise has suggested that this supply should be taken for a comprehensive water scheme for South Derbyshire. Close by is the Wakebridge Sough, which discharges at least 4 million gallons a day into the Derwent; so that these two soughs alone yield over 32 million gallons per day. Taking into consideration the extreme purity of the water, Dr. Barwise says there is, in the mountain limestone, a much-neglected and most valuable source of underground water. He hopes before long there will be a Bill passed, giving County Councils power to unite several sanitary districts, or parts of districts, under joint water boards, for carrying out comprehensive water schemes; and it might then be possible to utilize some of these valuable sources of water.

The Price of Gas at Leeds.—The Gas Committee of the Leeds Corporation last Thursday agreed to recommend the Council to reduce the price of gas in the city from 2s. 4d. to 2s. 2d. per 1000 cubic feet. During the first six months of this year, there was a gross profit on the gas-works of £18,615, which, after deducting £5400 for sinking fund charges, left a net profit of £13,215. Since June, there has been a slight loss, owing to the decreased revenue of the summer, and to the greater expenditure on repairs. However, the unusually low rates at which the contracts for coal have been let will, it is estimated, result in a saving of over £10,000 during the next twelve months.

Serious Interruption of the Water Supply to Toronto.—The Canadian correspondent of *The Times*, telegraphing on the 15th inst., says: "The city of Toronto, with a population of 200,000, is deprived of its water supply, owing to a break in the conduit pipe by which water is procured from Lake Ontario. The necessary repairs cannot be effected for several weeks. In the meantime, water is being procured from the surrounding villages, whence it is carried to the city by means of puncheons, barrels, and water carts. The residents are placed on short allowance. This accident is regarded as the worst calamity which has happened in any city throughout the Dominion for many years. The services of an English hydrostatic engineer will be secured, in order to guard against future accidents of the kind."

The Water Supply of Guildford.—An inquiry was recently held at Guildford by Colonel Coke regarding an application by the Town Council for sanction to borrow £2500 for purposes of water supply. The Board have since informed the Town Council that they learn, from the report of their Inspector, that the state of the existing machinery at the pumping-station adjoining the old town mill was such that it would be practically a waste of money to attempt to repair or remodel it, and that the better course for the Council to adopt would be to erect entirely new machinery, retaining only the Worthington pump in a building on the east side of Mill Lane; but this pump should be provided with a new boiler, and the engine would work more economically if it were a compound condensing one. The Board further learned that the Council had a considerable amount of water power available at the mill to drive new and extended machinery; and they were of opinion that it would be well to make use of this power to the greatest extent possible. The Board requested that, if the Town Council were prepared to act upon these suggestions, they would instruct their Engineer to prepare a revised scheme, and submit to the Board, with a detailed estimate of cost.

The New Water-Works for Coventry.—The construction of the new water-works at Whitley which the Coventry Corporation have had in hand since 1888, are approaching completion. The well, over which the pumping-station is constructed, is elliptical in shape, 14 ft. by 9 ft.; and in this form it sinks to a depth of 150 feet. Below this is a narrow bore of 24 inches diameter, carried to a further depth of 100 feet; making a total of 250 feet. From the sides of the well, 68 feet from the surface, two drifts shoot in opposite directions, one to the north 445 feet long; and below these, at a depth of 148 feet from the surface, another drift extends in a south-westerly direction to a length of 500 feet. The yield of water is about a million gallons per day; and it is raised and pumped into the mains by powerful machinery. The buildings comprise engine and boiler houses, coal-shed, smith's shop, and stores. The machinery has been constructed by Messrs. Moreland and Son, of London. It consists of two engines of 40-horse power each, two sets of pumps to lift the water from the well, and two to force it into the mains to the new reservoirs at Barker's Butts after it has been raised to the surface. The steam for motive power is supplied by three massive boilers. The mains are 14 inches in diameter to Bablake Church, from which point to the reservoirs they are 18 inches in diameter. The mains have already been filled, and the reservoirs cleaned out; but pumping operations have been suspended to allow of some finishing work in the engine-house.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 626.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Pa'd per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest. ment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	23½ - 24½	..	4 5 8
100,000	10	,,	7½	Do. 7 p. c.	10	16—17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼—7¾	..	4 3 10
40,000	5	,,	6½	Do. New	4	5¼—5¾	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	200—210	..	4 5 8
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	28 Mar.	11¼	British	20	55—56	+½	4 0 4
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8—8½	+¼	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	300—305	..	4 8 6
165,000	,,	,,	10½	Do. New do.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	270—280	..	4 12 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	207—212	..	4 14 4
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	10	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	295—296	−2	4 5 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	280—285	..	3 10 2
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197—202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	192—197	..	3 11 1
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	277—282	..	3 10 10
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	163—168	..	3 11 5
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	+5	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145—150	+5	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	249—254	..	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¾	..	4 16 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	17½—18½	..	5 8 1
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½*	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—106	..	5 13 2
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10½—11½	..	6 1 9
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	+7½	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	307—312	+2	3 16 11
308,685	,,	,,	13	Do. C do.	100	320—325	+2½	4 0 0
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	..	2 16 6
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230-235*	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	290—295	..	3 7 10
1,719,514	Stck.	10 Apl.	7†	East London, Ordinary	100	223—228	−1½	3 1 5
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303—308	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	258—263	..	2 17 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	145—150	..	2 13 4
500,000	100	14 Aug.	12⅔	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147—152	−3	2 12 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	290—295	..	3 7 10

* Ex div

† Next dividend will be at this rate.

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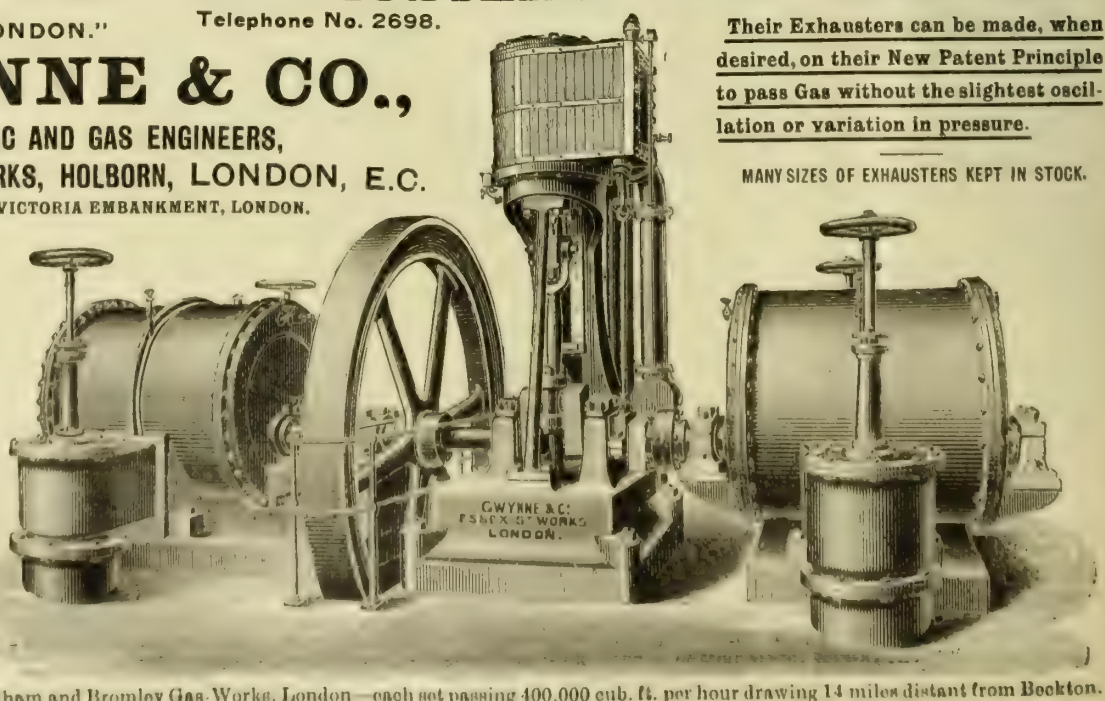

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

Gas Engineers in Liverpool.

THE meeting of the Incorporated Institution of Gas Engineers in Liverpool last week was an unqualified success, and will ever be a pleasant memory for all who were able to attend, if only for a portion of the time. The fact of several members of the Institution being compelled by the exigencies of business to restrict their stay in Liverpool to a few hours, is an indication of the difficulty which must attend the gathering together of gas engineers and managers from all parts of the kingdom at this season of the year; while the equally salient complementary fact of their being willing to go to Liverpool, even for so short a time, may be taken as an indication of the strength of their loyalty to the Institution, and their earnest desire to do honour to Mr. William King, the host for the occasion. The programme for the meeting has been published in the JOURNAL; and it is sufficient now to say that it was carried out to the letter and the minute, under climatic conditions which were only too kind. It was an excursion and sociable meeting, pure and simple; in this respect repeating the character of the Leicester fixture of last autumn—due allowance being made for the "local "colour." It is not to be expected or desired that these social gatherings of the members of the Institution will ever become big and unwieldy crowds. Much—perhaps most—of the credit for the perfection and satisfying disposition of the arrangements for last week's meeting must be given to Mr. King, the President-Elect, who had been as energetic in planning out the time, as he was untiring in seeing that everything was carried through according to the programme. For two whole days the busy Engineer to the Liverpool United Gaslight Company placed himself absolutely at the disposal of his visitors—answering every question addressed to him respecting local matters with a degree of patience that sometimes rose almost to the marvellous; and the thoroughness with which, having invited the Institution to Liverpool, he went about to testify to the reality of the welcome prepared for all who accepted the invitation, was beyond praise.

We desire also to record the noble hospitality displayed on this occasion by the Directors, which was in all respects worthy of the best traditions of the Company and the City—it would be superfluous to say more about it. The Chairman (Mr. Edward Lawrence, J.P.) previously known only by name to the majority of the members through our reports of his official utterances to the proprietors of the Company, will henceforward be remembered by his guests as an impressive personality. It is surely unique for a gas company at home or abroad to have a single name identified with the management for a period of seventy-one years, as in this example of the Liverpool undertaking and the name of King. The gas engineers who knew the late Mr. Alfred King personally are now among the seniors of the profession; and one can only trust their memory and judgment when with one accord they testify to the manner of man that he was. The youngest and most progressive gas manager in the country, however, can see for himself that Liverpool still exhibits as advanced a school of gas engineering, under the direction of Mr. W. King, as the whole United Kingdom contains; and the doings in and about the city on the Mersey last week in connection with the meeting of the Institution, suggest the fervent hope that the tradition which bears such fruit may long flourish in its native soil. Altogether, the experiences of the Institution in Liverpool amply bear out the promise we gave in this regard on the 27th of August—which is, of course, highly gratifying all round.

Gas-Testing Extraordinary.

THE graceful and genial manner in which the administrative and managerial authorities of the Liverpool United Gaslight Company "unbent" during last week to their gas engineering visitors could not hide the fact that a good deal of annoyance—perhaps we had better term it disappointment—exists on the side of the Company with regard to the hostile, carping spirit in which everything that can be said or done by or on behalf of the undertaking is met by the "popular" party in the Liverpool Corporation. The Gas Company carry on their operations under certain statutory regulations which they are careful to obey in the smallest particular. Their works and methods, technical and commercial, are as perfect as skill and care for their

own interests as well as for the public service can make them; and yet the Corporation contains a party which is always "throwing stones" at the Company, and would sooner the city suffered anything, even to being plunged in darkness, than that the Company should prosper. Of course, these absurd individuals, whose sole conception of municipal duty it is to be "agin the Gas Company," cannot hinder the undertaking from going on increasing in the scope and variety of its operations. But they can, and do, make a great deal of fuss locally; and occasionally they succeed in becoming offensive beyond the limits of the city they adorn—which must be a source of immense satisfaction to them. Very recently we had occasion to comment upon certain proceedings in the Edinburgh Town Council, when a local magnate declared that the gas supplied by the Edinburgh and Leith Gas Commissioners had been found by a peripatetic testing party from Liverpool not to be all that his colleagues' fancy painted it. We have since been supplied with what purports to be an account of the doings of the wandering gas testers referred to on this occasion. It is in the form of a "Memorandum" of the Special Lighting Committee of the Corporation of Liverpool, signed by the Chairman, Mr. Frederick Smith, dated the 23rd ult., and giving particulars of tests of gas made in different towns by Mr. C. R. Bellamy, the Corporation Gas Examiner, under conditions which are duly detailed. What is not explicitly mentioned, however, but only allowed to peep out between the lines of Mr. Smith's not very logical observations upon Mr. Bellamy's results, is the object of all this performance, which is nothing more nor less than to convict the Liverpool Gas Company of paying too much for their coal, getting too little for their residuals, and charging too highly for their gas. We have searched through Mr. Bellamy's tables in vain for any test of Edinburgh gas, and can therefore only conclude either that his visit to Edinburgh is mythical, or that his test of Edinburgh gas has been deleted for some reason best known to the Committee who employed and accompanied him throughout his travels. This is curious.

With regard to the primary object of the Committee's researches—the finding of contemporary evidence capable of being used against the Gas Company—this appears to have been rendered difficult of attainment by the circumstance of there being hardly another town in England supplied with gas of about the same quality as that of Liverpool. True, they found something like it in Glasgow; but there are reasons why Glasgow does not compare equitably with Liverpool in regard to its gas supply, besides the one kindly and sensibly hinted at by Mr. Smith—that the Liverpool Gas Directors could get their coal as cheaply as the Glasgow Corporation can, if they were not so bent upon throwing away £150,000 a year, for the fun of the thing. There is Sheffield, to be sure; but it is only by virtue of a strange accident that Sheffield can be put alongside Liverpool. The Sheffield Gas Company pretend only to supply gas of an average candle power of 17·92; and seeing that their standard is put at 16·5 candles, this seems sufficiently liberal. The Liverpool test, however, ascribes to the gas of Sheffield an illuminating power of 20·40 candles, which, of course, makes this abnormally cheap commodity do still more credit to the Company than their modesty has permitted them to claim. The statement, as a whole, is distinctly entertaining and instructive, but not always in the sense intended by the compilers.

The Commercial Company's Report and Accounts.

The report of the Directors and the accounts relating to the last half-year's working of the Commercial Gas Company have been published, and will be found reproduced in another column; the general meeting being called for Thursday. The revenue account shows a net profit for the half year of £48,680, as compared with £54,538 for the corresponding period of last year. With the amount carried forward and the usual deduction—to which is added a fresh entry of £637 for income-tax—there remains standing to the credit of the net revenue account a balance of £68,585 available for dividend. The Directors recommend the declaration of dividends after the rates of 13½ per cent. per annum upon the old stock, and 10½ per cent. per annum upon the new stock—being the same as last time; and also that the difference between these and the authorized rates of 13¾ and 10¾ per cent., having regard to the price charged for gas, be carried to the reserve fund. There are no other announcements in the report. The revenue account shows the gas-rental, at 2s. 6d. per 1000 cubic feet, to have amounted to £133,633, as against £128,836 for the corresponding period of last year, when the price was 1d. per 1000 cubic feet higher. The statement of meter-rental shows that the use of prepayment meters is still increasing in the district. The returns from residuals are not so good. Coke has fallen from £31,056 to £27,405, and ammonia from £12,559 to £7215. Tar only has improved, from £7262 to £8661. It would be interesting to learn what the Commercial authorities really and truly think of the condition to which the sulphate market has been brought. A drop in value of this commodity of 50 per cent. during the year means something to them, as it does to all producers. Thanks to the increased gas-rental, however, the gross revenue of the Company has only suffered to the extent of £2600. Coals cost £68,923, as against £62,087; and carbonizing wages are higher. There have been economies, on the other hand, in the matters of repair and maintenance. Bad debts are about the same; while law charges are a little more. The weight of coal carbonized rose from 100,435 tons to 108,381 tons, besides 1111 tons of cannel. The quantity of carburetting spirit used also rose from 110,385 to 201,864 gallons. The quantity of gas sold exhibits the substantial increase of 7 per cent., which is the largest rate of growth in the recent history of the undertaking. The balance-sheet shows a somewhat large addition to the stocks of residuals, which is not a satisfactory feature, if, as may be supposed, it indicates that these commodities were not readily saleable during the past half year even at the reduced values.

Carburetted Water Gas Interchangeable with Coal Gas.

The two separate and independent accounts given in the present issue of the Journal as to the working of carburetted water-gas plant, in Blackburn and Liverpool respectively, will be perused with different motives by a variety of our regular readers. It is not for us, of course, to perform the invidious and thankless task of comparing these examples with one another, with a view to ascribing technical or commercial superiority to either. All we are solicitous of doing in the interests of the British gas industry is to testify to the fact that the new method in gas manufacture has now established itself and earned satisfactory credentials in more than one pattern; and there can be no doubt that in this, as in other branches of trade, free competition will be beneficial both to makers and users. The Blackburn example is applied to an object now tolerably familiar to British gas managers from experiments that have been successfully instituted in London, Glasgow, Belfast, and Tottenham—it is for the time being an agency for carburetting the ordinary local make of coal gas. Blackburn has hitherto been supplied with gas averaging about 18½-candle power, produced by the carbonization of a mixture of common coal and cannel. Henceforward there is every probability of the use of cannel for this purpose being discontinued at the Corporation works, because the water gas, carburetted to an illuminating power of 21 candles or thereabouts, will be available as a cheap and convenient substitute for it. In Liverpool, on the contrary, 21-candle gas has to be sent out from the works to satisfy the statutory requirements of a supply testing to 20 candles anywhere in the district. Consequently, water gas of this quality has no carburetting value. It was therefore open to the Engineer of the Liverpool Gas Company, Mr. King, to follow the example of Glasgow, where it is understood that a highly carburetted water gas, of 40-candle power or so, is prepared for admixture with a much greater bulk of comparatively poor coal gas, in order to make up to 20 candles the quality of the gas sent out into the district; or to make his carburetted water gas of such a grade as to be capable of being distributed indifferently with his coal, or rather cannel, gas. As we think wisely—having regard to the local necessities of distribution—he chose the latter alternative; and, as a consequence, Garston to-day presents the unique example of a British gas-works sending out carburetted water gas for consumption as made, not for carburetting. The importance of this experiment, which appears so far to be an unqualified success, can hardly be overrated. What Liverpool is doing to-day, the rest of England may be disposed to do to-morrow, if

only it can be established that carburetted water gas can be prepared for consumption interchangeably with 16 or 17 candle gas, to as good advantage as it can be placed alongside 20-candle gas. Many things conspire to favour this development, if the economical conditions can be satisfied with oil at the present price. There will be no need for the new process to make gas much cheaper than an equal grade of coal gas, to render gas managers partial to it—at least as a means of providing for the "freak of "the load" in the depth of winter, and for the normal increase. It will not, so used, displace labour in established gas-works, but will rather provide employment for a lighter kind of labour than that which goes to common stoking. It will absorb the surplus coke—which is a great consideration for rapidly-growing works, where the coke sales do not advance *pari passu* with the demand for gas. And it will tend to keep a salutary check upon the cannel merchants, who have hitherto held gas managers to ransom in times of trouble in the coal market. Hence we await with interest any proof that carburetted water gas can be put alongside common coal gas, or coal gas slightly carburetted, as we now know it can be employed upon equal terms with cannel gas.

A Blue-Book on Work and Wages.

It cannot be fairly charged against the officials of the Board of Trade that they stint the public of solid fare in the shape of Blue-books. Hardly a week passes without the appearance of a new volume of reports or statistics dealing with the multitudinous subjects looked after by one or other branch of this busy Department—the latest being a report by Sir Robert Giffen upon the comparative statistics of the wages paid to the manual labour classes of the United Kingdom. This is in continuation of the reports and tables already issued relating to wages in the principal textile trades and in public and municipal employments. The information given is based upon schedules filled up by employers; and, with the experience previously gained, care has been taken to make the results trustworthy, and the averages for each trade true. One of the most important of the cases in which special arrangements were made to obtain reliable returns is that of the railway companies. In the case of seamen, the information wanted for the return was obtained from the articles filed at the office of the Registrar-General of Shipping. It is claimed that the Department has now in its possession much information as to rates of wages, changes in those rates, piece-work and logs, and other matters, and, according to the arrangements made, will have much more of such information in the immediate future; and it is desirable that this should be fully understood. Wages paid in gas-works are tabulated in this return. The conclusion drawn from these statistics is that since 1886 wages have generally tended upwards. The summary shows that, as regards men, the proportion earning less than 20s. per week is 24 per cent. only; between 20s. and 30s., it is 57·8 per cent.; and above 30s., it is about 18 per cent. Of course, these proportions would only apply to that part of the industrial community fairly represented by the trades dealt with in the tables comprised in the summary; but the list of occupations itself shows that the tables are samples of the great mass of occupations. It cannot be otherwise than advantageous to know where to find facts of this kind for use when questions of work and wages are being discussed.

Death of Mr. Arthur Willey.—It is with much regret that we record the death, at the early age of 33, of Mr. Arthur Willey, of Messrs. Willey and Co., Exeter. Deceased had been in delicate health for a considerable time; and for several years he had annually spent some months in Switzerland. Latterly, however, he seemed to be better; and it was hoped that a good span of life remained for him. Unfortunately, this hope has not been realized; and he died from consumption last Thursday. He leaves a widow and two children, for whom, as well as for the other relatives, much sympathy is felt.

Death of Mr. C. Overton, of Croydon.—Our readers may remember that, in the course of the very interesting account given by Mr. W. Hyslop, at the last meeting of the Croydon Gas Company, of the origin and development of the undertaking, he stated that, shortly after the works were established by a Mr. Defries, they were purchased by Mr. H. Overton, a wealthy brewer in the town, from whom they were acquired by the founders of the present Company. The son of this gentleman—Mr. Charles Overton—resided in a house in North End, Croydon, where he died rather suddenly last Thursday, at the age of 75.

WATER AND SANITARY AFFAIRS.

To-day has been appointed for the commencement of the inquiry directed by the Local Government Board in respect to the recent deficiency of the water supply in the district of the East London Company. As previously announced in our columns, the inquiry is to be conducted by Colonel Ducat, R.E., and Dr. F. W. Barry, both holding office as Inspectors under the Board. The Town Hall, Hackney, has been placed at their disposal; and great preparations have been made, in order to impress the Government officials with the extent of the default into which they are called upon to inquire. A deputation from the East-end Vestries has waited upon the Water Committee of the London County Council, to ask the assistance of the Committee in regard to these proceedings; and the question is to be dealt with in a report to be presented by the Committee at the meeting of the Council this afternoon. Somewhat in anticipation of this report, Dr. Collins, the Chairman of the Committee, told the deputation that "no doubt the Council would "be represented in some form at the forthcoming "inquiry." For no very ostensible reason, the Court of Common Council decided on Thursday that the Corporation should also be represented. Assuredly the City is not an East-end parish, nor the Corporation of London an East London Vestry. The County Council have an excuse for appearing, seeing that their jurisdiction extends over the whole Metropolitan area. Moroever, it has been rightly said that the Council are as much on their trial as the East London Company. But we can imagine that the Corporation do not like to see the County Council dominating the field, as a great central authority. One element in the agitation—and from it sprang the deputation to the County Council—has consisted in a conference of Vestry delegates, held in the usual head-quarters at the Hackney Town Hall. At this meeting it appeared that the Hackney Vestry had taken the somewhat unusual course—we might almost call it irregular—of sending a Sub-Committee to wait upon Colonel Ducat, previous to the public opening of the inquiry. The consultation which took place seems to have been limited to some unnecessary questions as to the extent to which Colonel Ducat would be prepared to receive evidence. The Colonel delighted the deputation by promising to take the necessary steps to secure the attendance of any witnesses who might be unwilling to come forward, as also to ensure the production of all books and documents likely to be wanted. We might ask whether this superfluous declaration was elicited by some suggestion from the Vestrymen that the East London Company would endeavour to evade part of the investigation. We venture to say that the Company will be perfectly willing to afford the most complete information, both verbal and documentary, and will cheerfully render the fullest assistance to the Inspectors. But the Directors have not called upon Colonel Ducat to say so. During the meeting of the delegates, Mr. Bousfield, Q.C., said he had offered to assist the Vestries in respect to the inquiry; but he explained that it was never his intention to conduct the entire case. His own view of the matter was that a joint Control Board or "Water Trust" for London and the surrounding districts was "absolutely necessary;" and when the matter came before Parliament, he would do all in his power to secure the appointment of such a Board. Mr. Bousfield may be sure that his view of the case differs from that which actuates the County Council.

The extent to which the conduct of the County Council is likely to come under review by the Government Inspectors in the present inquiry is a point of especial interest, which perhaps has been rather lost sight of by the Vestries, though we can hardly suppose that the Council are dull of apprehension in regard to the matter. In fact, it is this particular feature in the case which gives the Council a species of right as well as of obligation to appear before the Inspectors. If the conduct of the Council is not brought under review, the real cause of the recent deficiency in the supply must yet be shown as consisting in a want of reservoir capacity. The subject is very ably dealt with in a letter by "A Water-Works Director" which appeared in *The Times* last week. To this, a curious reply has appeared from the restless pen of Mr. Henry L. Cripps, who, as usual, leaves off with something more to say. In fact, his letter is singularly hazy as well as inconclusive. The "Water-"Works Director," on the contrary, writes in the most

unmistakable terms. Concerning the Bill of 1893, he quotes from a statement made by the County Council when the Bill was awaiting its second reading; the words being: "It was suggested on behalf of the Company that, unless "this Bill is passed, they will be unable to supply suf-"ficient water." This is the issue which Mr. Cripps has done his best to obscure, and which the County Council would evidently like the public to forget. The report of the Royal Commission is itself a thorough explanation of the recent difficulty; and we may say that, on the whole, there is something ludicrous in conducting a microscopic inquiry into a matter which is so palpable that its meaning can only be missed by those who have no desire to see it. But an inquiry has been asked for; and Mr. Chaplin has doubtless perceived that if he refused to grant it, the conduct of his department would be impugned. The utter hostility of the County Council to the Water Companies is shown by a recommendation from the Joint Committee on Public Control and Water Supply which comes before the Council to-day, repeating the proposal that the Solicitor should be instructed to take proceedings against the East London Company, for failing to maintain a constant supply—a failure simply due to the action of the Council. To show how zealous they are in the matter of the water supply, the Council are going to parade before the eyes of the public their famous Welsh scheme, an account of which appeared in some of the morning papers yesterday as "From a Correspondent." Who he is, matters little; but we described the scheme two months ago.

The decision in the Cardiff water supply case, reported in last week's JOURNAL, appears to be open to criticism. It turned on section 4 of the Water-Works (Regulation of Powers) Act, 1887—an extremely vague and unsatisfactory measure, which was added to the Statute Book at the instance of Sir Forrest Fulton. A person named Haines let to his tenant Newman a house at an inclusive rent; it being agreed that the landlord should pay all rates and taxes. For some years the landlord did pay the rates, including water-rates; but when he became bankrupt, the money was no longer forthcoming, and the Cardiff Corporation cut off the water supply. The tenant complained that this was a contravention of the Act; and the Deputy Stipendiary at Cardiff, holding that the complaint was well founded, fined the Corporation 10s. and costs. It was clear, however, that primarily the landlord was not liable for the water-rate. It was equally certain that he had not (in accordance with the practice where the owner is to be held liable for the money) entered into a written agreement to pay it. Nor was there even a scrap of evidence of an express verbal agreement on the landlord's part. This being so, the Magistrate's decision seems to have proceeded solely on the ground that demands had previously been made on the landlord and discharged by him, and that this constituted an implied agreement to continue paying. But it seems extremely doubtful whether evidence of so vague a character ought to be legally accepted as sufficient, where proceedings are taken under a highly penal enactment.

Excluding the admitted bargain between landlord and tenant, which in itself could not be binding on the Corporation, the groundwork left for the decision was of a singularly shadowy character. It raises, nevertheless, a widely important question as to the effect of bankruptcy upon a contract within the purview of section 4 of the Forrest Fulton Act. Bankruptcy relieves the property-owner from the obligations of any contract that he has entered into. But is his contract still to be binding, so as to give rise to penal consequences, upon the corporation or company from whom a supply of water has been obtained? Of course, a proof for the amount due in respect of water-rates can be lodged with the Official Receiver or Trustee in Bankruptcy; but in too many cases such a claim for dividend is not worth the bankruptcy stamp that must be affixed to the proof *plus* the eighteenpence that must be paid on swearing the debt. Of course, again, there is left the remedy which the Act gives by was of charge on the property of the contracting party. But for all practical purposes, the charge is worthless, because to enforce it would often cost a thousand times as much as the amount of the unsatisfied debt. In this respect, Water Companies have long found the Forrest Fulton Act a delusion and a snare; and the ruling in the Cardiff case would seem to show that the Act is even more one-sided in its operation than it had already been proved to be.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 691.)

THE chief business in the Stock Exchange last week was the settlement, which was quite as heavy as ever, although we are supposed to be in the slack season; and this tended to keep new business down to low proportions. But, in spite of this, prices in every market rose steadily, instead of drooping for lack of support. There is so much money about just now, and dealings are on such an enormous scale, that stocks of all sorts, from the giltest-edged down to the decidedly risky, get forced up irresistibly. There was a strong demand for money for the settlement; but the supply was too great for that operation to have any real effect on the Money Market. Business in the Gas Market was about as active as in the preceding week; and the general tone was very similar. Dealings in Gaslight "A" were numerous. At the opening, the stock looked as if it would recover, and was done at 297½. But the promise of improvement was not realized; and the price weakened, so that, by the close, the quotation was a point and a half down. However, the secured issues of the same Company were in great demand; and the quotations of all the preferences had a considerable advance. Seeing that, at these figures, they still return a clear 3½ per cent. for money, it is a question whether they are high enough even now. Dealings in South Metropolitans were few and featureless, without any indication of a move either way. Hardly anything was done in Commercials; but, when the report and accounts for the half year came out on Friday, and showed a maintained 13½ per cent. dividend, and another ¼ per cent. to the reserve fund, the old stock at once went up. Business in the Suburban and Provincial division was very scarce. Everything dealt in realized excellent prices; and Alliance and Dublin improved upon its quotation. Among the Continental Companies, there was little done, except in Imperial, which was active enough. Prices were steady at about middle values. The remoter undertakings were firm in general; while Monte Video and Chicago first mortgage bonds improved. Business in Water was very quiet. But prices showed no symptom of drooping; and Chelsea and Lambeth had a small advance. The issue of £100,000 of 3 per cent. debenture stock of the West Middlesex Company was subscribed five times over, and was allotted at an average of a little under 106 per £100 stock.

The daily operations were: On Monday, business in Gas stocks was active; and prices in general were firm without variation. Monte Video rose ½. Transactions were more restricted on Tuesday. Gaslight "A" showed renewed weakness; and the buying price was lowered a point. On Wednesday, business in Gas exhibited no inclination towards better activity. Gaslight "A" was steady. The secured issues advanced freely—"F" improved 5; "G," "J," and "K," 3 each; "C," "D," and "E," 2; and "H," 1. Chicago 2nd Bonds rose 3½. On Thursday, little else but Gaslight "A" was dealt in; and all prices remained unchanged. In Water, Chelsea gained 2; and Lambeth, 1. Friday's business in Gas was very limited; and prices were only moderate. Gaslight "A" fell back 1; but Commercial old rose 5. Saturday's operations were better; but prices closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Affairs of the Brush Electrical Engineering Company—The City of London Electric Lighting Contract—The Brush Company and Electric Traction.

CONSIDERABLE interest attaches to the proceedings at the recent general meeting of the Brush Electrical Engineering Company, in view of the discouraging statement in the Directors' report touching the experience of the Company in regard to their City of London contract referred to in this column last week. The Chairman (Mr. J. B. Braithwaite, jun.) had no very enviable task to perform in setting forth the general position of the Company, not merely in this regard, but also in connection with the increase of the bank overdraft from £35,000 to £78,000. This somewhat alarming evidence of lack of ready money to carry on the business was explained as being due to a rearrangement of the Company's indebtedness (the bankers having advanced money to pay other creditors); while the rest is attributed to an increase of the shares and debentures held in other concerns. This explanation only goes to show that the occupation of these big electric trading companies is still as much with finance as with engineering; so that it is only with reservation of the unknown quantity representing the former interest that their accounts can be held as revealing the current state of the industry with which they are identified. At any rate, an amount of £105,000 of new debenture stock, which is to be nominally, and it is hoped practically, redeemable, is needed to put the Company in comfortable circumstances as to working capital. Seeing that the share capital still stands at £450,000, with

£125,000 of debenture stock, and that the net earnings in the past twelve months were £7400 net—which was not sufficient to pay the full preference dividend—it must be conceded that things will have to look up very considerably during the current year, if the sanguine views of the Chairman as to the future of the Company are to be realized.

Last year, as already mentioned, the Brush fortunes were darkened by the unfortunate issue of their contract with the City of London Company, which turned what, according to the Chairman, would have proved the best year of the Company's existence into the worst. The Chairman was manifestly reluctant to weary the shareholders with the details of this troublesome business. But, at the call of the meeting, he was induced to lift a corner of the curtain shrouding the mystery; and the explanation, such as it was, proved to be of particular interest for engineers and contractors generally—not merely those engaged in the electric supply business. He stated that the Company's contract with the City of London undertaking was one of considerable magnitude, involving as it did a total sum of £300,000. Under the contract, the usual stipulation was made reserving to the Engineer of the Company contracted with the absolute decision as to whether or not the terms of the contract were being carried out. There is no reason to suppose that this provision would not have proved satisfactory to both parties, in ordinary circumstances. But, as it happened, the Lighting Company changed their Engineer three times while the contract was being carried out; and the last change turned out disastrously for the Contractors, for the third new Engineer entertained very different views from those held by his predecessors as to the way in which the obligations under the contract should be discharged. As this unaccommodating officer was sole and supreme judge of the matter, there was nothing for it but to "knuckle under;" and this, after enduring much tribulation, the Brush Directors eventually did, with the sad financial result already recorded. The high contracting parties being thus reconciled, by a compromise which appears to have been all one way, work was resumed. The simple tale told by Mr. Braithwaite gives rise to many reflections. As usual, nobody was held to be blameworthy for the Company's misfortune. The agreement to leave the Engineer of the givers of the contract sole arbiter of all questions arising during the execution of the work, is, indeed, not extraordinary. Nevertheless it is equally common to make provision for a reference of differences of opinion in this regard to an independent arbiter. In the present case, the contract appears to have been entered into at an era when the two Companies were in very intimate relationship, administrative and otherwise, with one another. These relations were altered in the course of time; and with the alteration there may well have arisen a question as to which party should be the more considered in regard to the obligations under the contract. The change of Engineers, to which the Brush Company's Chairman attributed this Company's affliction, may equally well have been an effect as a cause of the alteration of the City of London Company's attitude towards their former colleagues. There is a well-known narrative poem which tells in moving language how a grey beard undertook to instruct a youth in the science of chess-playing, with the not unnatural result that, in the fulness of time, "the old man was beaten by the boy." The Brush Electrical Engineering Company was once known familiarly as "Grandfather Brush;" and the City of London Company is the progeny of the old age of this not particularly reverend patriarch. There is something almost pathetic about the idea of this young creation of the Brush interest "doing" its parent to the tune of £19,000 in a single half year. But consider the bringing-up it had! Will this be the whole of the loss, we wonder? Nobody asked the question at the meeting; but time will show.

We have dealt at such length with the prospects and vicissitudes of the Brush Company this week, that it is hardly worth while to open up another electric subject. Let us conclude, therefore, with a notice of Mr. Braithwaite's observations upon the future of electric traction. It appears that the Company are paying great attention to this branch of the electric industry; and, in particular, are laying out their works for the manufacture of specialities in electric railway and tramcars and engines. The Chairman admits that it is to electric traction that the Company must look very largely in the future to keep the engineering shops full, which is as much as to say that there is not a great deal more to expect from electric lighting. He declared that "electric lighting is a firmly established industry, and is not likely to retrograde;" but he said nothing whatever about the prospect of there being many more £300,000 contracts to be picked up in this line—which, considering the Company's latest experience, is not, perhaps, regretted by the Directors. His expectation of imminent developments in the electric traction branch is perfectly understandable; and there is no apparent reason why the Brush Company should not secure a fair share of such work as may be going in this department. It will, however, be a fresh venture for them; and there are too many rivals in the field to enable the old plan of concessionary ventures to be tried again with any hope of success. It is but fair to the Brush Directors to record that, having regard to the position in which the Company have been placed by the unprecedented circumstances in connection with the City of London contract, they will forego half their fees for the ensuing year.

THE INSTITUTION OF GAS ENGINEERS IN LIVERPOOL.

It was generally believed that the Liverpool autumn fixture of the Incorporated Institution of Gas Engineers would prove popular; and the expectation was justified by the attendance of a numerous party of members on Thursday morning last at the Lime Street Station, when the opening event of the very promising programme—a visit to the Garston works of the Liverpool United Gaslight Company—was entered upon.

The train started at 9.50; and a few minutes took the party to the gas-works, which at present occupy an area of 7½ acres of a piece of land 31 acres in extent, acquired by the Company some years ago in view of the future needs of the undertaking in this neighbourhood. By the time when it became a practical question of utilizing the site for manufacturing gas, the feasibility of introducing carburetted water-gas into England had arisen as a problem of the hour; and Mr. W. King, the Company's Engineer, who was one of the first "on this side" to make a study of the subject, recommended his Directors to try the new system of gas making on the opportunity presented by the pending extension of the Company's manufacturing resources. The advice, fortified as it was by the results of a tour of inspection in the United States, was taken and acted upon; and the contract for the carburetted water-gas plant was given to Messrs. Humphreys and Glasgow, with eminently satisfactory results. In preparation for the new departure, however, Mr. King set to work to lay out a portion of the site in the far-seeing and thorough spirit which has long been a tradition of this great undertaking. A large storage gasholder and a relief holder were erected; and a fine example of construction the former is, although (perhaps some would say because) it does not exhibit any leanings towards the fashion of a modified guide-framing. The storage of a large quantity of oil was the next consideration; and this has been satisfied by the construction of two circular tanks, each of 1100 tons capacity. These are based upon a gridiron foundation, so as to be accessible underneath as well as all round for inspection. They are situated in a half-sunk and walled pit, so that, in the event of any oil escape and fire, no possible damage to anything else could ensue. Owing to their position, the tanks can be half-filled by gravity from railway tanks, run in on a siding from the adjoining railway; and there is a steam-pump connection to do the rest. Double valves, and every other precaution that experience and forethought can suggest, have been adopted to make the oil storage absolutely secure.

A plain, substantial brick building measuring about 155 feet by 55 feet, looking more like a mill than a retort-house—which latter type of structure, indeed, it does not in any way suggest—has been built to accommodate the generating plant, which it does with ample room and to spare. At present four sets of generators, with their superheaters and subsidiary appliances, are installed; constituting one-half of the intended equipment of the building. Only one set is actually needed for the present; and it is at work continuously. When filled up, the output of the house will be nominally 7 million cubic feet of carburetted water-gas per day; so that the present capacity is 3½ million cubic feet of gas per diem. The quality of gas manufactured is intended to be practically the same, as regards illuminating power, as the ordinary coal gas sent out by the Company—that is to say, 20-candle power (as measured by the aid of a flat-flame burner) in any part of the wide district. To ensure compliance with this standard, the works send out 21½-candle gas; and in order not to fail of giving satisfaction with the new kind of gas, this is made three-quarters of a candle better. For it will be observed that the use of carburetted water-gas by the Liverpool Company is not for enrichment, but as a product capable of being distributed and burnt interchangeably with the ordinary supply. This is the only undertaking in England which has up to the present acted in this way in regard to carburetted water-gas. The plan has been entirely successful both economically and technically. The Garston output stands the Liverpool Company in rather less than the cost of an equivalent make of cannel coal gas; and although the specific gravities of the two descriptions of gas differ, none but a few consumers, employing small and poor flat-flame burners, notices when the flames are supplied by the one or the other gas.

It is scarcely necessary now-a-days to describe at length the manufacture of carburetted water-gas, at Liverpool or anywhere else. Four-minute blows and seven-minute runs are the rule at Garston; and the whole apparatus works to admiration. The oil used is "Solar Distillate;" and the coke is sent in from one of the coal gas manufacturing stations. The gas is purified from carbonic acid and sulphuretted hydrogen; and the separated tar is burnt under the boilers. The whole station—buildings, gasholders, and manufacturing plant—should certainly be seen by the experienced gas engineer, who will not fail of being struck with a sense of the completeness, soundness, and general excellence of everything in and about the station.

At Garston, the party lunched; and thence drove in brakes to the Herculaneum Dock Station of the Liverpool Overhead Electric Railway. After a run in the cars, there was a stop to inspect the very complete power generating station of the Railway Company; and then an adjournment was made to the famous Landing Stage, where the process of bringing alongside the Cunarder *Cephalonia*, to sail the same afternoon for Boston,

was witnessed with interest. By the kindness of the Directors of the Cunard Line, a tender was provided which conveyed the party to the great liner *Lucania*, lying out in mid-stream; and the splendid ship was inspected from end to end, tea being served to the party in the saloon. The return to the city completed the business of the day; and the dinner given by the Directors of the Gas Company in the evening fittingly rounded off an outing which will be ever remembered with pleasure by all who participated in it.

The second day was devoted to a trip to Chester—the railway journey starting from Birkenhead; and after the many unique antiquities of the city had been inspected, a steamer took the party up the River Dee to Eaton Hall, the seat of the Duke of Westminster, the architectural beauties of which were duly appreciated. "And so," as Pepys would say, "back to Chester and home, well pleased with the entertainment and the company." No time was lost during the meeting in passing complimentary votes; but we take this opportunity of recording, on behalf of the members present at this gathering, the general sense entertained by them of the hospitality of the Directors of the Liverpool Gas Company, the kindness passing ordinary of Mr King, and the efficiency of everybody concerned with the arrangement and carrying out of the programme.

THE NEW WATER-GAS PLANT AT BLACKBURN.

There is now in daily operation at the Blackburn Corporation Gas-Works a very complete example—the first of its kind to be started in this country—of the carburetted water-gas plant put upon the market by the Economical Gas Apparatus Construction Company, of Toronto and London, who are working under the "Merrifield, Westcott, and Pearson" patents. The plant in question has a nominal producing capacity of 1¼ million cubic feet per 24 hours. It is in duplicate in all essential parts. One part only is, however, required for use at present, and this only for 12 hours a day, although complete 24-hour trials of the apparatus were made under the supervision of the Gas Engineer to the Corporation (Mr. S. R. Ogden) before the plant was taken over from the constructors. The contract was fully completed, we understand, a month prior to the stipulated time; and the guarantee given by the Contractors has been amply covered by the every-day performances of the plant—a "double event" upon which the Corporation and the Contractors are together to be congratulated. As the plant stands, it is in all respects a workmanlike and creditable piece of gas engineering, complete to the last particular, with nothing left to be adjusted or made good or to be in any way corrected. What this means in a new departure of this importance, engineers do not need to be reminded.

The water-gas plant has been installed in an old retort-house 44 feet square, cleared out for its reception, and provided with two annexes—one containing the steam-engines, pumps, and blowers, the other accommodating two boilers, either of which could supply steam for the double arrangement of generators and superheaters. The supplementary equipment comprises an underground storage tank for oil, which is filled by gravitation from the railway-tanks; an oil service-tank which commands the superheaters; and the relief gasholder. The carburetted water gas is made, scrubbed, condensed, and purified by lime (to remove the carbonic acid gas) before being mixed with the coal gas made upon the same works. The engine-room contains a pair of No. 8 Sturtevant fans, each driven by a belt from a vertical Tangye engine, a Waller's exhauster, and the oil-pumps. This is under the charge of one man. Another man attends upon the generators and gas-making part of the plant; and then there are the boiler and generator furnaces to be fed, and the latter clinkered. This accounts for the whole of the working staff of the new department.

The gas-making plant proper comprises a pair of generators, which are oval section, measuring 8 ft. 6 in. by 10 ft. by 14 ft. 6 in. high, closely connected with superheaters 8 ft. 6 in. in diameter by 32 ft. in height. The lower part of these vessels is styled the superheater, up to the level of the upper oil-feeds; the portion above this being called the fixing chamber. Water-cooled valves are provided, so arranged that the processes of blowing-up and gas-making can be effected either upwards or in the reverse direction; and the gas, when made, passes through a seal-cup, heats the oil supply, and is afterwards scrubbed and condensed. Water is used in the scrubbing process; and this and the residual tar are subsequently run off together into an underground separator—the first of its special kind to be tried in this country—where a perfect separation of the two fluids takes place, so that the water could be used over again if desired, while the tar is burned under the boiler to help the coke used for steam-raising.

At the present time, six minute blows and six minute runs are the working rule; the attendant going simply by the clock, and having all his valves conveniently at hand upon the stage which is erected over the tops of the generators. For every run, he uses 28 gallons of oil, measured by a Worthington oil-meter; and he feeds his generators when required with coke delivered to him in tipping waggons sent up by a lift. These contain about 16 cwt. of coke. There being two charging-doors to each generator, each side is charged alternately, for the purpose of giving a better distribution of the fuel than a single central door. The furnace only requires clinkering once every twelve hours.

The oil at present used at Blackburn is Russian "Solar Distillate;" but, of course, any description of mineral oil, free from pitch, that could be more cheaply purchased would answer the same purpose. It is simply in this regard a matter of proportioning the consumption of oil to the run. The same observation applies to the management of the generator. At Blackburn several descriptions of coal are carbonized; and consequently the quality of the coke supplied to the water-gas plant is constantly changing. No trouble in working has, however, been experienced on this score; it being a simple matter to vary the duration of the blow and the run, and by a reversal of the current to ensure the distribution of heat in the generator and superheater to the best advantage.

There are many admirable points of well thought-out detail in this Blackburn plant; but these cannot be described at length here, even if we could hope to make them really clear by the aid of letterpress. An engineer's eye would, however, take them in at a glance; and we can confidently assert that it will be worth while for any engineer desirous of keeping abreast of the modern development of carburetted water-gas manufacture in this country to proceed to Blackburn and examine the new plant for himself. This is the more desirable as every detail of a plant of this character registers some valuable experience; and in water-gas making it is experience rather than the knowledge of first principles which is essential to success.

Now for the results. The carbonizing book was laid open for inspection; and from its pages we took the following data, applying to twelve-hours' working on the 16th ult. Actually, the apparatus was at work from 6.10 a.m. to 5.42 p.m., or (in all) 11 hours 32 minutes:—

Gas made	352,000 cubic feet.	
Oil consumed, 1072 gallons . . =	3·04 gallons per 1000 cubic feet.	
Coke for generator, 11,088 lbs. . =	31·50 lbs.	,, ,,
Boiler fuel coke	6·00 lbs.	,, ,,
Illuminating power of gas . .	20·65 candles.	
Illuminating power per gallon of oil	6·79 candles.	
Candle-feet per 1000 cubic feet .	1358	

This gas was made in 42 runs, averaging six minutes per run, in one generator set. The residual tar, as already stated, is burned under the boiler to help the coke. The illuminating power is taken by means of a bar photometer, from the purified gas. On Sept. 19, gas was made for six hours only, which is, of course, very unfavourable to the plant. On this occasion, 167,000 cubic feet of gas, of an average illuminating power of 23·04 candles, were made with an oil consumption of 3·42 gallons per 1000 cubic feet, and 33·2 lbs. of coke for the generator, besides 6·89 lbs. of coke per 1000 cubic feet for the boiler. In a 24-hour run, the consumption of coke for gas making would not exceed 28 lbs. per 1000 cubic feet of gas.

Official Changes at the Oldham Gas-Works.—Owing to ill-health, the Manager of the Higginshaw Gas-Works of the Oldham Corporation (Mr. Piper) has been absent from his duties for some time; and he is still unable to resume them. In consequence of this, Mr. Edwin Platt has been placed in authority at the station, under the supervision of the Gas Engineer (Mr. J. Chadwick); and Mr. Piper, if his health improves, will have other duties.

Mr. Richard Carter, Assoc.M.Inst.C.E., died last Thursday at Harrogate, in his 78th year. He had an extensive practice as a Consulting Engineer; among his engagements being those of Director and Consulting Engineer to the Harrogate Water Company and Engineer of the Ripon Corporation gravitation water scheme. He also carried on an extensive linen manufacturing business at Barnsley, of which town he was twice Mayor, as well as Chairman of the Water Committee.

Personal.—Mr. G. Keyte, of Ramsgate, has obtained the appointment advertised in the Journal for Aug. 13 under No. 2553. Mr. F. W. Jones, formerly of Broseley, Salop, and son of Mr. J. H. Jones, of Ironbridge, Salop, has been appointed Manager of the Bingham, Notts., Gas Company, Limited—a position formerly filled by Mr. J. E. Hughes, who, as mentioned last week, has now gone to Holyhead. Owing to the extra duties imposed upon Mr. Matt. Dunn, Assoc.M.Inst.M.E., the Gas Engineer and Manager of the Selby Urban District Council, by the extended demand for gas, he has been granted an increase of £50 per annum in his salary, to date from July 1 last; and he is to have an assistant on the works.

Presentation to a Servant of the Glasgow Gas Trust.—Last Friday evening, in the Royal Restaurant, Glasgow, there was a large gathering of the local Gas Trust employees convened to make a presentation to Mr. Harry Smith, who is about to leave for the Transvaal. Mr. Hugh Scott, the Chief Clerk in the Engineer's department, occupied the chair; and, in making the presentation, referred to the fact that Mr. Smith had been upwards of a dozen years in the service of the Corporation Gas Commissioners, first in the stores department at the Dawsholm works, and for the past seven years in the Engineer's department. As tokens of the great regard entertained for him, Mr. Scott placed in his hands a splendid gold watch and a pocket barometer, with combined thermometer and compass. Mr. Smith made a suitable reply; and subsequently there were brief speeches by other members of the company. These were interspersed with songs, recitations, &c.

TECHNICAL RECORD.

GEOLOGICAL RESEARCH AND UNDISCOVERED STORES OF WATER AND COAL.

At the recent Meeting of the British Association, the President of the Geological Section (Mr. W. Whitaker, F.R.S.), devoted a large portion of his Inaugural Address, which was entitled "Underground in Suffolk and its Borders," to a consideration of the question of how far the sinking of wells has furnished information which will assist the geologist in the search for coal in South-Eastern England. His remarks on this subject were as follows:—

It is only from wells that we can tell the thickness of the drift over most of the great plateau; open sections being rare, except on the coast. The drift includes everything above the Chillesford clay—practically all the post-tertiary formations. No fewer than 173 sections show a thickness of 50 feet and upward; while of these, 34 prove 100 feet of drift, and some much more. At one place, the bottom of the drift has not been reached at a depth of 340 feet, or nearly 140 feet below sea-level. In the town of Ipswich, one boring has pierced 70 feet of drift, and another 127 feet in ground but little above the sea-level. The sandy deposit of the red crag rarely reaches a thickness of 40 feet. But, on the other hand, wells at Hoxne seem to prove more than 60 feet of crag; while at Saxmundham the formation is 100 feet thick; and at Leiston and Southwold, it is over 140 feet. At some depth underground, the colour-name is a misnomer—the shelly sands being light-coloured and not red. Below the crag, there is a great gap in the geologic series; and we come to some of the lower of the tertiary formations.

There are records of more than 40 wells in Suffolk that are partly in these deposits, and 36 of these reach down to the chalk—20 giving good sections from the London clay to the chalk. The important evidence given by these wells shows the underground extent of the older tertiary beds beneath the great sheet of crag and drift. Over this large tract, we can know nothing of the beds beneath the crag otherwise than from wells and borings; and until these were made, our older geologic maps cut off the older tertiary beds far south of the parts to which they are known to reach, though hidden from sight. Though the chalk is reached by many wells, less information can be obtained by reason of its great thickness; and the amount of overlying strata forms a bar to deep exploration. Of the Suffolk wells, 40 go through 100 feet or more of chalk. Of these, 20 go through 200 feet, 10 through 300 feet, and 5 of these through 400 feet or more. But in no case yet recorded has the chalk been pierced from top to bottom in Suffolk.

Reasoning, however, from the well-known Harwich boring, which passes through the whole of the chalk, proving a thickness of 890 feet, it may be concluded that in the south-eastern part of Suffolk the chalk reaches a thickness of about 900 feet. Towards the northern border of the county, it is probably more, as the deep boring at Norwich passes through nearly 1160 feet of chalk, and that without beginning at the top of the formation. The evidence tends to show that the upper chalk forms a good deal more than half, and perhaps about two-thirds, of the formation; the middle and lower chalk being rather thin. The glauconite marly bed at the base seems to be well developed, and to be underlain by the gault clay; so that there is no good evidence of the occurrence of upper greensand. The little that is known of the gault points to this formation being usually thin—presumably only 73 feet from top to bottom at Culford, and probably not more than between 50 feet to 60 feet at and near Harwich. The lower greensand has been found in one deep boring only, at Culford, in the north-west of the county, where it is represented by 32½ feet of somewhat exceptional beds.

When we reach the base of the gault, we pass from the region of facts into the realm of speculation, and come to perhaps the most interesting problem in the geology of the eastern counties—the consideration of the question: What rocks underlie the cretaceous beds at great depths? Beyond the outcrop of the lower beds of the chalk series in Cambridgeshire and Norfolk, there is a powerful development of the great Jurassic series. But the only two recorded deep borings in and near Suffolk that have pierced through the cretaceous base—at Culford and at Harwich—show not a trace of anything Jurassic; they pass suddenly from cretaceous into far older rocks. The recent trial boring at Stutton shows just the same thing, for the gault rests directly on a much older rock which cannot be classed as of secondary age. There are ten deep borings reaching to old rocks in the London basin, of which accounts have been published. In four of these (at Meux's, Streatham, Richmond, and Dover), Jurassic beds separate those rocks from the chalk beds; so that there are six in which these last rest directly on old rocks (at Ware, Cheshunt, Kentish Town, Crossness, Culford, and Harwich). Stutton makes a seventh. We owe nine of these borings to endeavours to get water from deep-seated rocks.

The borings at Dover and Stutton were started for a much more definite object than merely to prove the depth to older rocks, or the thickness of the cretaceous and Jurassic series. It has become the turn of geologists to help those who would find coal. The trial at Dover was successful; several hundred feet of coal measures having been found without reaching their base, but with several beds of workable coal. Fairly good reasons can be given both for and against the selection of many places for trial except in and near London, where no geologists would recommend it from evidence possessed. The area within which the borings that reach older rocks in the London basin is enclosed is an irregular pentagon formed by joining, in the order named, Dover, Richmond, Ware, Culford, Harwich, and Dover. The greatest distance between any borings is from Dover to Culford—about 86 miles. Therefore it is over a large tract that we have good reason to infer that older rocks are within reasonable distance of the surface, nowhere probably so much as 1600 feet, and mostly a good deal less. Outside this tract, several trial borings have been made. Near Burford, in Oxfordshire, carboniferous rocks, consisting of coal measures, have been found at a depth of 1180 feet, and pierced to a depth of 230 feet. In and near Northampton, carboniferous beds, older than the coal measures, have been found; and at Scarle, south-west of Lincoln, the older rocks have been reached at the depth of 1500 feet, beginning with the Permian—the carboniferous occurring after another 400 feet. These have been pierced for 130 feet.

Over a large part of South-Eastern England, reaching northward and westward of the London basin, though the older rocks are hidden by a thick mantle of Jurassic, cretaceous, and tertiary beds, they yet seem to be rarely at a depth that would be called very great by the coal miner. They are distinctly within workable depths wherever they have been reached. There is no area of old rocks at the surface in our island, south of the Forth, in which coal measures are not a constituent formation. It is not, however, to the more northern and distant tract—*i.e.*, north of the Forth—that we should look for analogy to our underground plain of old rocks; but rather to more southern parts, to Wales and to Central and Northern England, where coal measures are of frequent occurrence. There is no reason why we should not suspect a like occurrence of coal measures in detached basins, in our vast underground tract of old rocks. Certainly trials should be made to see if such hidden coal basins can be found.

The Dover boring has proved the presence of coal underground in Eastern Kent, along the line between the coal-fields of South Wales and Bristol on the west, and those of Northern France and Belgium on the east. The long gap between the distant outcrops of the coal measures near Bristol and Calais has been lessened very slightly by the working of coal under the Triassic and Jurassic beds near the former place, but much more by the French and Belgians, who have not only proved the extent of the coal measures beneath the Jurassic and cretaceous beds along their borders, but have largely worked the coal found. The Dover boring has still further lessened the gap. The Stutton boring cannot be said to be either a success or a failure as far as coal is concerned; but it is certainly a success in the matter of reaching the old rocks at a depth of less than 1000 feet.

Every boring is almost certain to afford some knowledge that may help in future work. A boring that may at first seem to be a failure, from striking beds older than the coal measures, may some day turn out otherwise. The coal-field along the borders of France and Belgium is sometimes affected by powerful and peculiar disturbances, by faults of comparatively gentle inclination (far removed from the usual more or less vertical displacements), which have thrown coal measures beneath older beds in large tracts. This was once a theory, but is no longer so, for much coal is now worked below the older beds that have pushed above the coal measures by the overthrust faults.

Another point to which attention has been drawn by Continental geologists is an apparent general persistence of disturbances along certain lines, or, in other words, the recurrence of disturbances in newer beds in those parts where earlier movements had affected older beds. So that, reasoning backward, where we see marked signs of disturbance for long distances in beds at or near the surface, there we may expect to find pre-existing disturbances of the older beds beneath. This, however, is a somewhat controversial question; and much remains to be done on it. But should it be proved as a general rule, it may have much effect on our underground coal. The question of the possibility of finding and of working coal in various parts of South-Eastern England is not merely of local interest; it is of national importance. The time must come when the coal-fields that we have worked for years will be more or less exhausted; and we ought certainly to look out ahead for others, so as to be ready for the lessening yield of those that have served us so well.

The above subjects were also referred to in two papers read by Mr. J. Francis, M.Inst.C.E., and Mr. F. W. Harmer, F.G.S., before the Geological Section.

The title of the paper by the first-named gentleman was "The Dip of the Underground Palæozoic Rocks at Ware and at Cheshunt." In it the author called attention to the fact that some geologists interested in ascertaining the lie of the ancient rocks beneath the eastern counties are doubtful whether reliance can be placed upon statements that have been made with regard to the dip of the rocks found in deep borings at

Ware and Cheshunt. He remarked that, though much time and money had been spent in obtaining the angles and directions of dip at these places, no description of the methods adopted had been published; and he now proposed to give a short account of what had been done.

The borings were undertaken by the New River Company, with the object of procuring water from the lower greensand. The bore-holes were accordingly put in hand; but, on reaching certain depths, it was seen to be hopeless to expect water from below the gault. Orders were about to be given for a cessation of the work, when a wish was expressed by certain geologists that endeavours might be made to learn the direction of the dip of the lowest stratum reached in each case. The Directors of the Company thereupon gave instructions for the necessary investigation to be made at their expense. A number of scientific men formed themselves into a committee to arrange the modes of procedure; and, under their advice, the various experiments were carried out.

Before the year 1872, a deep well and boring had been formed at Turnford. In 1874, arrangements were made for deepening this bore; and an iron tube, 24 inches in diameter, and nearly 1000 feet in length, was provided for conveying the expected supply of water to the surface. For some time the hole was sunk by the old system of breaking up the material with chisels. But in 1878, the method of boring by means of diamonds had been perfected; and it was then decided to obtain an early solution of the question by drilling, in this more expeditious way, a hole at Ware, six miles north of Turnford. In the end, however, the gault was pierced through at both places at about the same time. The author then described the method of boring through rock by the use of diamonds, and pointed out the advantages of the system; but he remarked that, though the exact angle of dip of the material passed through could be accurately ascertained, the rotation of the apparatus precluded all knowledge of the direction of the dip. Consequently, special means had to be devised for this purpose.

After making allusion to the disappointing results attained shortly before, at the boring carried out by the Metropolitan Board of Works at Crossness, and at that made by Messrs. Meux at Tottenham Court Road, particulars were given of the finding of the palæozoic rocks at Ware and at Cheshunt. The various appliances, magnetic or mechanical, either suggested or used, for obtaining the directions of the dips were described and illustrated by diagrams. The difficulties and temporary failures that occurred were referred to, as also the means adopted for obtaining complete corroboration of results. The conclusions arrived at were then stated. At Ware, at a depth of 828 feet below the surface, and 31 feet below the top of the stratum, the silurian rock dips at an angle of 41 degrees, and in a direction that is 1 degree west of south. At Turnford, at a depth of 994 feet below the surface, and 14 feet below the top of the stratum, the Devonian rock dips at an angle of 25 degrees, and in a direction that is 17 degrees west of south. It was pointed out that at both places these ancient rocks dip in directions lying between south and south-south-west; and by placing on a geological map of the south-eastern portion of England lines to show the ascertained bearings, it was demonstrated that the greatest inclinations of the strata were, roughly speaking, at right angles to the directions of the chief axes of the weald.

Attention was then called to statements made, without due authority, soon after the completion of the work, alleging that the general direction of the dips had been found to be towards the south-east—a misconception that it was desirable should be removed. It was mentioned that no trouble was spared to attain satisfactory results—more than a month having been devoted to the ascertainment of the direction of the dip at each place; while the composition of the committee was a guarantee that the methods employed were the best adapted for the purpose. With regard to the still more important question that the New River Company undertook to solve—viz., that of the existence or the non-existence of the lower greensand beneath the district north of London—it was contended that, considering the importance of the question, there was no reason for regretting the large expenditure thereby incurred. The results of the experiments might unquestionably be accepted as perfectly trustworthy.

The paper by Mr. Harmer dealt with the importance of extending the work of the Geological Survey of Great Britain to the deep-seated rocks by means of boring. He remarked that the systematic exploration of the subterranean geology of these islands is equally important from a scientific and a practical point of view. At present our knowledge of the structure of the rocks which form the foundation of our island home is due either to isolated and occasional borings or to deep wells sunk by mercantile firms. But the latter do not reach farther than is necessary to obtain a supply of water; and the work is generally suspended just where it becomes geologically most interesting. Such a survey, however, is important practically, because unsuspected sources of wealth may be hidden under our very feet. It is a mistake to suppose that a discovery such as that of a new coal field would enrich only the landowners of the district, because whenever any appreciation of real property takes place, the State at once claims its share of the increased value, both for Imperial and local purposes. The discovery of a new coal field would cause increased prosperity in the district in which it occurred; and from this the State, through taxation, would derive great, though indirect, advantage. The author expressed the opinion that the growing difficulty of finding employment for the ever-increasing population of these islands is a strong reason why the proposed survey should be undertaken. Part of the cost might, he suggested, be borne by the landowners under whose property any minerals were discovered. Certain districts should be selected with the consent of the local authorities, and parliamentary power taken to charge a royalty on any minerals obtained below a certain depth. Landowners would probably welcome proposals to make borings on their estates on such conditions. In the first instance, however, the subterranean limits of existing coal-fields, or mineral-bearing rocks, should be accurately mapped out; but trial borings should be undertaken in different localities, and each new boring would help to show more plainly the direction in which further investigations should be made. Much light would be thrown by such a survey on the circulation of underground waters—a matter of great practical importance. The expense of boring would be much reduced if undertaken on a large scale, as machinery and apparatus would be available again and again.

Additional Debenture Capital for the West Middlesex Water Company.—The tenders for £100,000 of 3 per cent. debenture stock of the West Middlesex Water Company (redeemable at par after the expiration of 25 years, on six months' notice), which were invited by the Directors a few weeks ago, were opened last Wednesday, with the following results: Highest tender accepted, premium £6 2s. 6d. per cent.; lowest, £5 3s. 6d. per cent.; average, £5 10s. 2d. per cent. The stock was tendered for more than five times over.

Testing a Brick Arch Roof.—The *Annales des Ponts et Chaussées* lately contained particulars of the testing of a brick arch roof at the water-works at Beaume. The works include a reservoir excavated in the rock, and covered by a brick vault of 13 feet span and 23½ inches rise, built of hollow bricks laid in mortar composed of 1323 lbs. of artificial cement to 1·3 cubic yards of sand. The arch was a circular segment composed of two rings of brick laid flat with 0·3 inch of mortar between, and covered with a layer of concrete 9 inches thick at the haunches; the whole being plastered with cement mortar ¾ inch thick. The vault abutted on "skewbacks" cut in the sides of the solid rock excavation, and a section of it about 2 feet long was tested six days after it was built by a symmetrically disposed load of cement-bags weighing about 10 tons. Half this weight was concentrated on about 3 feet at the crown, and the remainder was distributed evenly over the rest of the extrados. No cracks or settlement whatever were apparent after 18 hours' application of the load, which, however, was not increased, because "the handling of the sacks at the crown was sufficiently dangerous for the men."

The Relative Economy of Steam, Gas, and Petroleum Engines.—M. Lambotte, the chief of the technical department of the Société Anonyme Belge des Moteurs Economiques, has lately communicated to an association composed of former pupils at the Ecole de Liége some interesting comparisons between steam, gas, and petroleum engines, with special reference to the motors of the latter types which were on view at the Antwerp Exhibition last year. He adduces figures which show that the petroleum engine is the most economical up to 10-horse power; but beyond this the steam-engine is the better motor, when it is a question of long-continued work. If in that case it is desired to employ a gas-engine, the consumer will have to make his own gas. For 50-horse power, a day's work costs the same with producer gas or with steam; but in the neighbourhood of anthracite workings, the advantage would be in favour of the gas-engine. The conclusion arrived at by M. Lambotte is that this kind of motor has even now the highest economic coefficient; but it has not yet attained the 38 per cent. assigned to it by theory. Its improvement, according to him, lies in perfecting its cycle, and in making gas-generators more efficient.

The Economy of Incandescent Gas Lighting.—Dr. Schilling has furnished some particulars in regard to three installations of incandescent gas lighting in restaurants in Munich, for a year's working. In the first case cited, 26 lamps were in use; and 41 mantles were employed. The quantity of gas burnt was 5041 cubic metres (178,000 cubic feet). The number of lighting hours was 48,664; giving 1187 hours as the life of a mantle. The cost was 0·99c. per Carcel-hour. In the second case, there were 58 lamps; and 112 mantles were used. The consumption of gas was 16,979 cubic metres (600,000 cubic feet), extending over 156,091 lighting hours; the life of each of the mantles being 1394 hours. The cost was the same as in the preceding case. There were 32 lamps in use in the third restaurant; and they consumed 12,116 cubic metres (427,700 cubic feet) of gas during 111,391 lighting hours. As 78 mantles were employed, their life averaged 1428 hours each. The cost was 0·98c. per Carcel-hour. The mean illuminating power for the three installations was 3·23 Carcels (32 candles). In a business establishment in the city, having an installation of 27 lamps, the consumption of gas was 1071 cubic metres (37,800 cubic feet), extended over 9486 lighting hours. There were 37 mantles used; being at the rate of 266 hours per mantle. The average lighting power was 4·1 Carcels (40 candles); and the cost per Carcel-hour, 0·94c.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Oil-Gas Experiments at Bradford.

SIR,—In reference to the matters in Dr. Dvorkovitz's letter of the 20th of September, given in last week's JOURNAL, that relate to myself, I beg to remind him that on July 4, 1894, to the Bradford Corporation he promised to supply 105 cubic feet of 57½-candle power gas, or, in his own words, 1210 candles per gallon. The calculation really is $\frac{105 \times 57\frac{1}{2}}{5} = 1207\frac{1}{2}$. But he has evidently calculated his candles correctly, and then rounded off the result to an even number. On April 1, 1895, Dr. Dvorkovitz no longer employs the divisor 5; and his candles become five times too high. On April 8, 1895, he reverts to his candles of July, 1894, which are correct, and similar to those I employ (subject to the trifling correction I have mentioned above). He has since been in doubt, believing that his candles of April 1, 1895, which are wrong, might be wrong; but he is now inclined to the belief that his candles which are wrong are right. I have shown that he has no fixed idea of the value of a candle.

I would refer to his account of what it was my duty to do in respect to the carburetting arrangement at Thornton Road; but I find that Mr. Shaw, who is one of the owners, in a letter dated Sept. 20, and published in the *Bradford Observer* of the 21st, now declares that "the system of carburetting as arranged at Thornton Road is not part of our oil plant, but a suggestion of the Corporation Engineer."

Messrs. Newbigging, who are acting as the technical representatives of Mr. Isaac Smith and Mr. Shaw, have carefully avoided making any reference to the carburetting arrangement, either in their report of the 6th of August or in the letter of the 7th of September that was presented in leaflet form to the members of the Council at the meeting of the 10th of September. When it is quite settled among themselves as to who is responsible for that arrangement of carburetting, I may be willing to discuss the matter in detail with the gentleman who accepts the responsibility of the figures.

I notice that Dr. Dvorkovitz now admits that he stopped the first trial. That disposes of the previous statement, circulated and reported as having been said by him, that he "withdrew." I think it would be better for him to leave his technical advisers, Messrs. Newbigging, to deal with me. His remarks respecting what they say I said he must see are quite irrelevant, and cannot be taken notice of. When they say for themselves anything that is incorrect, I shall be able to answer them.

Dr. Dvorkovitz claimed 1210 candles, and I have found 1139 for the oil gas. Does the gas world believe that all this discussion relates to a matter of 71 candles per gallon of oil, or that it relates to an exaggeration of five? With a little patience, the matter will develop itself. Already there is a repudiation of the carburetting arrangement at Thornton Road.

I shall have occasion to revert to the subject of the Bradford oil-gas process at a later opportunity. In the meanwhile, I believe I have answered satisfactorily the points in Dr. Dvorkovitz's letter that relate to myself.

LEWIS T. WRIGHT.

1, *Victoria Street, Westminster, S.W.,*
Sept. 28, 1895.

[We have received, but too late for insertion in the present number of the JOURNAL, a letter on the above subject from Mr. Frank Wright. —ED. J. G. L.]

A New Gasholder at Spalding.—The new gasholder which has been erected at the Spalding Gas-Works was duly "opened" on Monday evening last week; the ceremony being performed by Mr. G. Hall, a member of the Gas Committee of the District Council. This is the third holder on the works; and it gives an addition to the storage of 162,000 cubic feet. The cost has been close upon £3000. During the past two or three years, the consumption of gas has largely increased in the town; and the output last year beat the record.

Shrewsbury Gas Company.—The annual meeting of this Company was held last Wednesday. The report for the year ending June 30 last stated that the available balance of profit is £3021; and the Directors recommended the authorized dividend of 7½ per cent. After paying this, £593 will remain to be carried forward. During the twelvemonth, there was an increase of 4¾ per cent. in the consumption of gas; and the unaccounted-for gas was 5·80 per cent. Coal contracts had been placed on more favourable terms than last year; and the Directors announced that they had made a further reduction in the price of gas of 3d. per 1000 cubic feet from the end of June. Reference was also made to the death of Mr. A. G. Brookes, who had been a Director since 1871, and Chairman from 1874 to 1893. The Chairman (Mr. J. S. Phillips), in moving the adoption of the report, stated that during the year an additional 486 tons of coal had been carbonized, as compared with the preceding twelve months; and 5·07 per cent. more gas had been produced from the coal—the improved results having been due principally to the generator furnaces now in use. The income from the sale of gas was £21,682, or £63 less than in the previous year. In spite of this, however, the Directors were able to further reduce the price. The amount of gas made was 142,672,000 cubic feet, as against 34,000,000 in 1863, when the Company commenced to pay a regular dividend. Alluding to the residuals, he mentioned that from tar they had realized the substantial increase of £525 by having entered into a contract for ten years; but against this must be set a decrease of £488 for sulphate of ammonia. Coal had cost £1991 more than in the previous year; and rents, rates, and taxes had advanced by £115. These latter payments now amounted to 16¾ per cent., which was equal to 1½d. per 1000 cubic feet of gas sold. In conclusion, he said the works were in the utmost state of efficiency, thanks to the able management of their Engineer and Secretary (Mr. W. Belton). The report was adopted; and subsequently the Directors' remuneration was raised from £175 to £300.

LEGAL INTELLIGENCE.

A Gas Collector Charged with Embezzlement.

At the Marylebone Police Court last Thursday, Thomas C. Lovell, aged 27, described as a labourer, of Gosberton, near Spalding, Lincolnshire, was brought up on a warrant, charged with stealing numerous sums of money, amounting in all to about £78, belonging to The Gaslight and Coke Company. Mr. R. Humphreys prosecuted. Evidence as to the arrest of the prisoner at Boston having been called, Mr. Tate, the Clerk, read the information laid by various witnesses upon which the warrant was issued for Lovell's detention. According to this, he was appointed by the Company as an automatic meter collector in 1894; a portion of his duties being to periodically collect the money in the meters, and pay it into the Brondesbury Branch of the London and South-Western Bank. A receipt for these amounts was at once forwarded to the head office of the Company. On the 17th of April, the Company received, by post, a banker's receipt for £53 10s., which was believed to be in the prisoner's own handwriting. The same day he should have reported himself at the head office, and rendered an account for the preceding week; but, as he failed to do so, one of the clerks called upon him, at his address in Purves Road, Kilburn, and asked for an explanation. He said: "I am in trouble; I cannot make up my money. I am about £15 or £16 short in my cash; and I cannot account for it at all." Subsequently, the prisoner's books were examined; and it was found that there was a total deficiency amounting to £78 16s. 9d. Shortly after the clerk called upon the prisoner, the latter left his house, and up till quite lately his whereabouts remained unknown. Mr. Curtis Bennett ordered a remand.

Reckless Waste of Water at Hanley.

Yesterday week, Elizabeth Wayte, an owner of property at Hanley, was summoned, at the instance of the Staffordshire Potteries Water Company, for causing a pipe to be so used that the water was wasted and unduly consumed. Mr. J. H. Knight appeared for the Company. The Chief Engineer of the Company (Mr. G. D. Harrison) stated that while engaged, on Sept. 6, in offices adjoining defendant's premises, he heard water running to waste. On investigation, he found, at the back of the house occupied by defendant, a tap running at full bore; and the water escaping from the slopstone into the drain. He told defendant that this was a most improper waste of the water; and she replied that her premises were so closed in by other buildings that it was necessary to leave the water running in order to clear the drains, and keep the place sweet. Mr. Harrison added that water was escaping at the rate of about 5000 gallons, or 22 tons, per day, which was ample to supply 500 persons. If 100 persons acted as the defendant had done, the entire supply of Hanley would run to waste. Mr. J. Warner, who appeared for the defence, did not dispute the facts, but pointed out that the defendant was entitled to use whatever water she required for domestic purposes; and he contended that the flushing of a drain was a domestic purpose. There was nothing, he said, in the Company's regulations forbidding the use of the water for such a purpose. The Stipendiary (Mr. H. Wright) held that there had been an undue consumption of the water, and fined defendant 20s., and 31s. 6d. costs.

On the same occasion, Alice Fresson, the wife of a drug dealer, was summoned for altering a service-pipe belonging to the Company without their consent, also with allowing the water to run to waste. It was stated that one of the Company's inspectors visited defendant's premises on Aug. 27; and in a closet he found that the service-pipe had been cut, pulled away from the wall, and turned into the pan, through which the water was running to waste at the rate of 60 or 70 gallons per hour. The attention of Mr. Fresson was called to the matter. But the same state of things existed when the inspector called the following morning; and he thereupon knocked the pipe up. Mr. G. H. Hunt, who appeared for the defence, said that, though Mrs. Fresson was the tenant of the premises, her husband carried on business there. He found that the water was escaping from a defective cistern, and sent for a plumber to repair it. It was the plumber who cut the service-pipe, and left it in the manner described. In answer to the Stipendiary, Mr. Hunt said the plumber was not present; and he had no witnesses to prove his statement. The Stipendiary said that, in the absence of such witnesses, the evidence clearly showed the defendant to be responsible; and this case was even worse than the last, as not only was water wasted, but the service-pipe had been improperly cut. Defendant was fined 20s., and 34s. costs.

New Machinery at the Malton Water-Works.—The Malton District Council have accepted a tender submitted by Messrs. Simpson and Co., of Pimlico, for a new steam pumping-engine for the waterworks at a cost of £920, subject to obtaining the sanction of the Local Government Board to a loan. The provision of a new engine will, it is stated, effect a saving of about £200 a year.

Water-Works Extensions at Spalding.—In their annual report, the Directors of the Spalding Water Company state that during the past year they have anxiously considered the best means of obtaining an increased supply of water. It had been intended to re-lay the supply main from Spalding in the direction of Bourne (from which place water is obtained); but the cost was found to be too heavy. Besides, the whole of the capital having been subscribed and the borrowing powers exhausted, the Directors say that it appeared to be impossible, without an application to Parliament to sanction an increase of capital, or sacrificing the entire dividend for some years, to raise sufficient funds to meet the heavy expense. They have now decided upon the erection of a pumping-station at Bourne, to cost about £1000, by which means the delivery of water at Spalding will be raised to 234,000 gallons in 24 hours. The Directors propose to pay a dividend of 6 per cent. for the past year.

MISCELLANEOUS NEWS.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

In the note to the letter by Dr. Dvorkovitz on the above subject which appeared in the last number of the JOURNAL, it was mentioned that he asked us to publish the first report to the Gas Committee of the Bradford Corporation by Mr. Lewis T. Wright, on his experiments with the oil-gas enrichment process at the Thornton Road station. This, as promised, we now do, together with the report of Mr. W. Wood, the Corporation Gas Engineer, on the working of the process from Feb. 4 to March 9, Dr. Dvorkovitz's remarks thereon, and other documents dealing with the subject.

Mr. Wright's First Report.

1, *Victoria Street, Westminster, S.W., Aug.* 1, 1895.

To the Chairman of the Gas and Electricity Supply Committee of the Bradford Corporation.

Sir,—The previous trial of the Dvorkovitz oil-gas process, commenced on the morning of July 3, 1895, under my observation, having been suddenly suspended by Dr. Dvorkovitz on the evening of the 4th of July, it was decided by your Committee, at the meeting held on the 5th of July, that a further trial should be carried out by the Corporation officials under my supervision, and that notice should be given to the owners of the process, who had nominated Mr. Newbigging as their representative. In accordance with that arrangement, the preliminaries having been completed, I commenced, on Monday, the 22nd of July, a trial in the presence of Messrs. Thomas Newbigging and Son. The investigation having been completed to my satisfaction, I now beg to place before you a report of the results obtained, and my opinion thereon.

One of the principal objects of this process is to "crack" the oils at a low temperature by exposing them to a large amount of heating surface of a moderate temperature; and another is to utilize the oil-gas tar (called by the inventor "bye-products") in the carburetting of coal gas for the purpose of raising its illuminating power. In this latter respect, it differs from some other modern oil-gas processes, which avoid the formation of any residual tar—a material that has not hitherto been able to command much value in the market; and in order to do this, the tar is continually and automatically returned to the retorts until completely carbonized into gas and coke. For this coke, which is remarkably pure, there is some demand for metallurgical purposes. Such processes, by gasifying a larger proportion of the oil, produce a larger volume of gas per ton of oil. It is claimed for the Dvorkovitz process that the oil-gas tar produced (bye-products) at a moderate temperature has a high value for carburetting and other purposes.

The plant does not contain any automatic arrangements for regulating the temperature of the retorts; this being effected by the manual control of the oil-cocks and the flue-dampers on the retort-setting. From what I have seen of the working of the retorts, I can say that the heats are well under control. The long run of superheating surface to which the vaporized oil is exposed, enables the cracking operation to be completed, according to the invention of the inventor, without the formation of obstinate obstructions in the retort connections caused by the accumulation of pitchy or carbonaceous substances. The absence of any notable quantity of carbonaceous deposit on the interior of the retorts is also an advantage, as it will add to the durability of them. In this process, quantity of gas is sacrificed in order to obtain an oil-gas tar containing a larger proportion of light oil, that might be valuable for the enrichment of coal gas when used as a carburetting material.

In order to arrive at the enrichment value of the oil gas produced in this process, it was important that the greatest care should be exercised, not only in the method of photometry employed, but also in the illuminating power determinations themselves. The method of photometry adopted was especially designed to neutralize any variations in any of the instruments employed as parts of the photometers, and also to make the tests on the coal gas and the enriched gas at the same times. The quality of the coal gas is continually varying within certain limits. The same remark applies to the quality of the enriched gas; and in order to avoid the possibility that by any chance a greater number of tests might fall on the coal gas when it was low in quality than on the enriched gas in the same condition, or *vice versâ*, I had previously decided to adopt only the method of making simultaneous tests on both the coal gas and enriched gas, and when the enriched gas tested should correspond to the coal gas that was being tested at the same times. The other method, of alternately testing the coal gas and the enriched gas in the same photometer, is open to the objection that the enriched gas tested does not actually represent the coal gas that has been tested, but the coal gas of other periods.

To carry out the simultaneous system of testing, it is necessary to employ two photometers; and as any part of these, such as the meters, or discs, or mirrors, or burners, &c., might have trifling deviations, it was decided to neutralize these by taking an equal number of tests of each kind of gas on each photometer. In this manner, on each run of twelve hours, there were taken twelve tests of each kind of gas; six tests of each kind being made on No. 1 photometer, and six on No. 2 photometer. Between the third and the fourth, the sixth and the seventh, the eighth and the ninth tests, the gases were reversed on the photometers—an hour being allowed on each change for the gas to become normal on the photometers.

The burner employed was the 15-hole Argand, fitted with a 7-inch chimney, and consuming the gas at the rate (uncorrected) of 5 cubic feet per hour, as prescribed in the Special Act of Parliament. To have adopted any other burner or rate of consumption would have been to throw the results out of accord with those hitherto obtained in Bradford. In recording these results, I call your attention to the mode of testing, in case you should have occasion to compare them with those obtained in other places with other burners. It is a general practice to state the enrichment values of any material in this manner, which is, strictly speaking, the enrichment effect produced on the burner consuming each quality of gas—both the coal gas and the enriched gas—at the same rate; and as it frequently happens, as in this case, that the burner with length of chimney employed is more severe upon gas of a low quality (say 15 or 16 candles) than upon gas of 18 candles, when burning at the rate of 5 cubic feet per hour, it follows that the enrichment value of the oil gas obtained is more than that which would be obtained from direct tests upon the oil gas employed; and the expression "enriching value" is employed to distinguish the results obtained in this manner of testing both qualities of gas in the same burner and at the same rate of consumption.

I made a series of tests at Bradford in order to determine the efficiency of the burner and chimney employed with various flame-values. This matter is more of scientific than of practical value in the present case, as the position of a gas undertaking having in its Act of Parliament a prescribed system of testing is that of desiring to know what effect a certain proportion of enriching material has in improving the light in the burner used in the manner prescribed in the Act; and for that reason I think it better not to depart from the custom. All the photometric results are corrected to 5 cubic feet of gas at 60° Fahr. and 30 inches barometer. They are, I consider, highly satisfactory.

From the *résumé* of the three 12-hour runs, it will be observed that the cost of enrichment is 0·76d. per 200 candles; that being the amount required to raise 1000 cubic feet of gas by one candle per 5 cubic feet. Referring to the calculation of the cost of enrichment, it will be noted that the total quantity of oil used in the three runs was 433 gallons (corrected to 60° Fahr.). The specific gravity of the oil was ·8866; and one ton will contain 252·6 gallons. At £4 per ton, delivered in Bradford, the cost of the oil is 3·8d. per gallon.

Wear and Tear.—This I estimate at 4d. per 1000 cubic feet of oil gas produced.

Gas added to the Bulk.—It is necessary to credit the process with the value of the 30,167 cubic feet of gas added to the bulk. To this item I would draw your attention, as it is an important factor in reducing the cost of enrichment. I have calculated the value of this from the cost of gas into the gasholders at Bradford during the three years 1891 to 1893, when the quality was 18·83 candles. The average cost during these three years was 14·5d. per 1000 cubic feet; and the value of the increase of bulk of gas of 17·74 candles per 5 cubic feet is taken at 13·66d. per 1000 cubic feet.

Oil-Gas Tar.—The value of this residual is determined from its value as a carburetting material, and that of the residue left from this operation as an article of sale.

Carburettor Trials.—The oil gas used in the carburettor was the quality condensed out from the oil gas in the condensers attached to the retorts. It has a specific gravity of 1·011 at 60° Fahr. In the first trial, on the 25th of July, 400 lbs. (equal to 39·56 gallons) were weighed into the carburettor, which is heated by the exhaust steam from the exhauster engine that drives a portion of the coal gas to be enriched through the carburettor. The tar in a short time commenced to boil. The carburettor is virtually a tar-still, and is provided with a condenser, through which the gas, supersaturated with the vapours boiled from the oil-gas tar, passes on its way to the gas-main. In this condenser the oils re-condense, and are again returned to the carburettor to be re-distilled and re-condensed. The specific gravity of the oils running from the condenser on the first trial was ·900. At the end of three hours, it was apparent that, though the oils were distilling rapidly and condensing in the condenser, there was no further enriching effect on the coal gas. The trial was then stopped; and it was found that the tar remaining (including the oil that drained back from the condenser) weighed 338⅝ lbs., and, having a specific gravity of 1·056, was equal to 32·06 gallons. The loss had therefore been 7·5 gallons. The quantity of gas enriched was 88,000 cubic feet of 16·80 candles, increased to 17·46 candles per 5 cubic feet corrected, or an increase of 0·66 candle per 5 cubic feet. This is equal to an enriching value per gallon of oil-gas tar, of—

$$\frac{88{,}000 \times 0{\cdot}66}{5 \times 39{\cdot}56} = 293{\cdot}6 \text{ candles.}$$

If the enrichment be calculated on the 7·5 gallons of oil vaporized, it gives a value of 1548 candles per gallon.

This oil-gas tar, in its crude form, is not, in my opinion, a desirable material for carburetting purposes. In this process, the coal gas is being continually exposed to a stream of the condensed oil, and it is impossible not to doubt that some of its illuminants will be washed out; and though a portion of these may be recovered at each re-distillation, it is very likely that, in the varying circumstances of practice, this may not always be the case. For the sake of such a small amount of enrichment, it would be better not to use the oil-gas tar in this manner, but to have it distilled and the lighter portions fractionated, in order to recover those oils that are suitable for carburetting, and that will vaporize and remain in the gas in one passage through the carburettor. However, valuing the oil-gas tar from the result obtained (calculation attached), I find that it is worth 1·71d. per gallon.

A trial of the carburettor on the 26th of July, conducted on the lines previously adopted, and running the oil-gas tar through the carburettor at the rate of 4·17 gallons per hour, gave an enrichment of only 0·09 candle per 5 cubic feet (*vide* photometric tests). This trial was carried out on the suggestion of the representatives of the process. The tar from the bench pots I value at ¾d. per gallon. The oil-gas tar produced in this process cannot be added to the stock of coal tar, and sold with that article, without arrangement with the contractor for the tar. Oil-gas tar differs in many respects from coal tar, and is not regarded by the tar distillers as having the same value.

In order to compare the results of this inquiry with those obtained at other places, it will be, of course, requisite to ascertain that they have been arrived at in the same manner, and that the same allowance for gas added to bulk has been made; and therefore, before results given for other localities can be compared with this, they must be compared on the basis of the circumstances obtaining in Bradford. In any case, I have no doubt that the use of oil will show an economy over cannel coal as a material for enrichment.

In conclusion, I would add that, during the tests, both Mr. Charles Wood and Mr. Sutcliffe, the Superintendent of the Thornton Road works, spared no pains in providing me with the means of conducting the tests and facilitating my inquiries.

(Signed) LEWIS T. WRIGHT.

Résumé of Three 12-Hour Runs of the Dvorkovitz Oil-Gas Process as Installed at the Thornton Road Gas-Works, Bradford.

Date. 1895.	Coal Gas Made, Cubic Feet, Corrected.	Oil Gas Made, Cubic Feet, Corrected.	Oil Used, Gallons, Corrected.	Cubic Feet Oil Gas per Gallon.	Illuminating Power in Sperm Candles per 5 Cubic Feet.			Candles. of Enrichment per Gallon of Oil.	Tar Made.			Coke Used Cwt.	Cost per 200 Candles.
					Coal Gas.	Enriched Gas.	Difference.		Condensers Gals.	Bench Pots. Gals.	Per Cent. on Oil.		
July 22 .	336,750	7,356	113·85	64·6	15·82	17·47	1·650	1202	36·50	8·7	39·7	6½	
„ 23 .	339,147	8,914	127·00	70·2	15·80	17·46	1·660	1132	37·75	4·0	32·9	6½	
„ 24 .	337,484	13,897	192·15	72·3	15·88	18·28	2·400	1107	65·00	3·0	35·4	6½	
Summary	1,013,381	30,167	433·00	69·7	..	..	1·903	1139	139·25	15·7	35·0	19½	0·76d.

Cubic feet of gas made per ton of oil = 17,599.

Cost of Enrichment by the Dvorkovitz Process.

	Pence.
Oil, 433 gallons, at 3·8d.	1645·40
Labour, 1½ days, at 15s.	270·00
Coke, 19½ cwt., at 7s. 6d. per ton	87·75
Wear and tear, 30,164 cubic feet, at 4d. per 1000 feet	120·67
Salaries, at 0·12d. per 1000 feet	3·62
	2127·44
	661·42
Cost of 385,716 candles.	1466·02

	Pence
Gas added to bulk, 30,167 cubic feet, at 13·66d. per 1000 feet	412·08
Tar, 139¼ gallons, at 1·7d. per gallon	237·57
Tar from bench pots, 15·7 gallons, at 0·75d.	11·77
	661·42

Cost per 200 candles, or cost of enriching 1000 cubic feet of gas by 1 candle per 5 cubic feet is—

$$\frac{1466{\cdot}02 \times 200}{385{,}716} = 0{\cdot}76\text{d.}$$

Statement of Candles (120 *grains sperm*) *Obtained from* 433 *Gallons of Oil.*

Coal Gas.						Candles.
336,750 cubic feet enriched by	1·65	candles per	5	cubic feet		111,127
339,147 „ „	1·66	„	5	„		112,597
337,484 „ „	2·40	„	5	„		161,992
1,013,381						385,716

Statement of the Candles in the Volume of Gas added to the Bulk.

7,356 cubic feet at	17·47	candles per	5	cubic feet	25,702	
8,914 „	17·46	„	5	„	31,128	
13,897 „	18·23	„	5	„	50,807	
30,167						107,637
Total						493,353

493,353 ÷ 433 = 1139 candles per gallon of oil.

$$\frac{\text{Candles . } 385{,}716}{\text{Cubic feet } 1{,}013{,}381} = 0{\cdot}3806$$ candle enrichment per cubic foot of coal gas, or 1·9030 candle per 5 cubic feet of the 1,013,381 cubic feet of coal gas enriched.

Value of Oil-Gas Tar for Carburetting.

[Carburetting trial of July 25, 1895.]

400 lbs., or 39·56 gallons, of oil-gas tar (1·011 sp. gr.) carburetted 88,000 cubic feet of coal gas 0·66 candle per 5 cubic feet.

Total candles enriched $\frac{88{,}000 \times 0{\cdot}66}{5} = 11{,}616$ candles.

Candles per gallon 11,616 ÷ 39·56 = 293·6 „

Value of 293·6 candles at ¾d. per 200 (*i.e.*, 1000 cubic feet of gas enriched by 1 candle per 5 cubic feet)—

$$\frac{293{\cdot}6 \times 0{\cdot}75}{200} = 1{\cdot}10\text{d.}$$

Value of residue after being spent for carburetting.

Residue was 338¾ lbs. of 1·056 sp. gr., or 32·05 gallons, or 32·06 ÷ 39·56 = 0·81 gallon per gallon of original tar, at ¾d. . . . . 0·61

1·71d. per gal. condensed tar.

Photometric Tests—Oil-Gas Enrichment.

[Results given in sperm candles per 5 cubic feet.]

Enriched Gas.	Coal Gas.	Enriched Gas.	Coal Gas.	Enriched Gas.	Coal Gas.
July 22, 1895.		July 23, 1895.		July 24, 1895.	
18·30	15·62	15·03	13·26	17·88	15·51
18·72	16·79	17·11	14·93	17·14	15·20
18·18	16·14	18·17	16·65	19·49	15·85
17·32	16·13	17·18	14·65	17·46	15·50
17·78	16·08	17·20	14·89	17·99	15·47
18·61	17·59	18·08	16·32	17·77	17·05
17·93	15·95	18·07	16·07	18·93	16·84
16·88	15·01	17·39	15·75	19·14	17·30
16·43	14·31	18·33	17·80	18·33	15·10
15·62	14·50	17·69	16·26	18·16	15·13
17·34	16·24	17·59	16·43	19·01	16·25
16·48	15·42	17·73	16·61	18·13	15·34
Aver. 17·47	15·82	Aver. 17·46	15·80	Aver. 18·28	15·88
Difference—sperm candles per 5 cubic feet, 1·65.		Difference—sperm candles per 5 cubic feet, 1·66.		Difference—sperm candles per 5 cubic feet, 2·40.	

Photometric Tests Taken during Trials of Carburettor.

Coal Gas.	Enriched Gas.	Coal Gas.	Enriched Gas.
July 25, 1895.		July 26, 1895.	
17·23	17·23	17·18	17·57
15·54	15·73	16·17	17·00
16·10	17·60	15·60	16·05
16·26	17·55	15·63	15·19
17·70	18·30	17·91	17·33
17·97	18·34	16·17	16·04
Aver. 16·80	17·46	Aver. 16·44	16·53
Difference, 0·66.		Difference, 0·09.	

All tests are corrected to 60° Fahr. and 30 inches barometer.

Mr. Wood's Report on the Working from Feb. 4 to March 9, 1895.

Gas Office, Bradford, March 28, 1895.

To the Gas Committee of the Bradford Corporation.

Gentlemen,—I beg to submit my report on the working of the Dvorkovitz oil-gas plant at Thornton Road works, from Feb. 4 to March 9.

The plant ran continuously for the 33 days; the first half of the test being made in very cold weather. During this period we used 55 tons 1¾ cwt., or 13,910 gallons, of oil; being an average of 421 gallons per 24 hours. The meter registered 948,000 cubic feet of oil gas, at an average temperature of 43° Fahr. and 29·67 in. barometric pressure. This is at the rate of 68·15 cubic feet per gallon, or 17,209 cubic feet per ton of oil; or when corrected to the standard temperature and pressure, 70·19 cubic feet per gallon, and 17,725 cubic feet per ton. The quantity of coal gas made during the same time was 41,125,000 cubic feet; and the 948,000 cubic feet of oil gas added amounted to 2·25 per cent. of the total. Altogether, 5190 gallons of bye-products were made, equal to 37·31 per cent. on the oil used. Of these, 991½ gallons were used for carburetting; and we have left 4198½ gallons, or 18 tons 16 cwt., equal to 30·18 per cent. by volume, or 34·17 per cent. by weight, on the quantity of oil used.

The expenses of working are about the same as stated in my last report. [See JOURNAL, Vol. LXV., p. 329.] Three men per 24 hours have done all the work, except pumping and measuring the oil and bye-products. This has now to be done by hand; but, of course, in permanent plant, a small steam-pump would do all this at a very slight cost. During the test, we only used 17 cwt. of coke per 24 hours; so that an allowance of 20 cwt. per day would be ample.

The value of the bye-products is an important item in calculating the actual cost of enrichment by this process. A sample was sent to Messrs. Read Holliday and Sons, of Huddersfield; but their tests do not help us very much to determine the value of the bye-products. We are only able to use 19 per cent. of the total bye-products for carburetting; and I do not think that, in regular working, we could use much more than this proportion, unless the bye-products were partially separated by distillation.

The oil gas, as made, was mixed with the coal gas at the outlet of the station meters; and, during the whole time, the illuminating power of the coal gas and of the mixed gas was tested as frequently as possible—420 photometer tests being made. The average illuminating power of the coal gas alone during the experiment was 15·16 candles; and that of the mixed gas, after carburetting, taken from the inlet of the holder, was 17·32 candles—giving an increase of 2·16 candles. This shows the oil gas, including the bye-products used for carburetting, to have an average enriching value of 111 candles. From the 991½ gallons of bye-products used for carburetting, 623¼ gallons were taken up by the gas, and 368¼ gallons of heavy tar left. As the result of the 33 days' test, we have therefore, per 100 gallons of oil, an average net yield of 6815 cubic feet of 111 candles enriching power, 30·18 per cent. of bye-products, and 2·64 gallons of tar. In order to test to what extent we can enrich with the bye-products, it would be best to get a few tons distilled. We could then experiment with the benzol obtained from them.

The oil cost us 4⅛d. per gallon; but a contract for a quantity could be made at less than this price, as now the carriage from London to Bradford alone cost 1¼d. per gallon. It is better to calculate the cost into the holder in each case, as the depreciation of the rich gas when stored depends principally upon the changes of temperature. Under similar conditions, we have found it to be less in the case of oil-gas enrichment than with the gas enriched by cannel. A photometer was fixed at Lidget Green; and a large number of tests made daily showed that the Thornton Road gas had not lost in illuminating power in travelling 1¾ miles from the works.

The cost of working may be taken as follows:—

420 gallons of oil, at 4⅛d.	£7	4	4½
20 cwt. of coke, at 7s. 6d.	0	7	6
Three men, at 5s.	0	15	0
Interest, wear and tear—say, 15 per cent. on £750 (300 working days per annum)	0	7	6
Total cost	£8	14	4½

Total cost brought forward £8 14 4½

If bye-products are valued at 6d. per gallon, then—

126 gallons at 6d. 3 3 0

£5 11 4½

And the cost of enrichment per candle-thousand—

$$\frac{£5\ 11s.\ 4\tfrac{1}{2}d.}{420 \times 68{\cdot}15 \times 111} = 0{\cdot}42d.$$

If the bye-products are only worth 4d. per gallon, the cost will be—

$$\frac{£6\ 12s.\ 4\tfrac{1}{2}d.}{3{,}177{,}000} = 0{\cdot}5d.$$

A fortnight's test has since been made at Thornton Road, to determine the cost of enrichment with cannel. In estimating this, the chief difficulty is to get the actual illuminating power of the gas from the coal alone, as the gas from both the coal and cannel is mixed in the retort-house. As the fairest way of arriving at this, we have taken the mean of the average tests of the coal gas made the week before the said fortnight. This gives the coal gas as 15·67-candle power, and certainly favours the cannel enrichment, as the coal gas would probably be better than this during the test, owing to the warmer weather which prevailed. The average illuminating power of the mixed gas at the inlet of the holder during the fortnight was 18·16 candles; being an increase of 2·49 candles, to obtain which 25 per cent. of cannel was used. The average price of cannel was 13s. 4½d.; and of the coal, 9s. 8¾d.—a difference of 3s. 7¾d. per ton. Although our present selling price of the coke and breeze from cannel are relatively higher than usual in comparison with the price of coke from coal, at these rates the value of the products from a ton of cannel is 2s. 11d. less than that of those from a ton of coal. The quantity of gas produced per ton, and the expenses of working either coal or cannel, are practically the same; so that, altogether, to enrich 10,000 cubic feet of gas by 2·49 candles cost 25 per cent. of 3s. 7¾d. + 2s. 11d. = 19·67d., or 0·79d. per candle-thousand.

The cost of cannel enrichment, as above estimated, is perhaps smaller than it has ever been previously in Bradford, and is due to the exceptionally low price of cannel in comparison with coal, and to the relatively high price which we now charge for cannel coke, but which, if we continue using cannel, probably cannot be maintained.

The annual make of gas at Thornton Road is about 350 million cubic feet; and, with the quality of coal now in use, requires about 2¼ candles enrichment in order to supply 18-candle gas. Assuming that this can be done by cannel at 0·79d. per candle-thousand, this will amount to £2592 per annum; while if done by oil gas at 0·5d., it would cost £1640, or a saving of £950.

(Signed) W. Wood.

Dr. Dvorkovitz's Reply to Mr. Wood's Report.

London, April 1, 1895.

To the Gas and Electricity Supply Committee of the Bradford Corporation.

Gentlemen,—According to your decision of the 28th of March, I beg to submit to you my remarks on the report of your Engineer about the working of the oil-gas plant at the Thornton Road Gas-Works.

First, I will point out that the test of the oil gas has been made in abnormally cold weather, during which period the illuminating power naturally showed a considerable falling off. The test of cannel gas was made in ordinary weather, and, as a matter of course, showed more favourable results. It will, therefore, be very unfair to base any comparison upon the exceptional results of the oil-gas tests during the first two weeks in February, as we were quite unprepared to cope with the difficulty; and the ordinary coal gas then showed a much greater falling off in illuminating power. As soon as arrangements were made for covering the condensers with a non-conductive felt, the oil gas at once resumed its normal candle power.

I will ask you, therefore, to base your decision upon the three weeks' working from the 18th of February to the 9th of March. The result will then be as follows: 8241 gallons of oil were used, and 575,790 cubic feet of oil gas produced, or 17,709 cubic feet per ton; the quantity of coal gas made during the same time being 23,197,420 cubic feet, of which there have been enriched—

9,156,000 cubic feet by	2·43 candles	=	22,249,080	feet-candles.
8,484,000 „	2·39 „	=	20,022,240	„
5,557,000 „	2·41 „	=	13,392,370	„
			55,663,690	„

Apart from this, there has been added *to the bulk* 575,790 cubic feet of gas with an average candle power of 17·83. Therefore the total feet-candles produced from the 8241 gallons of oil is—

(1) Feet-candles added to the coal gas	55,663,690
(2) 575,790 cubic feet of gas added *to the bulk* of 17·83-candle power	10,266,336
	65,930,026

In regard to the value of the bye-products, my previous experiments have shown the maximum amount of candles produced from 1 ton of oil in the form of oil gas alone does not exceed 1,785,000 candles; therefore the 8241 gallons of oil used could produce only 58,012,500 candles, and the difference between this figure and the total feet-candles produced as above—viz., 7,917,526 candles—is derived solely from the 581 gallons of bye products which have been used in the carburettor; representing 13,640 candles per gallon of bye-products used, or twice the candles received from the original oil. This fixes the value of the bye-products at considerably over 6d., irrespective of the value of the tar left.

The next point is the price of the material. As Mr. Wood states, the oil used was sent by rail from London at an expense for freight of 1¼d. per gallon, increasing the price to the exceptional figure of 4½d. This, of course, is not the route which would be adopted for the delivery of a contract supply in Yorkshire. There will be no difficulty in delivering the oil in Bradford at 3¾d. per gallon; in fact, I am prepared to contract to do so. I may remind you that Scotch oil has been invoiced to you as low as 3d. per gallon. While, however, Mr. Wood charges the oil at an exceptional price due to exceptional circumstances, he bases his price for cannel coal at a figure which he is bound to admit is so low that it cannot be relied upon. In this connection, I may call your attention to my offer of the 27th of February to charge you 4d. per gallon for the oil, and allow 6d. per gallon for the bye-products; leaving the cost of the oil actually used for enrichment at 2⅝d. per gallon.

Mr. Wood, in speaking of the added candle power, has overlooked the fact that it is impossible by this process to add candle power *without also increasing the bulk*. I have given you, by my plant, not only the added candle power to the coal gas which has been enriched, but also 575,790 cubic feet of additional gas having the same illuminating power as the enriched gas. Mr. Wood has also omitted to credit my process with 221 gallons of tar left after carburetting with the 581 gallons of bye-products, to which, though not a large item, I am entitled.

With respect to the cost of enrichment by cannel coal, Mr. Wood makes a calculation based upon a comparison between coal gas and cannel gas, stating that the cost of working the two is practically the same, but omits to point out that, when cannel gas comes into competition with the oil gas, it stands at a great disadvantage as regards labour, fuel, wear and tear, and extra purifying. I am unable to account for the extremely low price of cannel upon which Mr. Wood bases his calculation. Your last year's report gives 16s. as the average of 1894; while he takes 13s. 4½d. as the figure. You will be able to judge from your local knowledge whether this reduction is likely to be permanent. I myself should feel inclined to agree with Mr. Wood that this is indeed extremely doubtful; and I prefer to accept his previous estimate of 1d. per candle per 1000 cubic feet as the probable future average cost of enrichment by cannel.

I therefore feel justified in asking you to empower your Engineer to embody in his report the corrected facts and figures which I append in tabulated form, and from which it is clearly seen: (1) That the cost of enrichment by oil gas per candle per 1000 cubic feet is 0·27d., and not 0·42d. as Mr. Wood calculated. (2) That the average cost of enrichment by cannel coal is not less than 1d. per candle per 1000 cubic feet. (3) That the cost of enrichment of 350 million cubic feet of coal gas (yearly production at the Thornton Road Gas-Works) by 2¼ candles will be, by my process, £885, and by cannel coal £3281, *or a net saving of £2396 per year by adopting my process.*

(Signed) P. Dvorkovitz.

Table I.—*Cost per Candle Enrichment at the Thornton Road Gas-Works from Feb.* 18 *to March* 9, 1895.

8241 gallons of oil, at 3¾d. per gallon		£128 15 4
16 tons of coke, at 7s. 6d. per ton (17 cwt. per 24 hours) . .		6 0 0
Labour, 19 days (three men, at 5s. per day)		14 5 0
Interest, wear and tear—say, 15 per cent. on £750 in 19 days, at 7s. 6d. per day		7 2 6
		£156 2 10
Less—		
Cost of bye-products, which, as it is proved by enrichment, produce exactly twice as many candles per gallon as the oil itself, and therefore their value is not less than 6d. per gallon. The net amount has been 30·18 per cent. of the oil used, or 2538 gallons, at 6d. per gallon	£63 9 0	
38 per cent. of 581 gallons, or 221 gallons of tar left after enrichment, at 2d.	1 16 10	
575,790 cubic feet of gas of 17·86-candle power added to the bulk in the holder, at 1s. per 1000 cubic feet	28 15 9½	
		94 1 7½
Net cost of 55,663,690 feet-candles		£62 1 2½
Or 0·27d. per candle enrichment per 1000 cubic feet.		

Table II.—*Cost per Candle Enrichment at the Thornton Road Gas-Works for Thirty-three Days' Continuous Working from Feb.* 4 *to March* 9, 1895 (*Based on Mr. Wood's Report*).

13,912 gallons of oil, at 4⅛d.		£239 1 6
28 tons 1 cwt. of coke (17 cwt. per 24 hours), at 7s. 6d. . . .		10 10 6
Labour, 33 days (three men, at 5s. per day)		24 15 0
Interest, wear and tear—say, 15 per cent. on £750 in 33 days, at 7s. 6d. per day		12 7 6
		£286 14 6
Less—		
4198 gallons of bye-products, at 6d. per gallon	£104 19 0	
368 gallons of tar left after enrichment, at 2d. .	3 1 4	
976,440 cubic feet of gas of 17·32-candle power added to the bulk in the holder, at 1s. per 1000 cubic feet	48 16 5	
		156 16 9

41,125,000 cubic feet of coal gas enriched from 15·16 to 17·32 candles, or by 2·16 candles; net cost per candle enrichment of 1000 cubic feet, 0·35d.

Mr. Shaw's Letter to the "Bradford Observer."

In continuation of previous correspondence, Mr. W. W. Shaw has addressed to the *Bradford Observer* the following letter, for the purpose of drawing comparisons between the cost and productive capacity of several processes mentioned by a previous correspondent (Mr. J. Cowgill),*

* It is unnecessary to reproduce the whole of Mr. Cowgill's letter. He gave therein certain figures gathered from the reports of corporations who have adopted processes of enrichment by oil; and these are criticized by Mr. Shaw. They are as follows:—

	No. of Candles per Ton of Oil.
The Huddersfield oxy-oil process, from an oil at £3 per ton and 2s. 6d. royalty; being a total of £3 2s. 6d. per ton .	3,190,000
The Peebles process, from an oil at £3 per ton and 2s. 6d. royalty; being a total of £3 2s. 6d. per ton	2,112,000
Mr. Isaac Smith's process, from an oil at £4 per ton, free of royalty	1,443,000

Mr. Cowgill asked if, in the face of these results, the members of the Corporation could consistently vote for Mr. Smith's process being adopted at all the gas works, until the Gas Committee had had the others tested by as stringent a method as that to which Mr. Smith's had been subjected.—Ed. J.G.L.

and of discussing the circumstances connected with the offer in regard to the Dvorkovitz process now before the Corporation :—

Sept. 20, 1895.

To the Editor of the *Bradford Observer*.

Sir,—The Huddersfield and Peebles processes are each worked with Scotch oil, costing £3 10s. per ton delivered in Bradford. The Dvorkovitz process is worked with Russian solar oil, costing £4 per ton delivered in Bradford. The following calculations are based upon the official figures of the Corporation's Gas Engineer as the results of the 33 days' test in February and March, 1895 :—

Cost of Enrichment per Candle for every 1000 *Cubic Feet o Gas Enriched by the Dvorkovitz Process :—*

55 tons 1 cwt. 3 qrs. of Russian oil, at £4 per ton				£220	7	0
28 tons 1 cwt. of coke, at 7s. 6d. per ton				10	10	6
Labour, 33 days (three men, at 5s. per day)				24	15	0
Interest, wear and tear—15 per cent. on £750 for 33 days, at 7s. 6d. per day				12	7	6
Gross cost				£268	0	0
Less—4198½ gallons of bye-products, at 4d. per gallon	£69	19	6			
368 gallons of tar left after enrichment, at 1d. per gallon	1	10	8			
976,440 cubic feet of gas of 17·32-candle power added to bulk, at 1s. 1½d. per 1000	54	18	6			
				126	8	8
Net cost				£141	11	4

41,125,000 cubic feet of coal gas were enriched by 2·16 candles . . . . . 8,883,000 candles.

Or—

Net cost per candle enrichment, with bye-products at 4d. per gallon . . . . . 0·383d.
Taking the bye-products at 3½d. per gallon. . . . . 0·406d.
Or at Mr. Wright's valuation of 1¾d. per gallon . . . 0·488d.
Or still under ½d. per candle.

Notes.—The Russian oil was delivered to The Gaslight and Coke Company at Beckton in 1894 at £2 17s. per ton, and was invoiced by them to Bradford at £2 19s. 4d. per ton (carriage to add). As the carriage from Liverpool to Bradford is only 10s. per ton, the oil could be obtained under £4 per ton.

Illuminating Capacity of the Dvorkovitz Process per Ton of Oil Used.

55 tons 1 cwt. 3 qrs. of oil, at £4 per ton				£220	7	0
Less—Bye-products left (30·18 per cent.), 4198½ gallons, at 4d.	£69	19	6			
Tar left after enrichment, 368 gallons, at 1d.	1	10	8			
				71	10	2
				£148	16	10

55 tons 1 cwt. 3 qrs., at £148 16s. 10d. . . . . £2 14s. per ton.

Candle power as certified by the Bradford Gas Engineer—

Dvorkovitz process (17·209 × 111), 1,910,000 candles per ton of oil. . . . . at £2 14s. per ton.
Peebles (on Mr. Cowgill's statement), 2,112,000 candles per ton of oil. . . . . at £3 12s. 6d. per ton (including royalty).

Notes.—In Mr. Cowgill's estimate of 1,443,200 candles, no account is taken of the bye-products either as such or in the shape of gas. His figure of £3 per ton for Scotch oil is too low.

It is impossible to bring the Huddersfield process into comparison, as no independent figures are available, and we have only the interested statements of the owners and officials to refer to. The process has not been adopted by any gas company outside of Huddersfield, nor by any other corporation or public body. It is condemned by several of the best engineers in the country; and doubts are expressed whether the proprietors of the Peebles process would not step in to prevent its general adoption. Efforts to introduce it at Halifax have failed.

In support of the Dvorkovitz process, we can refer to the results of 33 days' test, as shown in the official report of the Corporation's Gas Engineer. [The writer then quotes from Mr. Wood's report, already given, the portions commencing at the second paragraph, and ending with the words "quantity of oil used;" and from the words "The oil gas as made," down to "now the carriage from London to Bradford alone costs 1½d. per gallon."]

It is thus shown that the cost of enrichment after a practical demonstration day and night in the keenest frosts of February last was between one-third and two-fifths of a penny per candle. This is reckoning oil at full price, and bye-products at less than Mr. Newbigging's valuation; while if we take the bye-products at Mr. Wright's valuation of 1¾d. per gallon, the cost still comes out at under ½d. per candle. We are, however, prepared to give double that amount (say, 3½d. per gallon); and on that basis the cost of enrichment would be only two-fifths of a penny. When suitably treated as part of the enrichment process, we consider them worth to the Corporation 4¾d. per gallon; and Mr. Dixon himself has frequently stated that he would heartily advocate the Dvorkovitz process, and (in his own words) would be "its best friend," if the cost came out at ½d. The results tabulated above give the actual candle power of the gas supplied, and were corroborated by independent tests made by Mr. Dixon's instructions about a mile from the works. The bye-products can be prepared for carburetting without causing either smell or nuisance.

For the Huddersfield process in July, 1894, the cost of enrichment by cannel was taken at 1½d. per candle, equal to £15,625 per annum, for 1500 million cubic feet made and enriched by 2 candles; and a contract was proposed to be made with Bradford on this basis. The Corporation Gas Engineer, in his report of July 4, 1894, estimated the cost of enrichment by cannel coal as being only 1d. per candle, or £12,500 per annum.

If the cost of enrichment by the Dvorkovitz process is taken at two-fifths of a penny, as shown above, and based on the results of the 33 days' test, the annual cost of oil enrichment from 16 to 18 candles would be £5000 per annum; showing an annual saving for the borough over cannel coal of £7500 or £10,500, according to whether the cannel cost is taken at 1d. or 1½d. per 1000 feet. This shows Mr. Smith's statement of an annual saving of £6000 to be well within the mark.

The Huddersfield terms, when their process was offered to Bradford in 1894 for Valley Road alone, involved payments for royalties, &c., of £1562 10s. per annum, equivalent to £4687 10s. per annum for the whole borough. Giving the Huddersfield process the benefit of their own estimate of cost (stated by their Engineer at a meeting of the Incorporated Institution of Gas Engineers in London, and reported in the JOURNAL OF GAS LIGHTING for June 5, 1894, at a time when their offer was before the Corporation of Bradford)—viz., 0·52d. per candle per 1000 cubic feet, with oil costing £3 7s. 6d. per ton, the saving over cannel coal at 1½d. per candle would amount for the whole borough to £4687 10s., after deducting the charges for royalties, &c.

The saving under the Dvorkovitz process, as shown by the 33 days' test on a cost of two-fifths of a penny per candle would, by comparison, amount to £10,500. It is a fact, moreover, that were the Huddersfield process applied to the whole borough, the owners would take £4687 10s. out of the town in royalties; while Mr. Smith does not ask for a single half-penny.

It may be said that the joint test made by the experts does not give results as favourable as the 33 days' test. Granted; but this is attributable—(1) To the inferiority in the quality of the oil, as notified at the time to the Town Clerk by the firm who supplied it. (2) To the oil plant not being worked at its full capacity on account of the smaller quantity of coal gas requiring enrichment in July. (3) To the omission of any allowance for the value of the bye-products. These sufficiently account for the decrease in the number of candles per ton of oil.

With respect to Mr. Wright's reports upon this test and arrangements with the Bradford Gas Committee, I could say much; but I desire to add nothing which may cause further trouble in the Committee. I may, however, state facts, and leave the public to form their own conclusions. Mr. Wright spoke very favourably of the Dvorkovitz process to Mr. Newbigging, and said also that the carburetting was not a reliable test; and he should not base any report upon such a test of only three hours' duration. Mr. Newbigging likewise agreed; and for Mr. Wright's information, and to enable him to arrive at a reliable valuation, Mr. Newbigging sent to him a detailed analysis of a previous test of bye-products, quite sufficient to show a value of at least 3½d. per gallon. Mr. Wright took no notice of this, but adopted his figure of 1¾d. after a test which he had declared unreliable, and had said he would ignore.

The system of carburetting as arranged at Thornton Road is not part of our oil plant; but it is a suggestion by the Corporation Engineer, and is made out of old material belonging to the Corporation. We prefer to extract the valuable properties, consisting of benzol and naphtha, for carburetting in the ordinary way. Mr. Wright worked this experimental plant in his own way, and against the advice of the Corporation Engineer; and when the experts left, they promised Mr. Wood to return and work the plant in the manner suggested by him as the best according to previous experience. They did not return, however, because they agreed to ignore the unreliable results of carburetting obtained in the manner they had adopted; and yet Mr. Wright brought them into his report. Mr. Newbigging's report upon this test is subjoined; and attention is specially directed to the last paragraph.

Mr. Smith's offer has already been so fully referred to that I need only point out that his guarantee against the cost of enrichment by the Dvorkovitz process (if continued in use at Thornton Road for six months) exceeding ½d. per candle per 1000 feet, is not a sporting offer, and is not prompted by selfish considerations of benefits to himself, direct or indirect. Mr. Smith is not interested in the remotest degree in the supply of oil for any process. Speaking from actual knowledge, I can vouch for the *bona fides* of the offer; and securing, as it does, a guaranteed saving of £30 a week to the ratepayers without a particle of risk, I am astounded that it should have been so contemptuously received, and its benefits so wantonly ignored. I can only suppose that the Bradford ratepayers are so lightly burdened that a saving at the rate of £1500 a year is a matter of profound indifference to them.

After criticizing the statements made by Mr. Dixon, the Chairman of the Gas Committee, the writer closes his letter with the following general remarks :—

When I was requested by Mr. Smith to meet the Gas Committee in April, 1894, to discuss the terms upon which the plant should be erected, I offered it to them on the principle of "no cure, no pay." The Chairman of the Committee (Alderman Moulson) assured me in Committee—Mr. Dixon being present—that the Corporation would adopt and take over the process and plant at Thornton Road "if it proved a success," which he himself said would be the case "if it effected a substantial saving" upon the cost of enrichment by cannel. The result of that assurance was the agreement with the Corporation mentioned in Mr. Smith's offer; and I think I have shown, by figures thoroughly tested, that Alderman Moulson's condition of a "substantial saving" has been amply fulfilled. I have also shown that in July, 1894, Mr. Dixon accepted 1½d. per candle as the cost of enrichment by cannel coal when he strenuously urged the Corporation to adopt the Huddersfield process. The difference between 1½d. per candle and ½d. per candle at the Thornton Road works alone is a saving of £2187 10s. per annum, or for the whole borough (for 2 candles) £9375 per annum. Is this not substantial enough to satisfy the most exacting?

And I would ask any fair-minded Bradford man if Mr. Smith has not fulfilled his part of the bargain, and whether the treatment he is now receiving at the hands of the majority of the Gas Committee reflects credit upon the Corporation of a town which he has twice served in the office of Chief Magistrate.

I am told that, if I can convert Mr. Dixon, all will be well; and although "a man convinced against his will is of the same opinion still," I ask: Will not Mr. Dixon afford us the opportunity of discussing facts and figures? He does not appreciate our process, but is captured and possessed by the delusive figures of its Huddersfield rival. Why does not Mr. Dixon arrange a meeting of gentlemen who understand business and figures, and let the thing be thoroughly sifted, and results accepted before the next Council meeting?

I appeal to the public men of Bradford, who value the honour and reputation of their town, to take such steps as may be necessary to compel a full inquiry into the groundwork of this letter.

(Signed) W. W. SHAW.

Messrs. Newbigging and Son's Report to Mr. Smith.

5, *Norfolk Street, Manchester, Aug.* 6, 1895.

ISAAC SMITH, Esq., Bradford.

Sir,—Agreeably to your instructions, we carried out, simultaneously with Mr. Lewis T. Wright, on the 22nd, 23rd, and 24th of July, a series of experiments with Dr. Dvorkovitz's oil-gas process for enriching coal gas, now in use at the Thornton Road station of the Bradford Corporation Gas-Works; and we beg to report thereon. It is not necessary for us to refer to what had been previously done in connection with the working of the plant. We shall only describe the experiments which we ourselves have made, except to say that, generally, our results bear out the results obtained by Mr. Wood, the Gas Engineer to the Corporation.

The trials were conducted under the most stringent conditions. The temperature and barometric pressure were taken constantly during the three days, and the necessary corrections made. Two standard photometers were employed, and the two gases—the ordinary coal gas and the enriched gas—were tested on these; being changed from one to the other photometer every three tests throughout each day. At each change, the gas was allowed to blow through the fittings for at least twenty minutes. For each single test there were the usual ten observations; and at every fifth observation, the screens or discs were reversed. Thus every precaution was taken to avoid anything like error.

The oil used in these trials was not equal in quality to that used in the previous trials made by Mr. Wood and those made by ourselves. It came from The Gaslight and Coke Company, who intimated that the quality was not equal to that of the oil previously supplied by them. Notwithstanding this, the results obtained, looking at them from every point of view, are highly satisfactory. The result of the experiments is that with oil at 3¼d. per gallon, and taking the value of the bye-products at 4·695d. per gallon, the cost of enrichment per candle per 1000 cubic feet of coal gas made and enriched amounts to 0·367d.

The full figures are as follows:—

Duration of trials	1½ days, or 36 hours.
Coal gas made and enriched	1,013,381 cubic feet.
Oil used	433 gallons.
Oil gas made	30,167 cubic feet.
Average illuminating power of the coal gas before enrichment	15·70 standard candles.
Average illuminating power of the enriched gas	17·63 ,, ,,
Enrichment	1·93 ,, ,,
Bye-products obtained from the condenser	139¼ gallons.
Coke used in firing	19½ cwt.
Labour	15s. 5d.
Salaries per 1000 cubic feet of oil gas made	0·12d.

Cost of Enrichment.

433 gallons of oil, at 3¼d.				£5	17	3·25
19½ cwt. of coke at 7s. 6d. per ton				0	7	3·75
Labour				0	15	5·00
Salaries at 0·12d. per 1000 cubic feet of oil gas made (30,167 cubic feet)				0	0	3·62
Interest and wear and tear—15 per cent. per annum on £750, 1½ days				0	9	3·00
				£7	9	6·62
Less—Bye-products from condenser, 139¼ gallons, at 4·695d.	£2	14	5·77			
Oil gas added to the bulk, 30,167 cubic feet, at 1s. 2d. per 1000 feet	1	15	2·33	4	9	8·10
				£2	19	10·52
Cost of raising the illuminating power of 1,013,381 cubic feet of coal gas by 1·93 standard candles				£2	19	10·52
Cost of enrichment per candle per 1000 cubic feet			=			0·367d.

The price of 3¼d. per gallon for the oil is the same as that on which the results of other enriching processes have been based. The price of oil delivered at ports in the United Kingdom is 2⅞d. per gallon.

As regards the bye-products obtained by us, these have been analyzed by Mr. John Craven, the Chemist to Messrs. Hardman and Holden, tar distillers, Newton Heath, Manchester; the following being the result of his analysis:—

In 100 parts—
23·0 per cent. of 54/91 benzol.
12·5 ,, 90 per cent. naphtha.
40·0 ,, heavy oils.
24·5 ,, residue (pitch).

Taking these several products at the current prices, net, we have—

23·0 gallons of 54/91 benzol, at 11d. per gallon	253·0d.
12·5 ,, 90 per cent. naphtha, at 11d. per gallon	137·5
40·0 ,, heavy oils, at ¾d. per gallon	30·0
24·5 ,, residue (pitch), at 2d. per gallon	49·0
Value of 100 gallons	469·5d.

The commercial value of a gallon of the bye-products is therefore 4·695d.

With respect to the labour employed, we desire to point out that, with continuous working of the plant over a period of 33 days' duration, the oil used was 13,912 gallons, and the cost of labour was £24 15s. Calculated out on this basis, the labour in the present tests amounts to 15s. 5d.

The average cost of enrichment by means of cannel, at current prices, may be taken at 1½d. per candle per 1000 cubic feet. We observe that the cost of enrichment by cannel at Bradford is less than this—due, however, to circumstances which are altogether exceptional.

Taking into consideration the simplicity of the apparatus, its inexpensive character, the ease with which it can be worked, and the satisfactory results obtained, we have no hesitation in saying that Dr. Dvorkovitz's process is a most valuable one, and that the Corporation will act wisely in deciding to adopt it at their several stations.

(Signed) THOMAS NEWBIGGING AND SON, MM.Inst C.E.

Reply by Mr. Cowgill.

In the *Bradford Observer* for the 23rd ult., Mr. Cowgill made the following reply to Mr. Shaw's letter:—

I cannot attempt to reply to the scientific portion of Mr. Shaw's letter; but there are questions of fact that even an ordinary individual can understand.

(1) As to the cost of oil used by Mr. Isaac Smith's process. Mr. Shaw, in his letter, gives the cost of the Russian oil used in this process at £4 per ton. Mr. Newbigging (the expert engaged by Mr. I. Smith with the express object of defending his interests), in his report, puts the cost of this oil at 3¼d. per gallon, which makes £3 8s. 3d. per ton, or 11s. 9d. per ton less than it can actually be purchased for. As a proof of this statement, the Town Clerk wrote, at the request of Mr. Wright, asking what was the very lowest price for large quantities that they would deliver this oil at in Bradford; and the reply he received was that they could not deliver it at less than £4 per ton net. Now, Mr. Newbigging, having taken the cost of this oil at £3 8s. 3d. per ton, or 11s. 9d. per ton less than it can possibly be purchased for, what reliance can be placed on his report, when one of the main factors on which he arrives at his conclusion is wrong? Or what reliance can be placed on Mr. Shaw's conclusion, if he takes Mr. Newbigging's report as a basis on which to work from?

(2) As to the cost of the oil used by the Peebles and Huddersfield process. Mr. Shaw, in his letter, says: "The Huddersfield and Peebles processes are each worked with Scotch oil, costing £3 10s. per ton delivered in Bradford." In reply to this, I beg to say that Mr. Shaw is wrong, as I have made inquiry of the Huddersfield Corporation; and they say that they are to-day paying £3 per ton delivered at their Huddersfield works, or 10s. per ton less than is stated by Mr. Shaw.

If I am correct in the above particulars—and I feel confident I am—then either Mr. Shaw or Mr. Newbigging, or both, must be wrong in both cases. If wrong, then their conclusions must be incorrect; and if their conclusions are incorrect, what reliance can be placed on their reports?

Mr. Wright's Replies to Mr. Wood and Messrs. Newbigging.

The *Bradford Observer* of last Saturday contained the following letters addressed by Mr. Lewis T. Wright to Mr. Dixon, the Chairman of the Gas Committee of the Bradford Corporation, in reply to the criticisms of Mr. Wood and Messrs. T. Newbigging and Son:—

Sept. 14, 1895.

Dear Sir,—I shall be glad if you will favour me by having the following reply to Mr. Wood's letter of the 3rd inst. placed before the Gas Committee at an early opportunity.

Firstly, as regards the calculations, I regret that I am not able to state that I consider his calculations to have been correctly stated. In his various reports on the subject of the Dvorkovitz process, the products obtained by multiplying the illuminating power of a gas by its volume in thousands of cubic feet is called "a thousand foot-candles," or "a candle thousand"—these two terms being employed as though one is the equivalent of the other. A careful inspection of his reports shows further that his value of "a thousand foot-candles," or "a candle thousand," is intended to apply to the quantity of enrichment required to raise the illuminating power of 1000 cubic feet by 1 candle. This value is precisely 200 candles, as everyone must be aware who is acquainted with the fact that the illuminating power of coal gas is stated, not, as Mr. Wood supposes, in candles per cubic foot, but in candles per 5 cubic feet.

Secondly, the suggestion made in my first report—that, rather than distil the crude tar with the purified coal gas, as was being done at the Thornton Road works, it would be better to have it distilled for the purpose of utilizing the lighter portion that might be profitably employed in carburetting the gas—cannot be confounded with a recommendation not to enter into the business of distilling the tar for the purpose of selling refined or partially refined products. The suggestion and the recommendation refer to matters totally different both in object and scope.

Thirdly, Mr. Wood is of the opinion that my estimate of the cost of cannel enrichment is somewhat too low. Mr. Wood must not forget that his opinions on this subject vary from time to time. On the 2nd of July, 1894, I observe that he is of opinion that cannel is likely to be reduced in the future considerably below 1½d. per candle per 1000 cubic feet (200 candles); and in his report of the 28th of March last, he states the cost at 0·79d. He, however, is now surprised that I should arrive at a cost of 0·81d. I would point out that evidence furnished by Mr. Wood shows that the cost of cannel enrichment at Bradford must be much lower than either of the above estimates, if the statements he has made at various times are to be upheld. For instance, during the 33 days' test, the coal gas was said to have been of 15·16 candles illuminating power, and on another occasion 15·67 candles; and further on in the same report of March 28, 1895, it is stated as being 15·75 candles.

With 25 per cent. of cannel, it is easy to see that, if the gas as delivered to the town be of 18·83 candles illuminating power (and that is the average of the three years ended March, 1893), then the enriching value of the cannel must be over 28 candles. Thus, with coal gas of the different values stated, to give gas of 18·83 candles, the cannel gas must have had the following values:

Value of Coal Gas.	Enriching Value of Cannel Gas.
15·16 candles	29·8 candles.
15·67 ,,	28·3 ,,
15·75 ,,	28·1 ,,
Average	28·7 ,,

So that, from the report referred to, it would appear that the enriching value of the cannel gas at Bradford is 28·7 candles.

As regards the price of the cannel coal, from the figures supplied to me by Mr. Wood, the present contracts include cannels ranging in price from 9s. 6d. to 13s. per ton; and the average, according to the various quantities of each kind, is 13s. 3½d. per ton. With cannel of

an enriching value of 28·7 candles, and costing but 13s. 3½d. per ton, it will be necessary to show that the whole of the bye-products from the cannel coal—viz., coke, tar, and ammonia—are only worth to the Committee 2s. per ton of cannel carbonized before a fraction can be put on to my estimate; and with the lowest possible prices and yields of coke, tar, and ammonia, it will be exceedingly difficult, in the face of Mr. Wood's report of the 28th of March last, to prove that the cannel enrichment is costing more than 0·70d. per candle of illuminating power per 1000 cubic feet (200 candles), as it will be also to show what circumstances have happened since March, 1895, that will justify his statements to the Committee on the 21st of August last that the cost was now, on account of the difficulty of selling cannel coke, over 1d.

The reason I did not, and do not, adopt Mr. Charles Wood's figures in this case of cannel enrichment—figures that lead fatally to the contradiction of his most recent views on the subject—is because it appears to me that the enriching value of over 28 candles is too high for the class of cannel coal used at Bradford, and too favourable to that source of enrichment, and consequently unfavourable to oil. I have preferred to adopt as a basis a class of cannel I have, among others, thoroughly examined on the large scale, and the qualities of which I can personally vouch for. It has but the enriching value of 23 candles—over 5 candles less than what Mr. Wood's figures would show to be the case at Bradford. It costs 3½d. per ton less.

I will examine Mr. Charles Wood's objections to my estimate, which is higher than is shown by his figures, and his definite statement that the cost is 0·79d., and yet he to-day considers as being unfairly low. The gas liquor, he says, is taken at too high a value. From figures supplied to me by Mr. Charles Wood, the Bradford Corporation obtained 0·84d. per gallon of 10-oz. liquor for the year ended March, 1893. In that period, sulphate of ammonia varied from (monthly averages) £9 15s. 7½d. to £12 0s. 4d. At the present time, it is true, sulphate is abnormally low, though it has been £11 7s. 6d. this year. I think the basis of the year ended March, 1893, with an average of £10 4s. 8d. per ton, is a fair one.

The calculation by which, at the close of his letter, Mr. Wood arrives at the conclusion that, if my cannel estimate had been calculated on some other basis, it would lead to the result of 0·98d. instead of 0·81d., is based upon two fallacies. In the first place, it deals with the case of the enrichment of 18¾ to 23 candle gas. This, however, is not the matter before the Committee, which is the enrichment of 15¾ to 18¾ candle gas—a very different matter, as the Committee is aware. In the second place, this calculation is based upon the belief in an impossibility—namely, the enrichment of 18¾ to 23 candle gas with a material of an enriching value of only 23 candles. Mr. Wood has forgotten that if, by mixing a low with a high grade gas, there is an enrichment of the lower-grade gas, there is at the same time a dilution of the higher-grade gas; and any dilution, to whatever small extent, of 23-candle gas with 18¾-candle gas must result in something less than 23-candle gas. Any calculations that have not exposed this fallacy to Mr. Wood show how little value they have when not employed with due consideration.

I shall be glad if the Committee will allow this letter to receive the same publicity that has been permitted to the letter to which it is an answer.

(Signed) LEWIS T. WRIGHT.

Sept. 21, 1895.

Dear Sir,—Messrs. Newbigging's letter to Mr. Isaac Smith, dated Sept. 7, demands some reply from myself owing to the forced circulation that has been given to it.

This firm endeavour to show that the cost of cannel enrichment at Bradford must be higher than my estimate of 0·81d., and have, by means which can be immediately exposed, been able to raise it to 0·952d. In order to do this, statements are made that the returns of the Bradford Gas Department show to be untrue.

In the first place, cannel is taken as costing 14s. 6d. per ton. The present Bradford contracts range from 9s. 6d. to 15s. per ton; and the average is 13s. 3½d. It is asserted by Messrs. Newbigging that the ammoniacal liquor is only worth 0·5d. per gallon of 10 oz. At Bradford, the following figures have been obtained:—

Year ending.	Average per Gallon.
March, 1891	0·94d.
,, 1892	0·85d.
,, 1893	0·84d.

According to Mr. Newbigging, jun.—for it was Mr. Newbigging, jun., who presented himself as the Mr. Newbigging allowed by the Committee to be present—the unenriched coal gas had an illuminating power of 15·7 candles (per 5 cubic feet). Mr. Wood has stated it to be from 15·16 to 15·75 candles. It is asserted that a cannel cannot be obtained at 13s. per ton with an enriching value of 23 candles.

The parties who have questioned my statement have placed themselves upon the horns of an awkward dilemma. The average illuminating power of the town gas during the three years ending March, 1893, is stated at 18·83 candles. If the unenriched gas be 15·75 candles, then, if the cannel used at Bradford have a lesser enriching value than 23 candles, the town gas must be less than 17·56 candles. Thus—

		Candles per 5 Cub. Ft.
75 p. ct. unenriched gas	0·75 × 15·75 candles per 5 c. ft.	= 11·81
25 ,, cannel gas	0·25 × 23·00 ,, ,,	= 5·75
	Average	17·56

If the town gas be, as it is stated to be, of 18·83 candles, then, if the average cannel employed have an enriching value of less than 23 candles, the unenriched gas must be more than 17·44 candles. Thus—

		Candles per 5 Cub. Ft.
75 p. ct. unenriched gas	0·75 × 17·44 candles per 5 c. ft.	= 13·08
25 ,, cannel gas	0·25 × 23 ,, ,,	= 5·75
	Average	18 83

The price of the cannel coke in my estimate—viz., 3s. 4d.—is the lowest the Committee has accepted for some time; the average selling prices having ranged from 4s. to 10s. per ton from January, 1890, to May, 1895. This immediately disposes of the question of my having overvalued the cannel coke.

The remark made by Messrs. Newbigging that it is well known that many high-class cannels yield worthless coke, is only a portion of the truth. It is that portion of the truth that it was convenient should be known. They might with equal truth and more candour have said "It is well known that many high-class cannels yield excellent coke, and one of them, not the least celebrated for the high quality of the gas it yields—viz., 38 candles—is famed for the excellence of its coke." High-class cannels have nothing to do with the case in point, nor can they be obtained at prices at all approaching 13s. 3½d. per ton. I have been studying these matters for 23 years, and am not aware that the firm that question my statements have ever exhibited any special knowledge on the subject of cannels and their distillation products. The criticism respecting the quantity of tar is too trifling to discuss. My note-books are open to the inspection of the Committee. I claim that Messrs. Newbigging have completely failed in their criticism of my cannel estimate, which they cannot increase by 1-100th part of a penny, even if it be now convenient for them to attempt to do so. Their estimate of 1¼d. is unsupported by the most meagre of data. It is a rough guess, and not a seriously considered estimate.

As regards price of oil, this was obtained for me by the Committee, who asked for a quotation for a contract supply. It accorded with previous offers of large quantities. As regards its quality, I must point out to the Committee a matter that appears irregular. The trial was concluded on the evening of the 27th of July, and some days were required to calculate out the results. My report was finished and dated the 1st of August. In the letter from Messrs. Newbigging to Mr. Isaac Smith appears an extract from a letter, dated the 31st of July, replying to one from the Town Clerk, in which Messrs. Bessler, Waechter, and Co. are said to write: "We are not surprised to learn that the results obtained from the waggon of oil recently supplied to you were not anything like so good as those obtained from Nobel's oil," &c.

This statement about the quality of the oil was not made with my authority. It must have originated from someone not acquainted with all the facts upon which an opinion could be based, for Mr. Newbigging, jun., was pledged to me not to divulge the results until they were complete. I cannot understand how and why the results should have been prejudged in that manner before my report was written and the result known to me. Traces of this correspondence taking place without my knowledge during a period when secrecy had to be observed, to prevent wild rumours being circulated, appear in a letter from Messrs. Newbigging to their client, and is correspondence prejudging the case before it was completed. The oil used came from the Kerosene Company, and is described as, and answers to, their best Solar oil. It gave 69·7 cubic feet of gas per gallon, with 35 per cent. (by volume) of tar. The former oil gave 68·15 cubic feet of gas, with 32·82 per cent. (by volume) of tar. As regards the enriching value of the gas, this was equal to 1139 candles per gallon of oil passed through the retorts, or 1753 candles per gallon of oil gasified (deducting tar). The result will appear to reasonable people quite normal, and should satisfy all but the insatiable.

The real matter at issue in this case is not the cost of the cannel enrichment, which, as far as Bradford is concerned, cannot be shown to exceed my estimate of 0·81d., nor is it the quality or quantity of gas made from the oil, nor any other of the trifling matters which obscure the real matter at issue, which is the value of the oil-gas tar or bye-products. After the investigation I have made, it is no longer possible to say that any portion of these have a value of 350,000 feet-candles per gallon when used for carburetting. That they have a net value for sale on distillation of 4·69d. per gallon, is equally impossible. The figures given in my report will be found to be the true ones; and I cannot hold out any hopes to the Committee that a higher value than 1·7d. is possible.

(Signed) LEWIS T. WRIGHT.

The Amersham, Beaconsfield, and District Water-Works Company, Limited, has been registered with a capital of £7000, in £1 shares, to supply water to the towns of Amersham and Beaconsfield, in Buckinghamshire.

Extensions at the Rhyl Gas-Works.—The Rhyl Urban District Council have placed orders with Messrs. Westwood and Wright for a 60,000 cubic feet gasholder, and with Messrs. G. Waller and Co. for a 10,000 per hour exhauster and steam-engine.

Another Munificent Gift to Belper.—At the meeting of the Belper District Council last Wednesday, the Chairman (Mr. Herbert Strutt, J.P.) made another generous gift to the town, and one which will benefit the whole body of ratepayers. For some time an additional water supply has been under consideration; and boring operations have been carried on. Mr. Strutt has paid the whole of the expense up to the present, amounting to about £500. Now he has undertaken to contribute £4000 to enable the engineers to sink a well. If water is found in sufficient quantity and quality underground, it will obviate the necessity for application to Parliament, and avoid compensation. The father of Mr. Strutt died last Easter; and, as may be remembered, he gave to the town the whole of the property of the Water Company, which represented a cost of about £16,000 or £17,000.

The Gas Supply of Boyle.—Owing to the stoppage of the gas-works at Boyle (Co. Roscommon), great inconvenience has been caused to the inhabitants. We learn from a local paper that the Town Commissioners have had to revert to oil for the public lighting, and that the shopkeepers and householders are obliged to use this material, with its attendant discomforts, for all purposes. The loss to the people is considerable; and, moreover, it is a distinct blow to the progress of the town. A number of the enterprising traders, however, are determined that some remedy must be found for the existing state of things. Communications have been opened up with Sligo; and the Engineer and Secretary of the Gas Company (Mr. C. B. Tully) has been requested to take the matter in hand. He has accordingly visited Boyle; and steps will now be taken to furnish the town with a supply of gas from works constructed on the best modern lines.

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company for the half year ending June 30 last, which, with the accounts for this period, will be presented at the ordinary meeting of the proprietors next Thursday:—

The Directors submit the accounts for the half year ended June 30, 1895. The revenue account shows a net profit for the half year of £48,680 17s. 3d.; making, with £736 4s. 7d. received for interest, £49,417 1s. 10d. This, added to the amount brought forward from the previous half year, makes £72,935 18s. 2d. Deducting therefrom £3712 10s. for interest on debenture stock, and £637 18s. 7d. for income-tax, there remains standing to the credit of the net revenue account a balance of £68,585 9s. 7d. available for dividend. The Directors recommend that dividends be declared at the rates of 13½ per cent. per annum upon the old stock of the Company, and of 10½ per cent. per annum upon the new stock, both less income-tax; and that the difference between the declared rates and the authorized rates of 13¾ and 10¾ per cent., having regard to the price charged for gas, be carried to the reserve fund. The balance of the net revenue will be carried forward to the next half year.

The accounts accompanying the report consist of the usual statements. The statement of capital stock (No. 1) stands as before—viz., £715,000 paid up, out of a total £830,000 authorized. The statement of loan capital (No. 2) is also unchanged—£165,000 borrowed, out of £300,000 authorized. The capital account (No. 3) shows receipts to the amount of £880,000, out of which a total of £866,092 had been spent up to Dec. 31 last, increased to £870,863 by the expenditure of £4771 (of which £1849 was for new coin-meters and fixing, £898 for new meters and stoves, and £2024 for new mains) in the six months covered by the report. The unexpended balance at the close of the past half year was £9137. The remaining statements in the accounts are reproduced in full.

No. 4.—REVENUE ACCOUNT.

To Manufacture of gas—		
Coals, including dues, carriage, unloading, and trimming (see account No. 8)	£68,923 4 10	
Salaries of Engineers, Superintendents, and other Officers at works	2,297 15 5	
Wages (carbonizing)	19,621 16 1	
Purification, including £1915 5s. 2d. for labour	3,477 17 2	
Repairs and maintenance of plant and works, materials and labour (less £516 19s. 11d. received for old materials)	16,453 9 5	
		£110,774 2 11
Distribution of gas—		
Salaries and wages of Officers (including Rental Clerks)	£1,391 19 8	
Repairs, maintenance, and renewals of mains, service-pipes, and fittings, including labour	2,587 19 11	
Repairs and renewals of meters	1,247 0 6	
" " stoves	1,005 6 4	
" coin meters and fittings	308 13 7	
		6,541 0 0
Public lamps—		
Lighting and repairing		2,315 5 6
Rent, rates, and taxes		6,359 13 0
Management—		
Directors' allowance	£1,250 0 0	
Company's Auditors	75 0 0	
Salaries of Secretary, Accountant, and Clerks	1,153 2 0	
Collectors' salaries and commission	1,532 11 6	
Stationery and printing	457 12 8	
General charges	496 15 4	
		4,965 1 6
Bad debts		1,013 7 1
Law charges		331 8 7
Superannuations		50 0 0
Official Officers		96 18 11
		£132,476 17 6
Balance carried to profit and loss net revenue account (No. 5)		48,680 17 3
		£181,157 14 9

By Sale of gas—		
Common gas, per meter, at 2s. 6d. per 1000 cubic feet	£124,114 11 6	
Public lighting and under contracts, common gas. (See statement No. 10.)	9,518 14 4	
		£133,633 5 10
Meter-rental	£2,079 10 9	
Stove-rental	928 11 1	
Coin meters and fittings	355 8 0	
		3,353 9 10
Residual products—		
Coke, less £3715 18s. 5d. for labour	£27,405 16 8	
Breeze, less £705 12s. 5d. for do.	578 16 2	
Tar	8,661 4 0	
Ammoniacal liquor and sulphate	7,215 17 9	
		43,861 14 7
Miscellaneous receipts—		
Rents	£277 14 6	
Transfer fees	21 10 0	
		299 4 6
		£181,157 14 9

No. 5.—PROFIT AND LOSS (Net Revenue Account).

Interest on debenture stock	£3,712 10 0	Balance, Dec. 31, 1894	£71,093 16 4
Income-tax	637 18 7	Less—Amount of dividend paid for half year ending Dec. 31, 1894, £45,787 10s. Amount available for dividend carried to Reserve Fund, £1,787 10s.	47,575 0 0
Balance available for dividend, carried to balance-sheet	68,585 9 7		£23,518 16 4
		Balance from revenue account (No. 4)	48,680 17 3
		Dividends and interest balance	736 4 7
	£72,935 18 2		£72,935 18 2

No. 6.—RESERVE FUND.

Balance on June 30, 1895	£39,802 4 6	Balance on Dec. 31, 1894	£38,014 14 6
		Net Revenue Account (No. 5)	1,787 10 0
	£39,802 4 6		£39,802 4 6

No. 7.—INSURANCE FUND.

Balance on June 30, 1895	£28,652 7 7	Balance on Dec. 31, 1894	£28,652 7 7
	£28,652 7 7		£28,652 7 7

No. 8.—STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1894.	Received during the Half Year.	Carbonized during the Half Year.	Used during the Half Year.	In Store, June 30, 1895.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common	43,704	99,893^{10}	108,381^{10}	150	34,976
Cannel	3,117	—	1,111*	—	2,006
	46,821	99,893^{10}	109,492^{10}	150	36,982

* 291,864 gallons of petroleum spirit (lower grade) used as a substitute for cannel.

No. 9.—STATEMENT OF RESIDUAL PRODUCTS.

—	In Store, Dec. 31, 1894.	Made during the Half Year.	Used during the Half Year.	Sold during the Half Year.	In Store, June 30, 1895.
Coke—tons	5,644	66,451	16,818	50,749	4,528
Breeze—chaldrons	1,450	8,454	—	8,054	1,850
Tar—gallons	218,460	1,172,172	—	1,143,432	247,200
Ammon. liq.—butts of 108 gals.	12,971	34,131	37,266	—	9,836
Sulphate of ammonia—tons	1,142	1,201¼	—	619¼	1,724

No. 10.—STATEMENT OF GAS MADE, SOLD, Etc.

Description of Gas.	Quantity Made. Meter Register.	Quantity Sold. Public Lights and under Contracts (estimated).	Quantity Sold. Private Lights (per Meter).	Quantity Sold. Total Quantity Sold.	Quantity used on Works, &c.	Total Quantity accounted for.	Quantity not accounted for.	Number of Public Lights.
	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	Thousands.	
Common	1,125,031	59,982	992,917	1,052,899	15,141	1,068,040	67,591	5,413

BALANCE-SHEET.

To Capital—			
For balance, per account No. 3		£9,137 0 0	
Net Revenue—			
For balance, per account No. 5		68,585 9 7	
Reserve Fund—			
For balance, per account No. 6		39,802 4 6	
Insurance Fund—			
For balance, per account No. 7		28,652 7 7	
Dividends outstanding		2,119 18 6	
Deposits		9,647 8 7	
Interest on debenture stock		223 15 0	
Sundry tradesmen and others, for amount due for coal, stores, and sundries		19,775 8 8	
Loan from bankers		10,000 0 0	
		£187,993 12 5	

By Cash at Bankers			£5,980 19 11
Cash in hand for current expenditure			2 240 0 0
Amount invested in Consols			66,667 2 1
Stores in hand—			
Coals		£22,636 11 4	
Coke and breeze		2,798 19 0	
Tar, sulphate, and ammoniacal liquor		21,799 8 7	
Sundries		9,095 13 11	
			56,330 12 10
Accounts due to the Company—			
Gas rental, quarter ending June 30, 1895	£39,216 4 6		
Arrears outstanding	1,941 13 9		
			51,156 17 3
For coke and other residual products		£5,218 17 4	
Sundries		379 3 0	
			5,598 0 4
			£187,993 12 5

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Report and Accounts.

The proprietors of the above Company held their half-yearly meeting yesterday. The report and accounts which had been previously circulated among them showed that the gross receipts for the six months amounted to £134,277, and the expenditure, including interest on loan capital, to £99,914—leaving a net profit of £34,363. To this has been added £629 brought from the last account; making the total sum available for dividend £34,992. The Directors recommended the payment of dividends at the rate of 10½ and 7½ per cent. per annum on the respective shares, after paying which there will remain a sum of £1425. From this they further proposed that £1000 be added to the contingent account; the balance to be carried to the next accounts. Contracts for coals and cannels have been made on terms favourable to the Company. They will shortly be in operation, and are such, said the Directors, as would enable them at the general meeting to notify a reduction in the price of gas, to take effect over the whole of the gas limits. The report also mentioned that the market for residuals has had a downward tendency. Under this head, there has been a reduction of £3105 in the receipts for sulphate of ammonia and coke, compared with the corresponding period of last year.

By the accounts, it is seen that the capital outlay in the six months was £2455; making the total to June 30 £944,260, and leaving an unexpended balance of £5646. On share capital account, there remains £236,000 to be issued; and of loan capital there is £114,000 left to be borrowed. The total revenue of the six months was £134,276, which was derived from the following sources: Gas, £101,340; public lighting and under contracts, £6089; meter-rental, £2928; coke, £14,415; breeze, £665; tar, £4303; ammoniacal liquor and sulphate of ammonia, £4281; rents, £190; and transfer fees, £62. The expenditure amounted to £94,887, of which £74,013 was spent under the head of manufacture; £6655 on distribution; £506 on the lighting and repairing of the public lamps; £3558 for rents, rates, and taxes; £5870 on management; and £605 for law charges. The other items on this side of the account were: Bad debts, £586; abatements and allowances, £2591; and annuity account, £500. The condition of the profit and loss account has already been shown. The contingent account shows a balance to be carried forward of £3870; and at the credit of the reserve fund is the sum of £45,914. On the renewal fund (leasehold) is a balance of £903; and on the insurance fund, £2693. The quantity of common coal carbonized in the six months was 55,053 tons, and of cannel (in addition to oil spirit) 10,503 tons, beyond which 292 tons were "used." The amount of gas made in the six months was 671,869,000 cubic feet; and the estimated quantities of residuals produced were: Coke, 78,436 chaldrons; tar, 626,124 gallons; ammoniacal liquor, 1,577,249 gallons.

MANCHESTER CORPORATION GAS DEPARTMENT.

Opening of Large Show-Rooms—Ironmongers and the Gas Committee—Alderman Gibson's Aim.

Handsome and commodious show-rooms for gas-stoves and other appliances have been opened in Deansgate, by the Manchester Corporation. The building is four storeys high; the ground floor and the one above being filled with gas-stoves and other goods by all the best known makers; while the basement and top floor are used for the repairing and renovation of the stoves that have been out on hire. The place is throughout artificially illuminated by the electric light, which strikes one as being a little curious, considering the purpose for which the premises were specially designed. The show-rooms were formally opened on Monday evening last week; and, on the invitation of the Gas Committee, a large number of the members of the City Council were present. The building having been inspected, the Lord Mayor (Alderman A. E. Lloyd) declared it open. He said he had often wondered how the Gas Committee had been able to carry on their operations in connection with the hiring of gas-stoves, &c., in so restricted an area as was at their disposal at the Town Hall. They had done well to go in for larger premises; and they had been fortunate in securing a plot of land which the Improvement Committee of the Corporation, to whom it belonged, hardly knew what to do with. For the land, the Gas Committee had paid £3220; the buildings had cost £2972; and £345 had been spent on fittings and equipment—making a total of £6537. He hoped that the Committee would be abundantly rewarded by the increased consumption of gas for their enterprise in providing these handsome rooms. The Gas Committee, restless and energetic as they ever were, were never satisfied unless they were doing all that it was in the power of their department to do to make life as pleasant as possible for the citizens. Tea was afterwards served to the company in the Town Hall; and one or two speeches followed. Alderman Gibson, the Chairman of the Gas Committee, said it might be that the event in which they had been taking part would form a page in the history of the gas undertaking, full of importance to the citizens. What the Committee desired was to develop, to the fullest extent, the resources of those magnificent gas-works in which something like 4 millions of money was invested. They wanted to make gas as good and as cheap as it could be produced by any other gas undertaking in the kingdom, with the same extent of plant and resources. Regarding the encouragement of the consumption of gas by the use of penny-in-the-slot meters, the Committee were already doing a great deal in this way. No doubt Liverpool had done much more; but it must be remembered that in Liverpool the gas supply was in the hands of a Company who offered great inducements to the use of such meters. In Manchester, before they could do what Liverpool had done, they had to secure the consent of 104 people. There could be no doubt that, by the use of these prepayment meters, the comfort of dwellers in cottages would be materially enhanced, and much would be done to abate the smoke nuisance, which there could be no doubt was due to the small rather than the big chimneys, although it was the owners of the big chimneys who were most frequently dealt with for the offence. With the stoves, as with the automatic meters, the Committee, if they were to do thoroughly efficient work, must be backed up by the Council. In February, 1893, because one or two ironmongers complained of interference with their business, the Council stopped the Committee from selling stoves, with the result that, while in the year before the adoption of the resolution 1100 stoves were sold—to be fixed by somebody—in the following year the Committee sold none. It was exceedingly unlikely that anything like 1100 stoves, or even a quarter of that number, had been sold by the ironmongers in the year following February, 1893. The result was that the ratepayers could not make full use of their gas-works; and many plumbers, glaziers, &c., had been robbed of work they ought to have had. It was for the City Council to say, as he would ere long give them the opportunity of doing, whether they would allow half-a-dozen tradesmen to continue in the enjoyment of a monopoly, to the detriment of the ratepayers of the city. He wanted to reduce the price of gas to 2s. per 1000 cubic feet, and to supply 35 cubic feet, instead of 25 feet, by the prepayment meters for a penny; and he believed that, if the Committee were allowed a free hand, this could be done within a reasonable time, without interfering with private enterprise in the slightest degree.

LEICESTER CORPORATION GAS, ELECTRICITY, AND WATER SUPPLY.

Half-Yearly Reports.

At the Quarterly Meeting of the Leicester Town Council last Tuesday—the MAYOR (Alderman G. Green) presiding—the half-yearly reports of the Gas and Electric Lighting and Water Committees were presented.

The Gas and Electric Lighting Committee reported that the accounts for the half year ending June 30 last showed that the net profit, after paying interest on capital, was £12,954. Out of this, had been paid £3370, being the half-year's amount of sinking fund, and leaving a balance of £9584 to be applied at the end of the official year—March 31 next—as the Council might (under the Acts of 1878 and 1884) direct. The accounts included, and the statement set out, the result of the working of the residual products manufacture and gas-fitting business. The net amount realized by the former was £8693; and on the gas-fitting business there was a net profit of £153. During the six months, 58,226 tons of coal were carbonized. The quantity of gas made was 597,894,000 cubic feet, as against 566,437,000 feet in the corresponding period of 1894; being an increase of 31,457,000 cubic feet, or 5·55 per cent. The average illuminating power of the gas at the Belgrave Gate works was 16·83 sperm candles, and at the Aylestone Road works 17·03 candles. Referring to the abolition of meter-rents, the Committee stated that they had discussed the best method of dealing with private meters; and had authorized the Engineer (Mr. Alfred Colson), when requested, to take over any such meters now in use, on the basis of a twelve years' life—due allowance being made for recent repairs. Regarding the electric lighting department, the result of the working during the half year was a loss, after charging £588 on sinking fund account, of £951, after taking credit for £268, the profit from the electric lighting fitting business. This amount, together with £191 loss for the half-year ending Dec. 31 last, made a total loss in connection with the department of £1142.

Alderman LENNARD moved the adoption of the portion of the report relating to the results of the operations of the gas undertaking; and he explained the different items of the accounts. He said the Committee had done their best; and he regretted that the financial results, in some respects, were not better. The balance-sheet was very just and fair; and the Committee had not overvalued anything.

Mr. POCHIN seconded the motion, and thought the town was to be congratulated on the efforts of the Committee; for they had been able to relieve the rates of the town.

The motion was carried.

Alderman LENNARD proposed the adoption of the portion of the report having reference to private gas-meters. He said they had had a good deal of advice on this matter. Some said that the owners of the meters should not be compensated. But he deprecated such a course as that; for it was simply confiscation. They had been advised by others, who took the opposite extreme, to pay the owner of the meter the original cost of the meter. This, he thought, would be quite wrong; and the Committee had decided to take a medium course. To take over the meters would cost £3000 or £4000, as against the original cost of £12,000. The money would come out of the revenue account; and the cost of redeeming the meters be spread over three half years. This would be, he considered, a fair and equitable way of dealing with the question.

Mr. ROWLETT seconded the proposition, speaking strongly in favour of the owners being compensated.

Mr. RICHARDS moved the deletion of that portion of the report. He contended that those who bought the meters did so for their personal advantage, to escape the exorbitant meter-rents.

Alderman WOOD supported the Committee's recommendation, on the ground of common justice.

Mr. MARSHALL would not oppose the recommendation, as he believed the Committee were actuated by a desire to act fairly all round.

Alderman LENNARD, in reply to Mr. Richards, said he wished to disabuse his mind of the idea that it was the users of meters who were responsible for the gas profits. The fact was the undertaking gained nothing from that source, as it cost all the amount of the rent to keep the meters in repair. It was the large consumers who made the profits of the department. He also wished to point out that in Leicester they gave no big discount for the large consumers; whereas in Birmingham, and other important towns, they had a differential rate. In Leicester, they charged the same price all round, to small and large consumers alike.

The proposition was agreed to.

Alderman LENNARD then moved the adoption of the section of the report referring to the electric light, and said the income had been

£963, including £268 for the fittings business. The expenditure, apart from interest and sinking fund, was £863, showing a profit of £100 on the revenue account, although it was not till late in the winter season that they got to work with it. But after deducting the interest and sinking fund, there was a balance of £951 on the wrong side for the half year. This was a large amount; but he would prophesy that, when he made the next half-yearly report, the balance-sheet would be pretty well even, after paying the sinking fund. The actual loss on working now was only about £400; £700 of the total deficiency being on account of sinking fund. In Leicester, they were rather conservative in matters of expenditure; and the Committee fully anticipated that they would have more than double the number of lamps on the mains by the time stated.

Mr. Rowlett seconded the motion.

Alderman Lennard, in reply to questions, said the Committee could supply the light now continuously for the 24 hours. But the expense would be seriously increased; and they wanted to be economical until there was a general demand. As a rule, they started running about four o'clock in the afternoon, and went on till about midnight. When the electric light department was as successful financially as the gas, the Committee would probably see their way to abolish meter-rents. He hoped before long they might be able to do something more substantial than abolishing the meter-rents—they hoped to reduce the price of the current.

The motion was adopted.

The Water Committee reported that the accounts for the half year showed that the net profit, after paying interest on capital, was £5056. Out of this had been paid £2577, the half-year's amount of sinking fund, leaving a net balance of £2479, which must be dealt with at the close of the current financial year in accordance with the provisions of the Transfer Act. The Committee were glad to be able to also report that the works in connection with the Swithland scheme were progressing very satisfactorily.

The report was adopted.

Alderman Wood subsequently made a short statement as to the existing condition of the water supply. He said the rainfall this year had been about equal to that of last year; and there had been a great deal more sunshine. Happily, they commenced the year with full reservoirs; and this had enabled them to hold out. But they would not be free from difficulty or danger if the drought was continued much longer. They had now in stock barely two months' supply. The consumption was at present 112 million gallons per month, against 82 millions a year ago; so they were consuming 25 per cent. more.

CLITHEROE CORPORATION GAS SUPPLY.

The Reduction in Price.

In the Journal last week, we briefly recorded that, at the meeting of the Clitheroe Town Council on the previous Thursday, a motion to reduce the price of gas to the extent of 6d. per 1000 cubic feet was carried by a majority of one—eight votes being given in its favour as against seven in support of an amendment. This was very close voting; and it showed clearly that the Council were pretty evenly divided on the question of the policy which was ultimately adopted. The reduction will come into operation at the end of the present financial year (March 25, 1896); and it is to be sincerely hoped that a largely increased consumption will ensue to justify the step the Council have taken. In connection with this matter, the Borough Accountant (Mr. W. J. Mitchell) prepared a tabular statement showing the progress of the undertaking in the 17¾ years during which it has been in the hands of the Corporation. This document had doubtless been well studied by every member of the Council before recording his vote; and therefore it may be of interest to reproduce some figures from it.

The quantity of gas consumed in the borough in the twelve months ending March 25 last (excluding that used for the public lighting) was: For domestic purposes, 18,236,600 cubic feet; for manufacturing purposes, 6,728,400 cubic feet—together 24,965,000 cubic feet. On this quantity, Mr. Mitchell showed that the proposed reduction of 6d. would lessen the income by £624 2s. 6d. To compensate for this, an increase to the extent of 5,992,000 cubic feet, or 31·75 per cent., would be required in the quantity of gas consumed. This figure was arrived at by taking the average price received last year (3s. 5·26d. per 1000 cubic feet), deducting the net cost (10·19d.), and taking off the proposed 6d.—bringing the amount down to 2s. 1d. in round numbers. Now the greatest annual increase recorded is 1,611,900 cubic feet, or 8·83 per cent.; and the average annual increase since the Corporation bought the works has been 2·81 per cent. Between these figures and the 31·75 per cent. which, as Mr. Mitchell shows, will be required, there is a great interval. Coming to the profit realized by the undertaking, in the first few years, down to 1882, the balance rose; but a reduction of 1d. per 1000 cubic feet in that year resulted in a deficit of £360. This, however, was soon recovered; and at the end of the financial year in 1885 the balance was £774. In September, a reduction of 5d. was made, followed by deficits for two years; then there was a recovery. There was a small debit balance in 1891; and larger ones in 1893 and 1894. Last March, however, the credit balance amounted to £604. In the 17¾ years, the profits totalled up to £5975; but allowing for the years when the balances were on the wrong side—amounting in all to £1087—the net sum carried to the depreciation fund is shown to be £4888, or an average credit balance of £274 17s. Of this £4888, the sum of £4103 has been expended on works, leaving only £785 to the credit of the fund. Mr. Mitchell remarks on this matter that ten years ago the Finance Committee passed a resolution authorizing a charge of 3 per cent. on the cost price of the works, &c., to be set aside each year to form a depreciation fund; but, owing to the reduction in the price of gas, the lower market value of tar and liquor, heavy repairs of the works, coal strikes, &c., the finances of the Gas Department have not allowed of the necessary contribution. The resolution has consequently been a dead letter. Had it been carried out, the amount now standing to the credit of the fund would have been £9657.

When Mr. J. A. Parker brought forward his motion for the reduction, he had to confess that the Gas Committee were by no means agreed as to the advisability of the step—in fact, they were about equally divided on the question. Had they been unanimous, he said he would not have dared to take the position he had done, of moving something practically contrary to their views. They had for years talked about reducing the price of gas; but there had always been something in the way. They had built a gasholder, made a tank, and extended the retort-house; and there had been an advance in the price of coal which had entailed a loss on the undertaking. Mr. Parker went on to say they had been told they ought to have a reserve fund. Well, there would, he said, have been such a fund if the money had not been spent in replacements and repairs. They could not eat their cake and have it; and they had swallowed it up. This was all very well; but there was a limit to it. He thought they might fairly expect to taste a little of the sweets as they went along, just to encourage them; and now he considered they might taste them by way of getting gas cheaper. Still, he did not wish to reduce the price and throw the burden upon the rates. If they examined the Borough Accountant's statement they would find that the proposed reduction would lessen the income by £624 per annum. This was just about the amount gained last year. If the gas had then been supplied at 6d. per 1000 cubic feet less, there would have been a loss of about £20 on the year's working. But it was hoped that this deficiency would be made up by increased domestic consumption. He did not expect it would; but they might get an increase that would make up part of it—possibly sufficient to meet the cost of necessary repairs and replacements. Other towns of similar size were making the supply of gas pay at considerably less than they were in Clitheroe; and it was not to be wondered at that they wanted to be on a par with their neighbours, and have gas as cheap as it could be made.

The motion was seconded by Mr. Whiteside, who submitted that the great objection to the proposed reduction—viz., that it would involve an increase in the rates—was more imaginary than real. He pointed out that the monthly returns of the Gas Committee showed that there was an average cost of 5d. per 1000 cubic feet less for making gas than there was last year; and he asked if they knew of anything to prevent this being maintained. In reply to this question, the Gas Manager (Mr. R. Barrett) said he did not think they could rely upon the present low rate of production. Now they had a contract on for the sale of residuals which was a favourable one, and above the market value. When this expired, they would probably have to take one that would be less advantageous.

The opposition to the proposal was led by Alderman W. Garnett, who moved an amendment to the effect that the price of gas should not be interfered with. He said he did not know of any arguments why the figure should be reduced. They had taken on the gas-works to pay for them in a term of 55 years; and at the end of that time, if they did not provide for depreciation, they would be in the position of having paid for them, but with nothing to show for their money. He well remembered, when the works were acquired—and he was a consistent and determined opponent of the purchase at the price—that the argument used to win over the town was that the rates would be reduced by the profits that would be made; and now, so far from coming up to those expectations, they were going, he believed, to commit themselves to a reduction which would require making up out of the rates. Alderman Sefton followed on the same side. He, too, feared that, if the price were reduced, the rates would have to be increased. Mr. Shaw, who said he had previously found himself in agreement with the mover of the resolution, now opposed him. He asked who was going to benefit by the proposal. He answered his own question by saying it would not be the ratepayers, but the gas consumers, who had already profited by reductions, and he objected to the benefits always going in the same direction.

The next speaker—Mr. Cowgill—supported the motion, if only, he said, as an experiment to try and bring in the 1400 non-consumers in the borough. He thought the Council should trust to these people becoming consumers—they, no doubt, having declined to use gas because it was too dear. It had been shown that previous reductions had eventually turned out to be beneficial to the undertaking; and probably this would be the case now.

The debate was closed by the Mayor (Mr. O. Garnett), who spoke against the motion. He thought they could not hope for so large an accession of consumers as would make up for the reduction in price. The works were established in 1836; and they had to be paid for in 55 years' time from 1878. Unless there was a depreciation fund, what would be their position? They were going to try an experiment with nothing to fall back upon. It was just as legitimate for him to embark in business and deliberately invite losses for someone else to make good, as it would be for him to recommend to the ratepayers that the Corporation should be in a position to make a levy on the rates for any loss in this commercial undertaking. The moral aspect was exactly the same.

The voting was then taken, with the result already recorded.

ELECTRIC LIGHTING NOTES.

Last Wednesday's meeting of the St. Pancras Vestry was most instructive to those interested in electric lighting questions. Foremost in importance came Mr. M'Gregor's motions—(1) "That the Vestry's resolution of the 31st of July last, prohibiting the London Hydraulic Power Company from supplying power to certain premises just within the parish boundary, be rescinded;" and (2) "That permission be granted for laying a service-pipe from the Company's mains, on condition that the power be used for no other purpose than is stated in the application—viz., the working of a goods lift." The Chairman (Mr. J. Thornley) having ruled that, under the new bye-law (No. 22), a rescinding resolution might be passed by a two thirds majority, this was accordingly done. Then followed a curious discussion. Mr. M'Gregor reminded the Vestry that the Electric Lighting Committee had endeavoured to coerce parishioners into using no other power but electricity in working lifts; and he therefore asked whether there were

any lifts in the electric lighting station in the King's Road just erected by the Committee. Mr. Lamble (the Chairman of a Sub-Committee who superintended the construction of the station), after some hesitation, said he was not aware of any. But Mr. Sweet, the Chairman of the Electric Lighting Committee, admitted that there was one in the coal-yard. "What power is used?" pertinently inquired Mr. M'Gregor. Mr. Lamble: "Water power." Mr. Barnes: "And this is where they manufacture electricity!" This damaging confession by Mr. Lamble caused the greatest uproar; and the Chairman was unable to maintain order for several moments. Continuing, Mr. M'Gregor said they were told eight weeks since that electrical energy was a suitable substitute for hydraulic power; while at that very time the Committee were spending money at King's Road in building a hydraulic lift for themselves. Mr. Sweet here attempted an explanation. He maintained that it was quite possible to use electrical power to work the lift in question. If the Vestry gave permission to the Hydraulic Power Company to lay their service-pipe, they would introduce a dangerous principle. The Company's own circular showed that they supplied their power for electric lighting purposes. At this point, it was evident that Mr. Sweet could not obtain a further hearing; and amid shouts of "Vote," he was obliged to sit down. The vote was then taken —52 being for granting permission, and 2 against it. Having thus purged themselves, the next business was proceeded with. A harmless-looking recommendation of the Electric Lighting Committee that a letter which had been received respecting the lighting of the public streets by incandescent gas-lights, be simply acknowledged, raised quite a storm. Mr. Hunt asked what was the nature of the communication. Its gist should, he said, be furnished to the Vestry in the usual way. Mr. Hodgson said the letter was sneered and laughed at by the Committee; and he thought the Vestry ought to do justice to what he believed to be the coming light. The existing four miles of electric lights in St. Pancras had cost an incredible sum; and incandescent gas lighting would be a boon to the ratepayers. Eventually, it was agreed that the subject should be referred back for the Committee to report as to the nature of the letter. Then came a very serious matter. Mr. Hodgson stated that a circular-letter, emanating from the Electric Lighting Department, and headed "To Electrical Engineers and Contractors," had been issued, to the effect that the supply, after the 1st of September, would be at 220 volts, and that no single circuit would be permitted to carry more than 20 ampères. Mr. Hodgson asked on whose authority this circular had been sent out. He said he believed that fittings for 220 volts did not exist; and several engineers had told him that such a voltage was dangerous. Mr. Sweet said the high pressure only referred to the new system in the King's Road Station. Mr. Baynes, their Chief Electrical Engineer, had told him that such high voltage lamps had been in constant use, with excellent results; and even 230-volt fittings were in the market. A member here rose to a point of order. Mr. Baynes had, he said, admitted to him that day that he could not get 220-volt lamps in London, and had agreed to put up 210-volt lamps *pro tem.* Mr. Orange wanted to know who had issued the circular, if the lamps demanded could not be obtained. Mr. Sweet said Mr. Bayr es had done it himself. At this, the Chairman remarked, with some feeling, that Mr. Baynes should first report such matters to the Committee, and not issue such circulars without their sanction.

Of course, we cannot see, but we may be prejudiced, why a small residential town with about 2500 inhabitants, a considerable proportion of whom occupy cottages, should be agitating itself about having the electric light; yet this is the case at Alsager, a place situated about six miles south of Crewe on the North Staffordshire Railway. No manufacturing industry is carried on at Alsager; and there are but very few good shops—most of the shopping being done in the neighbouring pottery towns. At present, gas or oil is employed for the private lighting; the roads—or "streets" as the District Council prefer to call them—being in darkness. The district is a scattered one; and, moreover, by far the larger number of the inhabitants are merely tenants of their houses. Where, then, do the special reasons for electric lighting come in? Naturally, the owners of the larger houses would like to have them lit by electricity, especially if this were done at the expense of the general body of ratepayers; but the latter would no doubt take a different view of the question. There being division of opinion on the matter in the District Council, the services of an electrician were called in to formulate a scheme. His first estimate was for plant involving an initial outlay of rather more than £7000. The working expenses were put down at about £1150; and the probable income at £2200. But, curiously enough, he omitted to provide for the repayment of the loan, although interest on the money was charged. This estimate probably staggered the Council, as they asked for another, which stands at £4000. It is stated that, as the plant estimated for would be sufficient for 40 street-lamps and 1200 private lights going at the same time, it would be quite safe to connect 1600 private lamps to the mains, seeing that not more than three-fourths would be in use simultaneously. The Council thought they would make a profit of £81 18s. per annum on the basis of a charge of 9s. for each lamp fixed. This looks very nice on paper—especially the odd 18s.; but the ratepayers want to know where it will be at the end of the first year's working? We should say very possibly swallowed up in a deficit. It seems to us to be the height of folly to entertain such a scheme as this; and, judging by the circulars which have been issued, some of the inhabitants consider its adoption will mean a 2s. rate. And where is this to come from? We question whether a place situated as Alsager is could run an electric lighting scheme successfully. At all events, if the more wealthy of the residents are enamoured of the system, let them unite their pecuniary forces and carry it out. The Council are young, and no doubt are inspired with the desire to be, as they suppose, "in the movement;" but they must be careful that this desire does not lead to the imposition of unnecessary burdens upon the ratepayers. By all means light the dark roads, but not by an unnecessarily expensive system.

Extensions are being carried out at the Derby Electric Lighting Works; and every effort is being made to complete them before the winter sets in. Three new boilers have been ordered; and an annexe is being built to make room for a new 20-horse power motor. The number of consumers has reached 194; while several others are waiting to be connected. At present the installation lights upwards of 12,000 lamps nightly. With regard to the finances, it is asserted that the undertaking has assumed an increasingly prosperous position, and that even now it more than pays interest on the outlay.

The Ratepayers' Association of Kingston, at their last meeting, discussed the question of the finances of the borough, particularly in relation to the steady rise in the rates. In this connection, some criticisms were passed upon the expenditure on electric lighting. This has already reached £16,000; and another £10,000 is about to be borrowed. Mr. W. Kemp took the lead in calling attention to this matter; and he asserted that, according to the published statement, the income from the electric light last year was £1400 less than the actual expenditure at the works. Yet, in face of this, the Corporation were proposing to extend their business, on lines which, to his mind, were very injudicious. At the present time, a 3d. rate was being levied for the purpose of supplying a light which was a luxury; and, in spite of what Mr. Preece and other engineers said, he declared that there was no reasonable prospect of the undertaking being a paying one. To his mind, Kingston could be lighted quite as efficiently, and at much less cost, by means of incandescent gas-burners. Another ratepayer—Mr. Savage—spoke of the perfect satisfaction which incandescent gas-lights had given him in his house; but he thought it would be most unwise and unbusinesslike for the Corporation to follow Mr. Kemp's advice, and not attempt to extend electric lighting. A resolution was passed, expressing the opinion of the Association that the present debt of the borough had arrived at such an amount that any further increase in unremunerative outlay must be deprecated.

Although the residents in North Bristol congratulated themselves when the Corporation consented to extend electric lighting in their direction, they find, now they have it, that it is not an unmixed blessing, especially when it suddenly fails. This experience befell a jeweller a few days ago, just as he was displaying his goods to a likely customer; and other tradesmen have suffered similarly. Fortunately, most of them have been cautious enough to retain their gas supply; and this, as the Chairman of the Gas Company (Alderman Dix) very properly reminds the citizens, is always reliable. On Saturday, the 21st ult., gas had to be used for about an hour, owing to the electric lights having gone out; and we learn from a local paper that the interruptions have already happened too frequently for the comfort of those who have taken to discarding the old light for the new one. On the following Monday, trouble, not to say danger, arose from another cause. While one of the electric cables was being tested, just outside some handsome business premises, smoke was seen issuing from the manhole over the sub-station chamber under the pavement; and, something being obviously amiss, a message was sent to the police, who despatched the fire brigade, and, by telephoning to the electrical works, had the current diverted. Meanwhile, the manhole lid having been removed, flame and smoke shot up in great body; and the alarming news that the electrical sub-station was on fire spread rapidly—causing no little uneasiness to tradespeople in the immediate locality. Although the hose-cart was taken to the place, the fire brigade would not risk an explosion by pouring water into the burning chamber; and Mr. Faraday Proctor, the Electrician to the Corporation, advised them that the best course was to let the flames exhaust themselves. A press representative who called at the central electrical works was informed by an official that only smoke came from the sub-station. But the police stated that flames shot up from 4 to 6 feet above the pavement —the dense body of smoke ascending to a considerable height; and this was confirmed by some eye-witnesses of the scene. At the electrical works, it was said that three times the ordinary pressure was being used in testing the cable; and the accident was attributed to the over-heating of temporary connections fixed in wood soaked in creosote. The occurrence happened just before five o'clock; but it did not prevent the electric light from being turned on later in the evening.

Yarmouth, like Bristol, has lately suffered from the unreliability of the electric light. Under the heading: "The Primitive Candle again in Request," the following paragraph appeared in the *Eastern Daily Press* on Monday last week: "On Saturday evening, those tradesmen whose establishments are entirely lighted by electricity were suddenly alarmed by being put into total darkness by the failure of the light. Those who had been wise enough to retain their gas-fittings quickly remedied matters—lighting the gas, and getting their outside lamps into requisition. But some who had gone so far as to do away entirely with their gas-fittings, were reduced to the extremity of sending out for candles; and this antiquated method of lighting trade premises had once more to be resorted to. The current remained off for about three-quarters of an hour, after which it gradually returned and supplied the shops with light for the remainder of the evening. At the Town Hall, a limelight exhibition was going on at the time of the failure; and it was not known by the audience till an interval in the lecture that anything had happened. The hall-keeper, however, soon had the gas chandeliers lighted; and the proceedings were therefore not interrupted in the slightest." The sudden collapse of the current only affected trade premises; all the outside arc lights burning as usual.

The main thoroughfare of Blackpool—Church Street—was plunged into darkness last Thursday night, owing to the failure of the electric light; and soon afterwards an alarming explosion occurred. It is supposed that sparks ignited the gas which had collected in two transformer boxes; and, with loud reports that startled the whole neighbourhood, the lids were blown off. Fortunately, no one was injured. Business had practically to be suspended for the rest of the night by most of the tradespeople.

The Stafford Corporation Electric Lighting Works, the foundation stone of which was laid about twelve months ago, have now been completed. The buildings, which were designed by the Gas Engineer (Mr. J. F. Bell), are handsome and substantial; and they stand side by side with the gas-works. Acting under the advice of the Consulting Engineer (Dr. John Hopkinson), the machinery and plant which the Corporation have put down are of the most approved types; and a liberal margin has been allowed to meet accidents and contingencies. The space covered by the buildings measures 130 feet by 70 feet. In the boiler-house, there are three boilers, each 30 feet long, and of a collective capacity of 1000-horse power. The furnaces will be served with the unsaleable waste from

the gas-works. Three splendid engines, with their necessary adjuncts, occupy nearly one-half of the floor space of the magnificent room in which they are placed; and an overhead crane, capable of lifting 12 tons with ease, travels the full length of the large apartment. Each of the engines is equal to 150-horse power; but, as a rule, they will be run at the lower, but more economical, load of 120-horse power. The dynamos convert the mechanical power of their engines into the corresponding amount of electrical power, with a loss of only 5 per cent. during the process, which, it must be admitted, is very near perfection. The storage department is fitted up with 112 cells; and the supply of the town can conveniently be left to these batteries during the early part of the day and after midnight. The supply is on Dr. Hopkinson's three-wire system.

THE RECENT SCARCITY OF WATER AT THE EAST-END.

The Official Water Examiner on the Situation.

In the course of his report (dated Aug. 27, and recently issued) to the Local Government Board on the condition of the Metropolitan Water Supply during the month of July, the Official Water Examiner —Major-General A. de Courcy Scott, R.E.—makes the following remarks as to the scarcity of water then prevailing at the East-end:—

It was stated in my report for the month of June that the Directors of the East London Water Company had found it to be necessary to reduce the supply of water pumped into their district, in consequence of the rapid depletion of the storage reservoirs which had been in progress. From the 15th of July, the supply was still further restricted. The water was shut off from all the mains, except those provided with fire-plugs, during from 21 to 22 hours out of each 24. The supply to three-fourths of the district was, consequently, received for only two or three hours daily. The Company are under statutory obligation to keep all mains which are fitted with fire-plugs constantly charged; and the houses and factories which are connected with these mains—representing about one-fourth of the whole number of services in the district—continued, therefore, to receive a constant supply of water. As a large number of houses in the poorer districts are not provided with cisterns for storing water, the substitution of an intermittent supply, of two or three hours' duration, for the constant supply, which had been universal, naturally resulted in serious inconvenience and considerable danger to health, owing chiefly to the impossibility of flushing the water-closets and drains as required.

The Engineer of the Company has reported that on the 27th of May the reservoirs of the Company were full to overflowing. These are capable of containing about 610 million gallons of water, exclusive of the considerable quantity lodged in the gravel between the puddle walls and the inner slopes of the reservoirs. The available quantity remaining in them on the 15th of July, when the further restriction referred to was imposed, amounted, it was stated, to only 25 million gallons, or about two-thirds of the quantity used in one day under the intermittent system of supply which came into operation on the 29th of June, as already explained.

This was the condition of things until the 23rd of July. The depletion of the reservoirs between the 27th of May and the 15th of July seems, therefore, to have proceeded at the rate of about 12 million gallons per day on the average. The balance required for the supply of the district was drawn from the River Lea, from wells, and from the Thames. The average daily quantity drawn in July from the Thames was 9,129,281 gallons; from wells, 6,223,785 gallons—total, 15,353,066 gallons. And this was, no doubt, a fairly constant quantity. If to this we add the 12 million gallons assumed to have been taken daily out of the store in the reservoirs, we arrive at a total of about 27 million gallons. The difference between this and the average quantity pumped daily into the district should represent the average amount of water which the Company were able to draw from the Lea during the period in question. The average daily supply to the district during the period from the 29th of May to the 15th of July seems to have approximated closely to 50 million gallons; and therefore the quantity drawn on the average from the Lea must, on these assumptions, have been 23 millions per diem.

The returns furnished by the Engineer show average daily quantities pumped as follows: During the week ending June 28, 56,100,000 gallons; do., July 5, 51,690,000 gallons; do., July 12, 50,409,482 gallons; do., July 19, 42,991,077 gallons. But a deduction of 10 per cent. should be made for slip and other losses, in order to arrive at the quantity actually distributed.

The discharge of the Lea at Feilde's Weir averaged in June 24,230,000 gallons per day. The return for July is not available; but the flow on the 30th of June seems not to have exceeded 20,350,000 gallons. There is probably some leakage through the weir, and the river receives the flow of some springs at points below the weir; so that the volume of the stream there is, no doubt, in excess of that gauged. Still the gauging may be taken as a basis for calculation; and it is apparent that the flow of the river from the 1st to the 15th of July approximated closely to that which, as has been shown in my annual reports to the Board, prevails during months of drought. The requirements of navigation have the first claim on the resources of the river, and may extend up to 5 million gallons in a day. It must therefore be inferred that the East London Company were taxing the resources of the river to the utmost possible extent.

It seems clear, from the reports made, that the necessity for rigorous limitation of the quantity pumped into the district was imperative, and that the measures adopted were not more drastic than the occasion required. The possibility of the continuance of the drought, which had prevailed for several months, and of accident to the main carrying water from the Thames, had to be considered, and it was absolutely necessary to endeavour to secure some small reserve of water, in order to place the Company in a position, in the latter event, to tide over the period which would be taken up in the execution of the necessary repairs.

It was apparent that the New River Company were in a position to render assistance in this emergency, since they could bring into action their reserve pumping power, and draw a larger proportion of their supply from their wells than they were doing, while restricting to an equivalent extent their extraction of water from the Lea. The Directors readily assented to the request of the Local Government Board that this assistance should be given; and they entered into an arrangement to this effect with the East London Company, which came into operation at the end of the month. At the same time, stand-posts were placed at various points on such of the mains as were constantly charged, so that the people in the vicinity could draw water throughout the day.

The gradual increase in the volume of the River Lea which ensued in consequence of the fall of rain which took place at the end of the month and since, has enabled the Directors to lengthen from time to time the period during which water is turned on to the service-mains. Seasons have occurred during which the September flow of the Lea has been exceedingly small; and it would not be prudent to revert to a constant supply until a reasonable reserve of water had been accumulated in the reservoirs.

The Action of the Local Authorities.

On Monday last week, a further conference of representatives of the various Vestries and District Boards of East London was held in the Hackney Town Hall, to consider what action should be taken with reference to the Local Government Board inquiry to be held as to the water supply of the district. Mr. G. B. Holmes occupied the chair; and among those present were Sir A. Scoble, Q.C., M.P., Mr. Bousfield, Q.C., M.P., Mr. H. S. Samuel, M.P., and several members of the London County Council. A resolution was adopted pledging the members of the conference to urge upon their respective Boards the necessity of contributing *pro ratâ*, according to population, to the cost of the inquiry. Sir A. Scoble remarked that they had not much time; but they must combine and employ one solicitor to represent the whole of the parishes. Something had been said to the effect that Mr. Bousfield and Mr. Fletcher Moulton might take up the case without fee, and conduct the inquiry for the parishes. He thought the conference had no right to expect these gentlemen to do anything of the kind. Mr. Bousfield said he had made an offer to give what assistance he could to the Vestries concerned; but he never intended that he should conduct the case for the conference. His own view of the whole matter was that a Joint Control Board for London and the surrounding districts should be formed. Such a Board, or Water Trust, he considered to be absolutely necessary; and when the matter came before Parliament, as no doubt it would, he would do all in his power to secure the appointment of such a Board. Mr. Samuel said he believed the issue of the inquiry would be that Parliament would be asked to say that such an important necessity of life as water should no longer be in the hands of private Companies. A deputation was appointed to wait on the Water Committee of the London County Council to ask their assistance in the matter. Accordingly, on the following day, the deputation attended at the offices of the London County Council, and had an interview with the Water Committee. They desired the Council, as the Metropolitan Authority, to give assistance to the East London parishes by providing Counsel, &c. Mr. G. Grocott, the Vestry Clerk of Hackney, said the Vestry had been deputed by the other local authorities to prosecute the inquiry; but as this was a question of interest to the whole of London, it was desirable that the County Council should be represented. The Chairman of the Committee (Mr. Collins) said the Council would be advised as to their powers in the matter; but no doubt they would be represented at the inquiry. At their meeting last Thursday, the Court of Common Council of the City of London decided that the Corporation should be represented at the inquiry. A special meeting of the Water Committee appointed by the East-end Vestries to prepare the case to be submitted on behalf of the consumers was held last Saturday afternoon at the Hackney Town Hall Mr. J. Bethell Holmes (Hackney Vestry) presided; and there was a numerous attendance of delegates. It was stated that fifty typical cases had been selected from each of the Hackney and Bethnal Green districts, and that a similar course would in all probability be followed by the other Vestries. The Chairman announced that the Committee had secured the services of Mr. Balfour Browne, Q.C., Mr. T. H. Bevan, and Mr. W. H. Eldridge as Counsel on behalf of the Vestries at the inquiry. It is understood that Mr. Pember, Q.C., and Mr. Cripps, Q.C., have been retained for the Company.

The Carriage of Liquid Ammonia on Board Ship.—The following notice has been issued: "The Board of Trade are advised that both the aqueous solution of ammonia and ammonia gas compressed into liquid form should be classed as dangerous goods, not only on account of the danger of explosion involved when they are contained in vessels not sufficiently strong to withstand the pressure which may be produced by a rise in temperature, but also on account of the highly dangerous nature of the gas. The following precautions should be adopted when either of these liquids is carried on board ship: It should be packed in iron vessels which have been carefully tested up to a pressure of 675 lbs. per square inch, and should be stored in a part of the ship beyond the influence of any heat from boilers or furnaces, and remote from the living quarters."

Austrian Incandescent Gas-Light Company.—The report of this Company for the year ended June 30 last states that the expectations to which the Directors gave expression in the last report have been more than realized. During the last year they have disposed of their rights and privileges in Russia, Scandinavia, and Denmark. They have, moreover, made arrangements with the Netherlands Company, which guarantee for a long time the sale of the chemical product. As a compensation for ceding the Dutch licence rights, they have obtained one-fourth in the nominal capital of the Netherlands Company viz., £12,500. For the right in Hungary they have received 2700 shares of the nominal value of 270,000 frs. in the Hungarian Company. The original amount of 1,142,015 frs. has now been entirely written down, partly out of profits and partly out of sale of patents. The usual reserve fund stands at 225,000 frs., and the special reserve fund at 323,171 frs.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I observe the letter by Mr. A. Wright, Convener of the Perth Gas Committee, regarding my writings concerning the retirement of Mr. T. Whimster from the post of Engineer and Manager to the Perth Gas Commission. It is, in some respects, unfortunate that in last week's number of the JOURNAL there should also have appeared a long note from myself, adhering to, and claiming confirmation of the view which Mr. Wright wishes to remove; because it is no interest of mine, and I certainly have no desire, to represent anything connected with the position of the Perth Gas Commission otherwise than is fair to all parties. Probably Mr. Wright will not object to look at the matter, as I presented it, from the point of view of one who was outside the influence of either the Sand Island or the Friarton Farm schemes. Mr. Whimster was asked to report "generally as to the condition of the gas-works, and specially as to the probable cost of removing the works to the Sand Island." He did so somewhere about the month of April last, giving the cost at which he estimated the removal. Thereafter Mr. W. Foulis, of Glasgow, was asked to report on the subject; and he did so in the beginning of August, recommending the removal of the works to a more suitable position, and adding that the proposed site at the Sand Island appeared to him to fulfil the necessary conditions. It will be observed that both gentlemen were confined to the consideration of the Sand Island site; and they reported according to the remit to them. Neither of them said it was a good site. In fact, Mr. Foulis pointed out the drawback there would be to it in the matter of getting foundations. Then the Friarton Farm scheme was brought forward; and Mr. Whimster was asked to report upon it. He did so; but again he gave no opinion, because apparently it was not asked, regarding the suitability of the site. Even before this report was submitted to the Commissioners, there came his resignation, which was placed before, and accepted by, the Commissioners at a special meeting, as it were in hot haste, as if some sudden occasion had arisen for his going. Now, all this, I think, bears out the view I gave, that Mr. Whimster probably felt himself rather obliged to report upon the capabilities of the site (the Sand Island site) than to criticize it. So far from saying, either by innuendo or insinuation, that pressure had been brought to bear on Mr. Whimster as to the selection of a site, my view rather was that the site was selected for him, and he was simply asked to report as to the cost of removal to it; and that Mr. Whimster, on a battle of sites becoming imminent, preferred to retire rather than enter into it. If this is not the real view, then, I must confess, facts may sometimes be misleading. If it be the true state of the situation, then it detracts nothing from Mr. Whimster's position. It will, however, be matter of regret that Mr. Whimster's age should have led to his retirement at a time when his employers should, naturally, have expected to receive the benefit of his great experience. To be sure, his services might have been retained as consulting engineer; but there is no mention of that—he has simply retired. Not only will the new man, as Mr. Wright states, be able to say something as to the designing of the new works, but he should also have to do with the selection of the site for them. If he has, then Mr. Whimster's work in the matter will be thrown away, and probably Mr. Foulis's too; and the whole thing will be taken up afresh. If he has not, then the situation will arise of a gas manager being appointed and told to "build a gas-works there," which every high-souled man would surely resent. Leaving this phase of the subject out of view, I must say the Commissioners are in an awkward situation. They have not agreed upon the new site—in fact, it is announced this week that Mr. Keiller, a member of the Commission, has circulated among his fellow members a statement to the effect that the removal of the gas-works to the Sand Island would cost £18,325, as compared with £16,433 to Friarton Farm; showing a difference of £1892 in favour of the latter. It is while thus divided upon a question of the most vital importance that the Commissioners are called upon to appoint a new Manager. There is danger that the man who may be appointed will receive the post more upon the ground of his leanings as to the site, rather than of his general ability. That is an eventuality which the Commissioners must beware of. Perhaps it would be better, were it possible, to drop the subject of the removal of the works in the meantime, and take it up next summer, when the new man will have had some acquaintance with his work.

The Dundee Town Council are to be recommended by their Finance Committee to promote a Bill in the next session of Parliament, giving them enlarged borrowing powers for their gas and electric lighting undertakings, and for regulating other matters, including the extension of the electric light installation. The necessity for further borrowing powers is pressing. At present, the statutory power they possess is limited to £200,000; but they have exceeded this sum, in indebtedness to the bank and otherwise, by about £6000.

It will be almost matter for regret with many to learn that the tall chimney at the Edinburgh Corporation Gas-Works has been condemned, and will soon be demolished. The chimney was a feature of the Edinburgh landscape. But it was greatly objected to by people of an æsthetic taste; and its removal will be hailed by them with delight. Perhaps it may be right to explain that the great height of the chimney was not owing to any whim on the part of the Edinburgh Gas Company, but that it was forced upon them. The gas-works are situated in a deep hollow, between the Calton Hill and the ridge upon which the Old Town is built. In the early days of gas making, great quantities of very obnoxious vapours were sent up the chimney; and the result was that, so long as there was only a stalk of moderate height at the works, the fumes got into the houses on the high grounds adjoining. The residents on the slope of the Calton Hill, being of a superior class, specially objected to the annoyance they were subjected to. Not only were the fumes of disagreeable smell, but it was found to be impossible to keep silver in the houses clean. The Gas Company therefore, in 1846, built the tall chimney, which had the effect of carrying the products of combustion away from everything terrestrial; and the complaints thereupon ceased. The chimney has done duty since, till this year, when it began to give way, from some cause which is still a mystery. The foundation is stiff blue clay, which is hemmed in at the north and south sides by igneous rocks. The clay is, somewhat strangely, water yielding; suggesting the presence in it of fissures or pockets containing water. It is pierced in numerous places by very deep wells, which are used for brewery purposes. For more than a year, the North British Railway Company have been engaged in driving a tunnel through the rock of the Calton Hill, about 100 yards from the chimney. In their work, they employ a very powerful blasting material, the shots of which, I have been told by a gentleman whose business place is in the neighbourhood, produced vibration sufficient to almost shake him off his chair. One of the theories for the giving-way of the foundation of the chimney, is that the violent shocks from the blasting operations in the tunnel may have rent the rock, and led to the draining away of the water in one of the fissures in the clay on the east side of the chimney, thereby lessening the amount of support it received on that side. Though this is, to my mind, the most feasible suggestion, it will probably never be known. I daresay it might have been possible to have righted the chimney, though it was some 5 or 6 feet off the plumb; but the masonry of it is showing signs of giving way, and the Commissioners have wisely resolved to take it down.

The question arises as to what is to be put in its place. The Gas Commissioners propose to erect a chimney 250 feet high, having altered the height from 160 feet as mentioned last week. It was then stated that the Dean of Guild Court urged that the new chimney should be erected rather to the south than to the east of the present one. At this week's sitting of the Court, Mr. Masterton, the Assistant Manager in the gas-works, on behalf of the Commissioners, presented a plan showing that the Commissioners had to a considerable extent acceded to the wish of the Court. The Commissioners had the assistance, in considering the matter, of Mr. C. Dennis, of Bury, who is probably the greatest authority in this country upon the construction of flues and chimneys. Anything, therefore, which they may have resolved to do, will be regarded as safe and reasonable. On considering the matter, it does look as if, other things being equal, it would be advisable to get away as far as possible from the east side of the present chimney, where the weakness exists. This has now been done; and the Dean of Guild expressed the opinion that the site was a good deal better than the first one proposed. The idea is to get the chimney as near as possible to the high houses in the Canongate, so as to remove it from the centre of the valley, and to a large extent to conceal it among other buildings. That is quite as it should be, provided the chimney can be made serviceable, which is the first consideration. But the Court went further, and suggested that the Commissioners should give the new chimney something of an architectural character. They thought, also, that 200 feet should be high enough. Mr. Masterton said the intention of the Commissioners was at first to erect two chimneys of 160 feet each; but that the one they had now agreed upon would have to do all the work. He was afraid that a chimney of 200 feet would scarcely have sufficient draught. The Court granted a warrant to proceed with the foundation of the new chimney, and to erect it to a height of between 20 and 30 feet; but they continued the questions of height and appearance for the further consideration of the Commissioners. Now it is quite true that, in a city such as Edinburgh, it is particularly desirable to have everything as good looking as possible; and it is also true that, so far as proportion is concerned, it will cost no more to erect a chimney of artistic design than to build an ugly thing. But I should say that, if an attempt be made to coerce the Commissioners into erecting a costly structure, they ought to resent it. In the present condition of the Edinburgh Gas-Works, and taking into account the rapid growth of the gas consumption, it is evident that before very many years the present site of the works will require to be abandoned, and a new one, giving more room, will have to be found. A chimney of moderate cost would therefore be the most desirable. It would be advisable from the Commissioners' point of view; but it might also be an advantage in the æsthetic sense, because, were the Commissioners encouraged to seek for a new site, the citizens might look forward to the whole works being cleared away in a few years.

The Falkirk Gas Commissioners have narrowly escaped having another litigation on their hands. A claim for £144 15s. was made by Messrs. Scrimgeour, of London, for services rendered in connection with the Corporation Gas Bill. The Messrs. Scrimgeour raised a summons against the Corporation for the amount. On Monday night, the Gas Commissioners considered the subject; and by 5 votes to 4, they resolved to settle the claim outside the Court—the losing motion being that they should defend the action. The Commissioners are under negotiation for the construction of a railway siding into the gas-works. At present, their carting account is about £500 a year; and they expect to be able to reduce this sum. The railway would require to pass through ground belonging to the Falkirk Iron Company; but the Company, it is stated, are willing to consider favourably any proposal by the Gas Commissioners as to the passing of a railway through their property.

In connection with the working of the Inverness Corporation Gas-Works, there was last year a profit of £1788. At the end of the preceding year, the balance of profit amounted to £2802; and there is now a credit balance on hand of £4591. Last year the Corporation reduced the price of gas from 5s. 4d. to 4s. 7d. per 1000 cubic feet; and they now propose to reduce it to 4s. 2d., which will make the very gratifying reduction of 1s. 2d. per 1000 cubic feet within little more than a year. The Finance Committee, adopting a suggestion by the Manager (Mr. J. Thomson), have agreed to recommend that £1350 should be expended out of revenue on a retort-bench; being one-half of the cost, the other half to be charged to capital, to cover the portion which is an extension.

With regard to the erection of a new gasholder by the Gourock Gas Commissioners, a bed of whinstone rock was found 14 feet from the surface of the ground. The Commissioners resolved to stop the excavation of the tank at that level, instead of proceeding to the originally intended depth of 20 feet. On Wednesday night, however, they reconsidered the matter; and, on account of the view that the holder would sit too high if the tank only went down 14 feet, they resolved to go down the full depth of 20 feet. The extra outlay will be about

£400, and will bring up the cost of the holder to about £3600. The holder is the one which Sheriff Cheyne, in April last, granted the Commissioners permission to erect without obtaining the sanction of adjoining owners and occupiers of houses.

The Largs Police Commissioners on Monday night considered the subject of the adoption of the Burghs Gas Supply (Scotland) Act, 1876. Two gentlemen opposed the proposal on the ground that three years had not elapsed since they had the subject before them. The proposal to adopt was, however, carried by 3 votes to 2.

A special meeting of the Cupar Gas Company has been called, to consider whether the Company should not be converted into a limited liability one, and be registered as such.

The Town Council of Aberdeen had a long discussion last Monday week on a proposal by the Streets and Roads Committee to lay a number of the secondary thoroughfares in the city with a pavement made of macadam and tar. Before making the proposal, the Committee visited London and other towns where such paving has been used; and they returned satisfied that it would be an advantage to the city to try it. The first cost was certainly less than for other forms of improved paving. The only question was as to durability; and on that point, though the data are not very authoritative, the Committee resolved to risk the experiment. Now, had it been in any other place than Aberdeen, the proposal would most probably have been at once adopted. In Aberdeen, however, there is a large production of the granite paving-stones which were the most approved form of paving not so many years ago. There is still a large demand for these stones; and the representatives of the working population, fearing that, if Aberdeen were to show the way in Scotland in the matter of superseding granite paving, the movement might lead to the loss of work in the district, sent a deputation to the Town Council who spoke against it. Some of the Councillors took the same view; and the proposal was defeated by 14 votes to 9. The policy is quite natural; but it is short-sighted, as are all movements for the restriction of public improvements. The great noise of traffic over granite pavements makes them undesirable, and as soon as a satisfactory substitute is found, their day will be gone. A better movement in Aberdeen would, therefore, have been, seeing that they have already a very large connection in the paving industry, to have sought to improve it rather than to cripple their future. Of course, the successful party are the party of the labour interest, which is very seldom well advised. The interest in the question to your readers lies in the fact that an extended use of tar for paving purposes would very largely assist their revenue.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 28.

Sulphate of Ammonia.—Throughout the week, supplies have been adequate, although there has been a fair demand (largely, it may be observed, from second hands to cover sales); and prices have been fairly maintained. The closing quotations were £8 15s. per ton f.o.b. Leith; £8 16s. 3d. f.o.b. Hull; and £9 f.o.b. Liverpool. For forward delivery, speculators are offering at a very moderate premium upon spot values; but these offers do not seem to be attracting much business, notwithstanding that sulphate of ammonia is relatively so much cheaper than nitrate of soda and other high-class nitrogenous material.

Nitrate of Soda is very quiet. Spot value of fine quality is 7s. 10½d. per cwt.; and cargoes of ordinary quality, autumn shipment, are worth about the same. The efforts to effect a combination for the curtailment of the output have so far been unsuccessful.

LONDON, *Sept.* 28.

Tar Products.—Pitch maintains its position; and, judging from the repeated inquiries, it looks as if at any rate this season will not see lower prices. Benzols are a fraction higher in price; and as stocks in this country are now said to be *nil*, it is not unlikely that a further improvement may take place. The demand for creosote is dull; and prices continue low. Carbolic acid is moving off at old rates; while anthracene is easy all round. Business has been done during the week at the following prices: Tar, 18s. 6d. to 22s. Pitch, west coast, 35s.; east coast, 37s. 6d. Benzols, 90's, 1s. 0½d.; 50's, 1s. Solvent naphtha, 1s. 1d. Toluol, 1s. 1½d. Crude, 30 per cent., naphtha, 4¾d. Liquid creosote, 1¼d. Naphthalene salts, 25s. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 7d.; 75's, 1s. 9½d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia is distinctly in better request. Considerable business is reported, but at very low prices—ranging from £8 12s. 6d. to £8 17s. 6d., less 3½ per cent., according to port of shipment and delivery conditions. Gas liquor is quoted at 6s. to 7s.

Gas Storage Extension at Woodbridge.—Messrs. Clayton, Son, and Co., of Leeds, have just completed the work of enlarging the gas-holder of the Woodbridge Gas Company. A new lift, columns, and other necessary requirements have been provided, which will enable the Company to supply at least ten hours' extra consumption of gas in case of emergency. In commemoration of the event, the employees of the Company have been entertained by the Directors to a dinner.

The Water Cutting Off Case at Cardiff.—In reference to the case reported last week in which a Mr. Newman sued the Cardiff Corporation for illegally cutting off the supply of water to the house of which he was the tenant, it is only fair to the Corporation Water Committee to say that the supply was cut off at the instance of a rate collector named Marks, after the Town Clerk had decided that no such action could be taken, and definite instructions had been given not to do anything in the matter. Marks has since been called before the Committee, and asked for an explanation. He acknowledged his mistake, but, in extenuation, he said that he signed the requisition for cutting off the water without considering the circumstances. He expressed his extreme regret for what had happened, and said he had paid the fine and costs out of his own pocket.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—No material change can be reported as regards the coal trade of this district. Business continues extremely slow, with no improvement in prices; whilst, with pits in most cases working only three to four days per week, supplies are ample. House coals, here and there, are meeting with a somewhat better sale; but generally there is neither that increased demand for winter requirements which usually comes forward, nor the advance in prices which is generally put in force with the close of the summer season. The exceptionally hot weather, of course, tends to diminish the demand for house-fire qualities. Steam and forge coals are a continued drug upon the market, the increased demand for iron-making purposes not being sufficient to make itself felt upon the large supplies offering; and prices are cut excessively low. Engine fuel is more plentiful, if anything; and there is no difficulty in meeting requirements, with prices about as last given. At the pit mouth, best Wigan Arley averages 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; common house coals, 7s. to 7s. 6d.; steam and forge coals, 6s. to 6s. 6d.; and engine fuel, 3s. to 3s. 6d. for common slack, and 4s. 6d. to 5s. for better qualities. For shipment, only a slow inquiry is reported to be coming forward, with prices as low as ever; 7s. to 7s. 3d. per ton representing the average figures for steam coal, delivered at the ports on the Mersey.

Northern Coal Trade.—The course of the coal trade in the North has been affected, on the one hand, by the desire to export coals before the closing of the northern ports of the Baltic, and, on the other, by the very hot weather limiting the consumption of household coals. Best Northumbrian steam coals have been in fair demand, and have commanded about 8s. 9d. per ton f.o.b.; whilst second qualities have been generally quoted at from 8s. to 8s. 3d., and steam small coals at 3s. 6d.—the latter kind being rather scarce. Manufacturing coals are very quiet; but there is a little desire to contract forward, as some consumers seem to believe that the price may be dearer next year. In regard to gas coals, there has been a partial settlement of the contract for Newcastle. It is the largest in the North; about 200,000 tons being carbonized yearly. Contracts have already been entered into for more than a third of this quantity, at about 6s. 6d. per ton f.o.b. A large tonnage has been offered at higher prices; and counter negotiations are being entered into, so that probably the bulk of the coal will be bought at rates that are not much above that just named. This will represent a considerable saving on the coal from the price that is being paid for this year's supply. Generally, the gas coal trade is steady; and the deliveries are being largely increased, as is usual when October is at hand. There is very little alteration this week in the coke trade; the improvement of the past few weeks being still maintained. For export, the price of coke is 14s. per ton f.o.b.; while for local use the quotation is about 13s. per ton, delivered at local furnaces. Gas coke is steady in price; but there are large stocks at most of the inland gas-works, and the production is now beginning to increase, so that in some cases lower offers are being made when the demand is for a considerable quantity.

Scotch Coal Trade.—Inactivity characterizes the coal market in Scotland just now. It is recognized that contracts which were lost last year might be recovered if quotations a little lower were tendered; but coalowners feel that they have already gone low enough, and they are unwilling to go further. In the east of Scotland, trade is exceedingly slow. In the west, where there is a better demand, the men are for the most part working only four and a half days a week. Prices for all varieties remain much about the same, and are given as: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 168,665 tons—an increase as compared with the quantity in the preceding week of 23,889 tons, and upon the quantity in the corresponding week of last year of 159,020 tons. For the year to date, the total shipments have amounted to 5,286,969 tons—an increase as compared with the same period of last year of 1,510,810 tons, but a decrease on the same period of 1893 of 89,836 tons.

Gloucester Water Supply.—At last Tuesday's meeting of the Gloucester City Council, the Surveyor was empowered to arrange, if necessary, for supplementing the city water supply from the Severn; the supply at the Witcomb water-works having been reduced by deficiency of rain to less than two months. It was stated that the new works at Newent were being pushed on with all possible despatch; and it was hoped they would be available by the end of 1896.

Northam Water Supply.—In consequence of grave difficulty in respect to water supply, the Northam District Council at a recent meeting instructed Mr. Baldwin Latham, C.E., to investigate possible sources, and prepare a scheme which would serve the whole district. The population was upwards of 5000 in 1891; and the district includes Westward Ho and Appledore, and is very variable in regard to elevation. Mr. Latham pointed out that it would be quite easy to obtain a gravitation supply for Westward Ho, Orchard Hill, and Appledore, but difficult to supply the higher part of Northam by this means. Of five sites which he had marked as collecting areas, one south of Redford Farm, Abbotsham, would be most suitable. It had an area of 120 acres, and had neither habitations nor mill rights. An impounding reservoir there would be sufficiently high to supply all but part of Northam. In order to make economical water-works, an intermediate distributing reservoir would be required; and at the point where this was made, he proposes to put down a small pumping plant to send water to a high-level reservoir to serve the more elevated parts. He suggested that an Act of Parliament should be obtained, as by this means the term of repayment of the loan would be longer than under a Provisional Order; and he said that, if there was no opposition, the cost of an Act would be no greater than that of an Order. In the course of the discussion, Mr. Latham was asked if the cost would be £20,000; and he replied that he did not think it would. It was decided that Mr. Latham should supply plans and estimates for his scheme.

The Nidd Water-Works of the Bradford Corporation.—The Water Committee of the Bradford Corporation last Friday decided to recommend the Town Council to accept the tender of Mr. Phineas Drake, for the construction of a new storage reservoir and filter-beds at Chellow Dean, in connection with the Nidd Valley water-works. The amount of the tender was £59,950; and the reservoir will have a capacity of 32 million gallons.

Extensions at the Selby Gas-Works.—The gas-works of the Selby Urban District Council have lately been extended, to the designs and under the supervision of the Engineer and Manager (Mr. Matt. Dunn, Assoc.M.Inst.Mech.E.), by the construction of three beds of oval retorts, the enlargement of the retort and engine houses, the fixing of annular condensers, and a new engine and exhauster, the erection of meter and gas testing houses and plant, &c. The summer production of gas this year shows an increase of 37 per cent. over 1894, and of more than 50 per cent. over 1892. These improvements will amply provide for dealing with the increased production and output of gas. The eight-hour system has been adopted by the Council for stokers and wheelers.

The Construction of the New Water-Works at Plymouth.—The Plymouth Water Committee have arrived at an important resolution. Two years ago, they obtained parliamentary sanction to extensive works, including the construction of a large storage reservoir, and the laying of a pipe-line to supersede, or supplement, the conveyance of water to the service reservoir by means of the historic Leat. After lengthy deliberation, it was decided that the Corporation should themselves lay the pipe-line and undertake the preliminary work of excavating the sites of the masonry dams for the reservoir. So far as this work has gone, it is claimed that the Corporation have saved money by doing it instead of employing a contractor. The Committee have now resolved that the remainder of the works, which are the more important and costly, shall be executed by the Corporation and not by contract. They propose to employ a firm of surveyors to take out the quantities of the works in relation to the Burrator reservoir, and to pay them a commission of ¾ per cent. on the value of the works; the commission to include the cost of lithographing and all out-of-pocket expenses. A difficulty has apparently arisen in defining, under the circumstances, the value on which the commission is to be paid; for the resolution says "such value to be arrived at in a manner to be hereafter determined by the Corporation." The works have been and will be carried out under the supervison of Mr. James Mansergh, the Consulting Engineer, and Mr. E. Sandeman, the Corporation Water Engineer.

The Glamorgan County Council and the Water-Supply Proposals of the London County Council.—During the proceedings of the Glamorgan County Council at Pontypridd last Thursday week, the Chairman (Mr. J. B. Jenkins) reported that the Water Committee had directed the Clerk to inquire of the District Councils what their provision for water supply was, having regard to future probable increase of population, and possible diminution of sources of supply, and to ask them whether they would be disposed to be included in a joint scheme with other districts for securing a proper and sufficient supply. Mr. T. J. Hughes declared that he was greatly disappointed they had not done more than was indicated in the report; for the position was now infinitely more serious than it was three months ago. At that time they contemplated the possibility of further inroads being made into their valuable sources of water supply; now they saw that this possibility had become a strong probability. The London County Council had formulated a water scheme; and the special report of their Engineer showed that it was proposed to adapt for the use of London five existing sources of water supply in Wales, the total anticipated yield from which was estimated at 415 million gallons per day, or a greater body of water than passed over the Thames at Teddington Weir every day. Moreover, each of these sources was above 600 feet high. The water supply for the populous part of the county of Glamorgan had necessarily to be of very high altitude; and their present sources ranged from 600 to 2800 feet. Another very important factor was that these five sources came from those districts which they in Glamorgan were told, when they were opposing the Birmingham scheme, ought to be available for them. He thought the matter to be of such importance that he moved—"That the Water Committee be asked to hold a special meeting; that the Committee be empowered to take such steps and incur such expense as the urgency of the situation might demand; and that it be an instruction to the Committee to invite the co-operation of such county councils and other public bodies in South Wales as are specially interested." The report and resolution were adopted. A few members of the Water Committee afterwards met; and it is understood they decided to hold a special meeting at an early date.

Proposed Water-Works for Crowborough.—A company is being formed at Crowborough, Sussex, for the promotion of a scheme for the establishment of local water-works; and Lord Cantelupe has given permission for the necessary land on Crowborough Common to be utilized for the construction of a reservoir, without making any restriction whatever.

Exhibition of Gas Appliances.—By arrangement with the Stoke-on-Trent Corporation Gas Committee, Messrs. John Wright and Co. have lately been exhibiting, in the Town Hall, a large collection of their gas stoves and appliances. In connection therewith, Miss Beatrice Shaw, of the Nottingham School of Cookery, conducted some demonstrations in cooking by gas, which attracted good audiences.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 672.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	24—25	+½	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	10	16—17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼—7¾	..	4 3 10
40,000	5	,,	6½	Do. New	4	5¼—5¾	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	200—210	..	4 5 8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	222-227*	..	4 16 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	27 Sept.	11½	British	20	54—55*	..	4 1 10
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8—8½	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	305—310	+5	4 7 1
165,000	,,	,,	10½	Do. New do.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	270—280	..	4 12 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	207—212	..	4 14 4
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	293—297	−1½	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c.Pf.	100	282—287	+2	3 9 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	+5	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	+3	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	+1	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	280—285	+3	3 10 2
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	+3	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145—150	..	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	249—254	..	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Apl.	5	Met.of Melbourne, 5 p.c. Deb.	100	115—117	..	4 5 6
541,920	20	12 June	5	Monte Video, Limited	20	18—19	+½	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	105—110	+3½	5 9 1
500,000	100	4 June	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	26 Apl.	7	San Paulo, Limited	10	10½—11½	..	6 1 9
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	307—312	..	3 16 11
308,685	,,	,,	13	Do. C do.	100	320—325	..	4 0 0
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	..	2 16 6
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	292—297	+2	3 7 4
1,719,514	Stck.	10 Apl.	7†	East London, Ordinary	100	223—228	..	3 1 5
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	117—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303—308	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	259—264	+1	2 16 9
406,200	100	,,	7½	Do. 7½ p.c. max.	100	208—213	..	3 10 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143-148*	..	2 13 4
500,000	100	14 Aug.	12⅔	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147—152	..	2 12 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	290—295	..	3 7 10

*Ex div

† Next dividend will be at this rate.

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*** See Advertisement p. 662 of this week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

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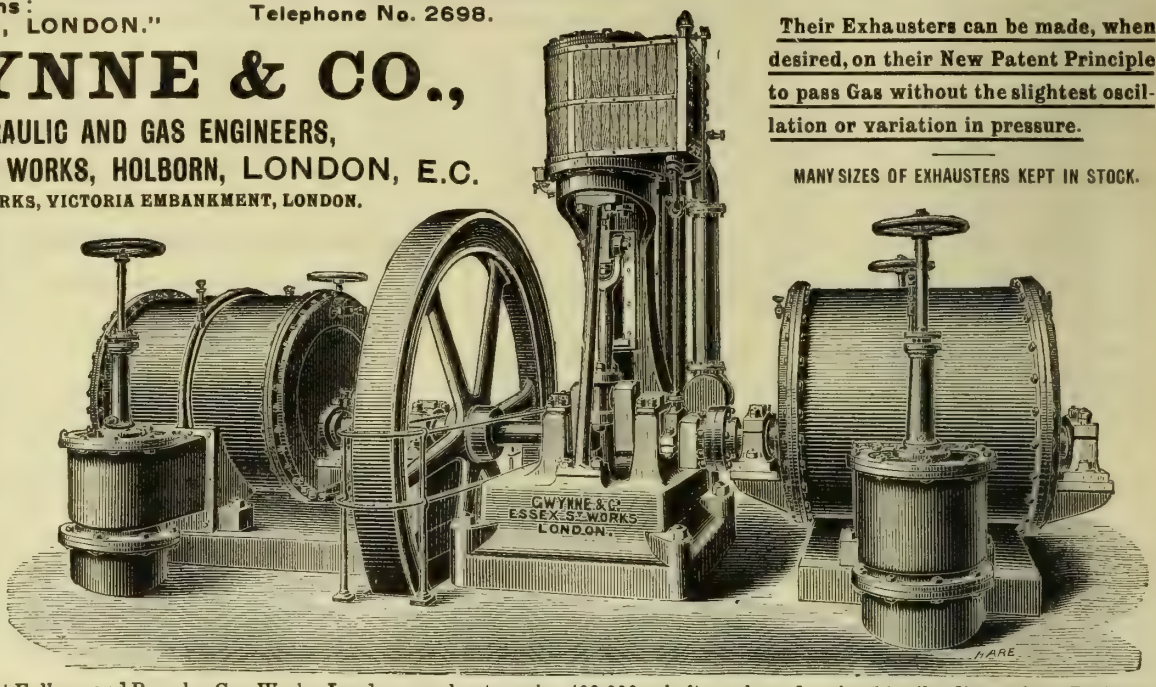

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Clerk to the Council.
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Sept. 18, 1895.

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The Directors do not bind themselves to accept the highest or any tender.
By order,
HY. JOHNSON,
Secretary.
Romford, Sept. 28, 1895.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

Mr. Livesey on Gas Capital.

THE important letter of Mr. George Livesey upon the question of gas finance recently raised in these columns should be carefully studied by every gas director in the land. We have little to say about it, for the reason that most of the points made by Mr. Livesey are unanswerable. We take the opportunity of assuring our valued correspondent that there is no Socialism in the views entertained and expressed by us with regard to the case for making all gas capital redeemable. The two articles we have devoted to the question differ in character, as every reader will have noticed for himself. The first merely put the query as to why there should be such a radical difference in the status of the two kinds of gas capital; and the second showed the bearing of the inquiry upon gas companies' prospects, and threw out a few confessedly crude suggestions with a view to putting the problem in a perfectly fair light. Perhaps there was some ambiguity about the statement singled out for criticism by Mr. Livesey. We never contemplated the extinction of the proprietary rights of gas shareholders by paying off the whole capital. Obviously, if this were done, the undertakings would not belong to anybody; so that it would be worth nobody's while to look after or to keep them going. It is always difficult to convey one's meaning perfectly, when the idea sought to be expressed is a mere generality, and novel at that. What we meant by the sentence in question may be better understood if the word "all" in it is not taken in the sense of "the whole," but of "all classes" of capital.

Corporations cannot wipe out all their gas capital; for there will always be some wanted to carry on with. The really practical issue of the problem we have stated is that municipalized gas undertakings must inevitably gain a march upon gas companies by the steps imposed upon the former for reducing their gas capital; and it appears to be quite true, as Mr. Livesey to-day observes, that the average gas director is regardless of all such considerations. If gas companies' capital were brought down, as Mr. Livesey recommends, to the equivalent of the real assets, there would not be so vast a discrepancy between the burden of capital in their case and that which the ordinary municipalized gas undertaking has to carry. There is nothing, it is true, to prevent a municipality from paying off everything down to the latest loans; but as against this the capital expenditure of the average municipality tends to be higher than that of the average gas company working under modern conditions. That is to say, the company will, as a rule, be better administered. This is an assertion that will be contested in their own minds by some of our readers, if not in the publicity of print. But we maintain it; and the only exceptions that can be effectively cited to the contrary only prove the rule. Doubtless there are well-administered municipal gas undertakings and badly-administered gas companies, the sliding-scale and auction clauses notwithstanding. Yet it is generally found to be true that the standard of gas administration and management does not tend to rise under municipal auspices. It cannot do so while local authorities dilute their gas making with politics, cut down salaries, and convert their establishments into hotbeds of corruption—petty corruption, as yet, but still corruption for all that. On the other hand, as Mr. Livesey truly says, there is a great deal of nonsensical, expensive pretence about the administration of many gas companies. All the best average capitalist-director can do for his company is to know a good manager when he sees him; and if he is able to do as much, he is well worth his fees, even though these average £15 an hour. At the same time, there is usually an extravagant amount of "gilt-edging" to the Board, consideration being had to the slight value of the common kind of directorial performances, beyond that division of ultimate responsibility which is due to the management. There have been several modern instances that could be cited to show up Boards of Directors in the character of a set of broken reeds.

Gas Affairs in Liverpool.

THE Corporation of Liverpool have taken a further and a most extraordinary step in the attack they are making, under the leadership of Mr. Alderman Smith, upon the Gas Company. The "Memorandum" issued by the Special

Lighting Committee respecting the illuminating power and other circumstances of the gas supply of Liverpool and other towns, to which reference was made in this column last week, was brought by Alderman Smith under the notice of the City Council at their meeting last Wednesday; and any value that might have attached to the statements therein contained, so long as it was possible to regard it as a *bonâ fide* compilation, was effectually destroyed by the unblushingly partisan aspect that was put upon it on this occasion. Immediately upon this, the Alderman moved the following resolution: "That, in view "of the high price paid for coal, &c., used by the Liver-"pool United Gaslight Company, and the consequent high "price of gas and coke, the Town Clerk be and he is here-"by instructed to do all that is necessary to enable the "Council to promote a Bill in the forthcoming session of "Parliament to obtain powers to establish and maintain a "competitive gas supply, and that Standing Order No. 61 "be suspended accordingly." We give the resolution in full, in order that such a fine example of the practical good sense that for the present rules the corporate authorities of Liverpool shall be put upon record in these columns. The motion was carried unanimously. We do not know the nature of the Standing Order that had to be suspended to enable Alderman Smith to bring on his motion; but it might be to the effect that the Corporation of Liverpool are not to be made to occupy a false and ridiculous position at the bidding of any member of the Council, judging from the consequence that ensued upon Alderman Smith's action. It has been suggested by a local newspaper that the adoption of the resolution and most of the other proceedings of the Council at this particular meeting were not business, but merely manœuvring to catch votes at the approaching municipal elections. The language used by Alderman Smith in support of his case certainly sounded more like an "appeal to the gallery" than an argument for the specific course to which he wished to commit the Corporation. How little seriousness underlay the whole tirade can be perceived from the orator's own admission that no real damage to the Company was intended by the proposal to establish competitive municipal gas-works. We cannot, at any rate, spare space for discussing the position which serious action upon Alderman Smith's resolution would create both for the Corporation and the Company. The present City Council appear to be the laughingstock of sober citizens; and it is to be hoped that, when the elections are over, Liverpool may find itself equipped with a more rational set of rulers. One local newspaper seems to think it expresses this popular view of the situation in remarking that the Company "wants, "at least, a thorough shaking up." At the same time, there is not the smallest evidence that the ratepayers as a whole, or any considerable section of them, would approve of the gas supply being confided to such a Corporation as the city gets provided with nowadays. It would be an insult to the people of Liverpool, who cannot be supposed to be destitute of common honesty and commercial capacity, to imagine them to be desirous of ruining the Gas Company, even if the Legislature would sanction any proceeding calculated to have such an effect. A few ignorant voters may be caught by tirades against monopoly, and laudation of the principle of competition in gas supply. But it is only necessary to look across to their neighbours on the other side of the Atlantic ferry to see what the latter means in action. Alderman Smith may think he knows why Liverpool gas stands at its present price. Let him find out what the commodity costs in New York, Brooklyn, or Boston, and why.

The Commercial Gas Company's Meeting.

The meeting of the Commercial Gas Company on Thursday was, as usual, brief and uneventful. The Chairman, Mr. J. Blacket Gill, did not detain the proprietors with a long speech, but ran through the principal entries in the accounts, and assured his auditory, in conventional terms, of the sound condition of the undertaking. He did not respond to our invitation to tell the world what the Commercial Board think of the sulphate market; and Mr. H. E. Jones, the Company's Engineer and General Manager, also passed very lightly over this delicate subject, in the pointed little speech which, as usual, he made in response to the complimentary vote of thanks to himself and the engineering staff. Yet it must be very annoying to engineers and works' managers to find the fruit of their labours half spoilt by the result of mercantile dealings which are more than suspected to have been prejudiced by sheer bungling somewhere. A cynic might say that it is a pity sulphate will not burn, otherwise a timely conflagration might be hoped for to clear the stocks that have acted like an incubus upon the markets ever since some would-be clever operators undertook to impose their own terms upon buyers—only to "get left" upon the mountains of their own raising. Curiously enough, the beet sugar crop of the Continent is reported this year to be 1,200,000 tons short. Is this due in any degree to the circumstance of the manure that should have long ago been sold and put upon the sugar lands being still kept in reserve?

The Gas Supply of Dublin and Edinburgh.

The Alliance and Dublin Consumers' Gas Company have had a favourable half year, and expect to do still better; the immediate consequence of which is a reduction in the price of gas of 2d. per 1000 cubic feet. By a coincidence, the Edinburgh and Leith Gas Commissioners find themselves in a position to make an exactly similar reduction of price; so that the two national capitals of Ireland and Scotland for once find themselves "in the same boat." Both Dublin and Edinburgh have increased consumptions; but the growth of the output in Edinburgh and Leith is extraordinary and unprecedented. Dublin has only just recovered the increased cost of working due to the adoption of the eight-hour shift; and the Chairman explains that it was to this, and not to dearer coal, that the last rise of price is attributable. Most gas companies had about the same time to pay more for their coal; but the Chairman took credit to the Board from the circumstance that just then the Company had three years' contracts running at very low rates, "which the consumers got the benefit of." The latter observation is undoubtedly true; but it should not be overlooked, in connection with this testimony to the value in some circumstances of long coal contracts, that the advantage might just as easily have been to the other party. The Chairman of the Dublin Company probably does not expect, and certainly does not get, thanks for that benefit to the consumers of which he spoke; but if he had been in the awkward predicament of having to apologize for paying more than the market price for coal under a long contract, he would hear of it.

The Meeting of the North of England Association.

The members of the North of England Association of Gas Managers met at Hexham on Saturday, under the presidency of Mr. Herbert Lees, the Manager of the Hexham Gas Company, whose Inaugural Address will be found in another column. Mr. Lees has succeeded in educing from his Hexham experiences and observations data which will be found of more than local interest and value. His treatment of the question of meter-rents is a good example of this. A diligent reader of his Journal, Mr. Lees took an opportunity for mentioning with approval an article that appeared in our columns eight years ago. We take this as a great compliment, and more—it is these evidences that his cogitations and labours are not as water poured upon the sand which encourage the journalist in his work. The paper read at the meeting was by Mr. J. Holliday, of Scarborough; and the subject was "The Encouragement "of the Small Consumer." Curiously enough, the President's address had made it clear that the term "small "consumer" often covers a class of customer who is not particularly worthy of special consideration. Mr. Holliday, of course, had in view the deserving type of small consumer—the cottager. The most prominent feature of the paper was the proof it supplies that even monthly collections of rental do not impair the popularity of the prepayment meter. Besides this, it is full of most valuable information respecting the working of the latter system, well put together, and instructively treated. There can be no question of the utility and vitality of a Gas Managers' District Association that can command a supply of addresses and papers of the quality of those read at Hexham on Saturday. The meeting was otherwise successful; and the proceedings concluded with a dinner provided by the hospitality of the Directors of the Hexham Gas Company.

The Scottish System of Assessment.

An interesting account of the rating system followed in Scotland, as compared with English practice in the same regard, appeared in last week's number of our contemporary *London*. It is observed in this article that the

Scottish rating system is remarkable for doing without many elements that bulk very largely in the English system. To begin with, in Scotland there is no Assessment Committee, and no such factor as "rateable value." There is only one column of figures opposite the names of the hereditaments inscribed (say) in the Glasgow valuation roll, and this is called the "yearly value," which is, broadly speaking, equivalent to our "gross annual value." Hence there can be no question of statutory or other deductions. The whole of Glasgow is valued by an expert, who is styled the City Assessor, and is at the head of a large department of the Corporation. There is no opportunity here for the legal and expert revelling over a quinquennial valuation, as in London; for the institution does not exist. The City Assessor simply prepares a new valuation roll every year; sending to each ratepayer a notification of the amount in which his property is assessed. If any objection is raised to the valuation, the same official hears it in the first place, and gives every facility to those who would induce him to alter his opinion. After the roll has been settled and signed by the Assessor, an appeal will still lie to a special Valuation Appeal Court, constituted of a Committee of Magistrates; and beyond this authority again to the Law Courts, on points of law. It thus appears that the Scottish system of assessment, as carried out in Glasgow, has very great advantages over the English manner of attaining the same object, in the points of simplicity, celerity, and economy. Such a scandalous proceeding as was the last Gaslight and Coke appeal to the Middlesex Sessions, costing nobody knows how much a day, would be impossible in Scotland. The ordinary Scottish Assessors, moreover, are not troubled with the valuation of gas and water undertakings, railways, or canals, which are remitted to a special Assessor, whose whole time is devoted to the work, and whose office is in Edinburgh. All this sounds very direct, businesslike, and cheap; and yet the Scottish ratepayers are quite as much dissatisfied as their southern fellow-victims. Though there is no published dual valuation, as between gross annual and net rateable value, yet in Scotland as in England it is necessary to work out an estimate of value very much after the same principle of deducting certain allowances from the gross valuation; and the same inequalities of rating occur. And still the ratepayer accuses the rating authorities of squeezing him. Gas and water mains, moreover, like railways, appear to be assessed by mileage, and not by their earning capacity. Thus the Corporation of Glasgow have water-mains passing from the source of supply in Loch Katrine through the parish of Aberfoyle—the land covering the pipes being cultivated and rated just as it was before the mains were laid. Yet the Corporation are made to pay two-thirds of the whole rate collected in Aberfoyle, through being assessed, as hypothetical tenants of the mains in question, upon the basis of 3 per cent. on the capital cost of laying them. One would like to hear of an assessment system free from little weaknesses such as this.

The Winter Instructions of the Metropolitan Gas Referees, which were issued last week, contain the usual intimation that the maximum quantity of sulphur permissible in gas will, until further notice, be 22 grains per 100 cubic feet.

A Correction.—With reference to the paragraph in the JOURNAL last week (p. 674) in regard to the presentation to a servant of the Glasgow Gas Trust, we are asked by our informant to mention that the name of the recipient was Taylor.

Personal.—We regret to learn, from the *Jewish Chronicle* that Sir Julian Goldsmid, Bart., M.P., feels himself constrained, owing to the state of his health, to considerably lighten his public work; and that, with this object in view, he will withdraw from several of his offices in and out of the community. His resignation of the presidentship of the Anglo-Jewish Association has, we understand, already been placed in the hands of the Council. While expressing regret at the cause which has led Sir Julian to take this step, we must offer him hearty congratulations on the distinction which has just been conferred upon him by his admission to Her Majesty's Most Honourable Privy Council. Mr. Harry Kendrick, assistant to Mr. S. Y. Shoubridge, of Salford, and formerly assistant to Mr. H. Hack, of Saltley, Birmingham, has been appointed Manager of the Stretford Gas Company's works; and he will enter upon his duties this week. Mr. Frederick Gibson, who has been for ten years in the Manager's office at the Carlisle Corporation Gas and Water Works (five years as pupil to Mr. Hepworth, and five years as assistant), has obtained the appointment of Engineer and Manager of the Chelmsford Gas Company, which was advertised in the JOURNAL a few weeks ago. There were 81 applications for the position.

WATER AND SANITARY AFFAIRS.

"VERY little public interest appeared to be taken in the "proceedings." Such was the statement given in *The Times* concerning the opening day of the Local Government Board inquiry relative to the recent deficiency in the supply of water to the East London Company's district. Commencing on Tuesday, the inquiry came to a close on Saturday, except that an inspection of some of the fittings, and a visit to the works, will take place on Thursday. As for the interest taken in these proceedings, that has its real centre at Spring Gardens. The County Council are seeking to gain their own ends; and the public can scarcely be expected to feel very deeply concerned as to the manner in which the pursuit is conducted. When things take a more practical shape—if ever they do—some amount of excitement may arise. We should like to know what benefit the East-end of London can hope to derive from the examination of a number of witnesses before Colonel Ducat and Dr. Barry at the Hackney Town Hall. The County Council are attacking the London Water Companies through the medium of one of them. That is the whole of the story. It is not a question of how much water shall be given to East London, but who shall give it. The Vestries make a fuss—the sapient authorities who watered the roads when the people are said to have "stormed the water-carts" with pails and cans to get a supply for domestic purposes. But all the present inquiry can do is to underline a set of facts already on record. In the archives of the Local Government Board there is a report by Major-General Scott, written at the close of 1887, which points forward, as clearly as anything could point, to the trouble which has beset the eastern part of London during the past summer. Thus we read: "On a general view of the whole circumstances, it seems "evident that the question of the water supply of the "North and East of London has entered a critical stage; "and it may be said that the restriction in the supply, "found necessary by the East London Company during "the past summer, was a premonitory symptom of diffi-"culties which in future seasons of scanty rainfall "will be more severely felt." So it has come to pass. But why was it ever allowed to do so? Viewing the rapid increase of the East London population, General Scott was afraid of what might happen by the year 1892. But what were the East London Company doing? Were they content to let matters slide, so long as they could earn "fat" dividends? though their dividends were not so particularly fat after all. The Company knew the danger, and sought to guard against it. The evidence given by Mr. W. B. Bryan, the Chief Engineer to the Company, is conclusive to this effect. He states that "from 1890" he had considered the question of further storage, and in 1891 the Company took action by purchasing ninety acres of land for the purpose of adding to their reservoirs. He brought the question of storage before the Royal Commission in 1892, and he felt the matter was urgent.

That the Commission under Lord Balfour of Burleigh accepted Mr. Bryan's view of the situation is well known. Greater storage capacity was declared to be requisite in order that East London might have an adequate supply. But how did the County Council behave in this matter? To what extent did they assist in warding off the peril which was seen to be approaching? Mr. Bryan states that on March 16, 1893, in a conference between the Council and the Company, the former, though "solemnly "warned" of the risk that would be incurred, absolutely refused to give their consent for money to be raised to provide fresh storage works and pumping machinery. Yet we have been coolly told again and again that the Company did not propose in 1893 to construct any new works, and, if they did, the objections of the Council had no reference to the works, but to something else. It is perfectly clear that the Company did intend to construct extensive storage works, with the requisite pumping machinery. But the Council refused to concede anything more than the raising of money to lay new mains for a period of two years. Now we find it argued before the Government Inspectors that the Company should have constructed the works out of revenue, and cut down their dividends. We should like to know how this was to be done, when half a million of money was wanted. What is the present position of the Company? Struggling with frost in the winter and drought in the summer, they

have seen the reserve fund dissipated, and the dividend reduced. That there is a fair prospect for the future is due to no goodwill on the part of the Council. Despite the opposition encountered in that quarter, Parliament has given power to the Company to raise the half million, and to construct the requisite works, with a stipulation that no time shall be lost. Had the power been given a year earlier, the recent drought would have been successfully met, and the present inquiry would never have been asked for. The Council fought hard against the Company's Bill in 1893, and obtained its rejection. Let us hear what Mr. Binnie, the Chief Engineer to the Council, has to say on this subject in his evidence before the Inspectors. He repeats the fallacy that in the Bill of 1893 "no specific "works were mentioned." But the ninety acres of land had been purchased two years before; and, according to Mr. Bryan's evidence, delivered subsequently to Mr. Binnie's, it was in March, 1893, that the conference was held at which the Council refused to give their consent to the raising of money for fresh storage works and pumping power. Apart from Mr. Bryan's evidence, it is perfectly well known that the Company proposed to expend the money in the extension of their reservoirs, and in other works necessary to the maintenance of the supply. There might be no plans and sections, neither were these required, though this is probably Mr. Binnie's sole warrant for saying that "the 1893 Water Bill of the Company "contained nothing pledging it to carry out the works." "It was purely a Money Bill," says Mr. Binnie, "and "contained provisions as to fittings to which the County "Council objected." But Mr. Binnie did not know, what he should have known, that these provisions were withdrawn before the second reading came on. He also denies that if new works had been authorized in 1893, the reservoirs would have been ready before the drought of 1895. Yet Mr. Bryan states that, under the Act of 1894, a new reservoir—representing 200 million gallons—will be ready in January next. This would, therefore, have been a year earlier had the Bill of 1893 been allowed to pass. The story of the "shattered mains" is also disposed of by the circumstance that all the damaged mains were repaired by the middle of April.

We might pursue Mr. Binnie's evidence further, and show how the opinions which guided him in objecting to the Company's plans were in direct opposition to the conclusions and recommendations of the Royal Commissioners. But the report of the Local Government Board Inspectors is to come, and our remarks to-day must needs be limited. We would say a word, though briefly, as to the excellent address delivered at the half-yearly meeting of the East London Water Company last week, by the Chairman, Mr. George Banbury. In that address, marked by moderation as well as by vigour, a distinction is drawn between the Council and the Progressives who, by a process of "gerrymandering," have managed to secure a predominance which does not rightfully belong to them. The day may come, though we fear it is remote, when the Council will be better constituted, and when a working majority of the members will maintain a policy worthy of a great municipal authority. The determination of the Council last Tuesday to take proceedings against the East London Company for recovery of penalties, marks what may be properly called a spirit of "relentless hostility." Mr. Beachcroft did well to move his amendment; but he argued in vain against the party which appears to consider everything fair in a fight against the Water Companies. There is even to be another Local Government Board inquiry, instigated by the County Council, and commencing on the 31st inst. This has reference chiefly to closet-flushing cisterns, and affects all the Companies.

Mr. Lass's Analysis of the Metropolitan Water Companies' Accounts, for the year ended Dec. 31, 1894, and March 31, 1895, has now been issued. This is the fifteenth year of publication of this useful compilation, the value of which at the present juncture will be specially appreciated by those who are occupied with the Metropolitan Water Question.

Death of Mr. A. Fraser.—We regret to record the death, on Sunday morning, of Mr. Alexander Fraser, M.Inst.C.E., the Chief Engineer of the Grand Junction Water Company. Mr. Fraser had been for many years connected with the Company; and, as our readers will remember, he was associated with Mr. W. Hunter, M.Inst.C.E., one of the Directors, in the preparation of the large scheme of water storage at Staines which was brought before Lord Balfour's Commission.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 750.)

The pleasant rise in prices which has been going on so gaily for some time past in the Stock Markets received a severe check last week; and not too soon either, if only to remind people that even a balloon cannot go up for ever. The tone was, of course, set by the mining market, where buying orders ceased, and something like a rush to realize set in. Some people will be hard hit; but the general position will be a deal healthier for some abatement of this feverish speculation. If it were not checked in time, the ultimate crash would be terrible. Foreign affairs also have been disquieting; China, Madagascar, and Constantinople being focuses of anxiety. Thus prices have fallen all round, except in that Happy Valley the Gas Market, where they rose buoyantly. And there is this difference to be noted, that the rise in gas stocks is genuine, the result of a *bonâ-fide* demand for money investments. Business was pretty active during the week, especially in Gaslight "A," which was remarkably steady; stock changing hands every day at about 295½, or a shade better. The secured issues improved upon their advance of the previous week, with a further rise in the "J" 10 per cent. But transactions were much quieter. There was more activity in South Metropolitans; and the "B" and "C" stocks seemed to command any price in reason. The "C" has now left the 4 per cent. price behind it, like the "B." No business was done in Commercials; there appearing to be no stock in the market. The Suburban and Provincial Companies again had a record week of inactivity; not a single transaction being marked in any one of them. But Brentford new had a nice advance, though why there should be such a discrepancy between the prices of the old and the new is a mystery. Business was more moderate last week in the Continental undertakings. Imperial was fairly firm and unchanged; but Union had another considerable rise. Several improvements in value were effected by various undertakings in distant parts. Both issues of Chicago bonds had a good rise; and San Paulo continued its upward movement. Melbourne bonds are also a point better *ex div.* Among the Water Companies, business was more active; and the general tendency was favourable. East London moved irregularly, owing to the uncertainty felt as to the result of the Local Government Board inquiry.

The daily operations were: The Gas Market opened rather tamely on Monday; and business was at no time very brisk. Chicago first mortgage bonds rose 2½. There was considerably more activity on Tuesday, with good steady prices. Brentford new advanced 4½; and San Paulo, ½. In Water, West Middlesex improved 3; East London, 2; Lambeth, 1; and Grand Junction, ½. On Wednesday, transactions in Gaslight "A" were the main feature; prices being very even. South Metropolitan "C" rose 5; ditto "B," 3; and Chicago second mortgage bonds, 2. East London Water relapsed 2½. Business on Thursday was more restricted; and the only alteration in quotations was an advance of 2 in Gaslight "J," with business done at 286. Friday's transactions were not remarkable; but prices seemed a shade higher. Continental Union rose 5. Saturday was quiet and firm; and quotations closed unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Question of Raising the Voltage of Low-Pressure Electric Supplies.

The topic of the hour in electric light circles is the recent decision of the St. Pancras Vestry to raise the voltage of their supply from 110 to 220—an alteration that has already been effected by the Electric Lighting Committee of the Bradford Corporation, and formed the subject of an article in an engineering contemporary which was discussed in this column at the time. The change in question has been made by the advice of Mr. Baynes, the Electrical Engineer to the Vestry, who has only recently left the service of the Bradford Corporation; so that the new policy may be held to be a point of personal practice with him. It has aroused a good deal of animated, not to say acrid, controversy in the columns of *The Times*; but the merits of the matter are not to be decided by the *dicta* of more or less interested electricians. It appears that, for the present, only new customers of the St. Pancras undertaking are to be put upon the higher voltage service; but in the long run, if the change works well, and without much delay, it must be made general in the district. The principal question arising in connection with the alteration of pressure refers to the lamps. Hitherto lamp manufacturers have been accustomed to work to the lower standard of from 100 to 110 volts; and it is admitted that an altogether new make of lamp will be needed to meet the fresh conditions of the service. Mr. Baynes declares that there is no difficulty in the matter, since he has had 220-volt lamps in use for 18 months, presumably at Bradford; and he further states that 8 candle lamps at 230 volts are in the market, and a high-voltage lamp of even 6-candle power is on offer.

Professor J. A. Fleming has given a qualified assent to the

change; but he thinks that, if the higher voltage is to become general, domestic fittings will have to be much more severely tested and inspected than has been customary heretofore. Mr. Baynes concedes the necessity of very careful inspection and testing; but he observes that this is an essential point in any well-regulated central station, and applies to any system. This is doubtless the case. But past experience has not shown that the St. Pancras installation stands particularly well in this respect; and captious critics might inquire how much more sodium the Vestry expect to make in their underground conduits under the new conditions. So far as the cardinal point of the safety of users of the new high-pressure service is concerned, it is stated that there is no more risk of getting a dangerous, or even painful, shock from a 220-volt service than there is from one carrying half the voltage; the utmost that would be felt being a tingling sensation if two terminals were connected through the skin. Time will elucidate this question. But meanwhile it is clear enough that the change to the higher voltage is all in the interest of those central station undertakings that are committed to the low-pressure principle of electric distribution. So far it is a concession to the high-pressure school, who have all along contended that no system in which the mains are restricted to carrying only the low voltage hitherto employed can be commercially successful over anything like an extensive area. It means burying a copper mine to command even such a compact district as that of the St. James's and Pall Mall Company; and, of course, to double the voltage renders this copper competent to earn much more money.

There is no reason to suppose that consumers will care whether they are supplied at 110 or 220 volts, so long as they are assured that their fittings will stand. But this is certainly not a time when they could be expected to incur any extra expense for adapting their fittings to suit a change made wholly in the interests of the suppliers. If, moreover, there is any real difficulty in procuring, at no greater cost, low-power incandescent lamps of the new pattern, the suppliers may well lose as much as they can hope to save by the new system of supply. Electricians themselves seem to hold that much depends upon the possibility of satisfying their consumers with the 8-candle lamp which has been adopted as the conventional unit for the enumeration of lamp connections. This gives but a low standard of lighting, and is confessedly inappropriate to shop and general commercial use. But domestic users are expected to be content with it; and they are not encouraged to patronize anything more brilliant. Now we hear of a 6-candle high-voltage lamp as being yet more suitable for lighting interiors. Whether or not the public will take kindly to this progressive degradation of their house illumination, remains to be seen. We may be mistaken, but imagine that a glimmering "night light" on this scale is not the most hopeful weapon wherewith to attack the incandescent gas-burner. The incandescent electric lamp trade is naturally perturbed at the advent of a change that bids fair to render all stocks valueless, and sets up a standard in lamp manufacture to which only a few factories have yet learnt to conform.

Mr. Baynes may be, and probably is, right when he says that the 110-volt lamp, like the original 50-volt lamp of Edison and Swan, is fated to become in time "a matter of ancient history." But the makers and sellers of the article so condemned are not likely to derive much consolation from this reflection. There never was much trade done in 50-volt lamps, which were proprietary goods, and more curiosities than anything else at that. But the manufacture of 100 to 110 volt lamps has attained to very large proportions; and they will not be ousted without a struggle. Still, the industrial clock cannot be made to stand still at the bidding of those who are pecuniarily interested in arresting the flight of the moment. If the new system is good for anything, and anywhere, it must infallibly spread. It was the incandescent lamp that made the electric lighting industry; but now the lamp must follow in its train. There is yet the question of fire risk, about which the insurance companies will have to say something. Dr. Fleming observes that with a three-wire system of distribution charged throughout with a difference of potential of 200 volts between each side of the system (making 400 volts over all), conditions might arise that would throw the whole pressure upon house fittings originally calculated for 100 volts only; and this is something to be carefully weighed.

Consolidation of the Brooklyn Gas Companies.—For something like a twelvemonth negotiations have been in progress for the consolidation of the seven Gas Companies in Brooklyn; and the recent filing of the certificate of incorporation of the Brooklyn Union Gas Company, with a capital of $15,000,000, is a sufficiently clear indication that they have been brought to a successful termination. The following are the names of the Companies, with the amounts of their capital: Boston Gas-light, $2,000,000; Fulton Municipal, $2,000,000; Citizens', $1,750,000; People's, $1,000,000; Williamsburgh, $1,000,000; Metropolitan, $1,000,000; Nassau, $1,250,000. The new Company hold a controlling interest in the stock of every one of them; and it is stated that they have spent nearly $12,000,000 in the purchases. It is believed that the consolidation—the chief opponent of which was Mr. J. E. Addicks—will result in a great saving of expense to the producers, in the works as well as in the offices.

THE PRESERVATION OF IRONWORK BY PAINTING.

Few subjects are of more practical interest for the engineering constructor—be he designer, contractor, or superintendent—of iron or steel structures, than the means to be employed for preserving these materials from corrosion, rusting, and decay. Time was when the principal labours of the engineer were carried out in stone or brick; but this is the age of steel and iron, and at the present time the proportion of capital laid out upon structures in the latter class of materials has attained to an unprecedented and constantly growing figure. The difference in question has many ulterior consequences, not the least striking of which is the great prominence assumed by paint. The engineer of old time, after he had successfully brought his bridge, or his pier, or whatever the structure in stone or brick might be, to complete realization, could leave it alone with confidence that it would endure for as long as it might be wanted, without further attention from him. But his modern successor knows that, without well-directed, assiduous preservative treatment from the very first handling of the materials in which he works, all his skill of design and construction will be thrown away. Men can do wonders in the way of construction with iron and steel. But these materials are perishable in every form and grade used in the arts; and this consideration imposes upon those who have to deal with them the gravest responsibility for taking such preservative measures in regard to them as will most effectually counteract their natural tendency to crumble into the dust. The modern engineer has occasion to realize to the full the lesson conveyed in the well-known lines describing the insubstantiality of those "cloud-capp'd towers" which he nevertheless has occasion to erect; and if Shakspeare had had modern constructions in steel and iron in mind when penning his gorgeous rhapsody, he could not have more succinctly described the eventuality against which the engineer has to keep incessant watch and ward.

Painting—including in the meaning of the word every description of surface treatment of a perishable material of construction, other than a purely chemical process which superficially changes its nature, with the object of preserving it from rusting and decay—is the subject of many technical papers; but the interest of the matter is not to be exhausted by any number of essays. The most pretentious recent contribution to the literature of preservative, as distinguished from decorative, paints is a paper read by Mr. M. P. Wood before the last meeting of the American Society of Mechanical Engineers, which is worth summarizing, and will also serve as a "peg" whereon to hang a few additional observations on the subject-matter. Mr. Wood states the essentials of a good paint, for whatever use intended, as follows: First, it must adhere firmly to the surface over which it is applied, and not chip or peel off. It must be non-corrosive to the material it is used to protect, as well as to itself, under long periods of atmospheric exposure and chemical changes. It must form a surface hard enough to resist frictional influences, yet elastic enough to conform to all changes of temperature, or with a coefficient of elasticity as nearly as possibly the same as that of the material covered by it. It must be impervious to, and unaffected by, moisture and atmospheric and other influences to which the structure may be exposed. Secondly, the paint must work properly during the laying on—a property depending largely upon the relative proportions of pigment and liquid; the nature of both elements having also influences upon the result. Thirdly, it must dry sufficiently rapidly; this function depending mostly on the liquid, although the pigment in many cases influences it. Fourthly, the paint must have proper durability, which is a function both of the pigment and the liquid. And as the question of cost often governs the selection of a paint, the element of durability may be regarded as the most important one in the list. It does not always follow, however, that a paint good and durable in itself has good protecting results; the nature of the surface to which it is applied (such as rusty iron) sometimes neutralizing its own virtues. Fifth comes the question of covering power, by which is meant the capacity to afford the greatest amount of protection for the least expenditure of material.

The term covering power means different things to different colour manufacturers and master painters, according to the purposes which the paint is intended to subserve. For structural purposes, the term commonly means the extent of surface that a given weight or quantity of paint will cover. Mr. Wood states that a good iron oxide paint will cover nearly twice as much surface as white or red lead. The specific gravity of the pigment enters into this question, and so does its refractive power for light, and physical condition as to grinding. Lamp-black, because of the minuteness of its particles, goes farther as a covering than any known pigment; and, according to Mr. Wood, one part of lamp-black and nine parts of sulphate of lime by weight give most excellent results in covering power. Prussian blue, the scarlets, and the pigments called "lakes," on account of their light-dispersing power, deceive the eye as to their covering value when they are freshly laid on; but they soon exhibit their worthlessness.

The designing of a paint, for whatsoever purpose intended, necessarily involves consideration of the points already set

forth, as well as the cost. The first question to be answered in connection with the preparation of a paint is, according to Mr. Wood, whether it is necessary for the pigment to be used pure, or whether an admixture of inert substances can be permitted—presumably to give body to the paint. He states, in reply to this, that experiments of long continuation lead to the conclusion that oxides of iron, lead, manganese, and other strong pigments, can be mixed with large proportions of inert substances without any detriment, and generally to the manifest improvement of the paint as a protective agent on many structures, notably of wooden or composite material. He illustrates his meaning with reference to oxide of iron paint. If one ounce of this pigment, pure, be spread in two coats over a given surface—say, of two square feet—so that the surface is completely hidden, and the job is a satisfactory one so far as covering power is concerned; and if, secondly, the same weight of oxide be mixed with three times as much barytes, kaolin, or gypsum, and the resultant compound spread over the same area of surface as before—it is obvious that the amount of colour per unit of surface will be the same in both cases; but in one case there is four times as much pigment in the paint as in the other, and three-fourths of it inert. Yet for railway cars, and wooden structures generally, preference would be given to the latter preparation, for durability as well as cheapness in the bulk.

Mr. Wood distinguishes as inert substances in a paint those which do not promote the oxidation of the oil or the substance to which the paint is applied—such as whiting, sulphate of lime, barytes, kaolin, silica, feldspar, and talc. Whiting, gypsum, and barytes he regards as the best of the list; the others being objectionable as grinding greasy, or hard to grind, or of a nature readily decomposed by water. Barytes, from its great weight, is objectionable only when bought by the pound in a dry state, or when occurring as an adulterant in paste or prepared paint. He styles sulphate of lime the best of the inert substances to mix with any pigment, all things considered. It should be thoroughly hydrated, when as much as 45 per cent. by weight can be mixed with 50 per cent. of sesquioxide of iron as a pigment. (This remark seems to apply only to artificial oxide of iron paints.) Oxide of iron he describes as practically unchangeable by centuries of exposure. At the same time, he terms it an agent for inducing and promoting oxidation in all organic substances with which it is brought in contact, which in an oxide paint is the oil. This statement only holds true when there is no chemical change or combination between the pigment and the liquid or medium.

Prizes for Essays on Profit-Sharing and Trade Unions.—M. le Comte de Chambrun has offered two prizes for essays on "Profit-Sharing" and "Trade Unions." The latest date for sending in the former is Dec. 31, 1896; but a year longer is allowed for the latter—possibly owing to the wider scope of the subject. They are to be addressed to the Société des Etudes Sociales, Paris. The Count is known to be identified with social questions; he having endowed the Social Museum in Paris.

The Liverpool Meeting of the Institution of Gas Engineers.—By an inadvertence which escaped notice during the preparation for the press of our account last week of the Liverpool meeting of the Incorporated Institution of Gas Engineers, we wrongly designated Mr. W. King the President-Elect of this organization. Mr. W. Foulis, of Glasgow, is the Vice-President of the Institution; and it is therefore to him, if to anybody, that the description applies. It was, however, merely in the ordinary colloquial sense that we used the term, which has no place in the official nomenclature of the Institution. We permit ourselves to hope, in the interests of the Institution, that, notwithstanding the strain brought upon the Engineer of the Liverpool Gas Company by the duties and responsibilities of his position in the city, which may render Mr. King loth to take any other office for the present, our mistake may turn out in time to have been rather an anticipation.

Presentations to Mr. Albert Ford.—On the completion of a three years' eventful engagement with the City of Santos (Brazil) Improvements Company, Limited, as the Engineer of their gas and water works in Santos, Mr. Albert Ford was presented by the employees with a plated toilet service, inscribed in English and Portuguese, an illuminated address, and a gold watch and chain; and on the 26th ult., the Directors placed in his hands a cheque for £50, accompanied by a testimonial of their appreciation of his work, and by expressions of regret that he was unable to continue in their service. Mr. Ford was selected out of about 200 candidates for the position he has just relinquished; and during his tenure of it he had a trying experience. For six months there prevailed a "labour famine;" there were two epidemics of yellow fever and one of small-pox; and, to crown all, there was the revolution. Notwithstanding these impediments, Mr. Ford has remodelled the gas-works, reorganized the water-meter system, and constructed a masonry service reservoir capable of holding a million gallons. His average make of gas in 1894 was 11,190 cubic feet per ton of coal; the illuminating power being 18·2 candles, using 13 per cent. of cannel. In that year the net receipts were 43 per cent. more than in 1893. During the three years, 300 new gas services and 1200 new water services were connected and 200 new lamps were put up.

NOTES.

Purifying Gas Without Valves.

In connection with the recent visit of the members of the Incorporated Institution of Gas Engineers to the Garston works of the Liverpool Gas Company, it should be recorded that the attention of the visitors was drawn by the Engineer of the Company, Mr. W. King, to a peculiarity of the purifying arrangements. The carburetted water gas made at these works—as described in last week's JOURNAL—is purified by lime, with a catch purifier of oxide. The singularity of the arrangement of the purifying plant consists in the absence of valves; their place being supplied by simple syphons or U bends in the gas-mains, which can be filled with water so as to absolutely cut off the passage of gas, or emptied at will. It was explained by Mr. King that he had had so much trouble with valves in connection with sulphur purification—even those of the water-slide type—that, when it became necessary to provide purifying arrangements for the new carburetted water-gas station, he decided to dispense with everything of the kind, and fall back upon the simple, positive action of a syphon. There can at any rate be no leakage of gas through such a substitute for the usual valve; and the only obvious drawback—the liability to freezing during severe weather—can, of course, be met in the ordinary way already employed in the same circumstances for the hydraulic seal of the purifier covers. It is believed that the Garston purifier house is unique in regard to the absence of valves of any kind.

The Water Supply of American Lake Cities.

In view of the project of the London County Council for rejecting the River Thames as a source of water supply for the Metropolis on account of its liability to sewage contamination in the upper parts of the stream, it is interesting to note that the New England Water-Works Association have just held their annual convention in the city of Burlington, Vermont, which shares with Chicago, Milwaukee, and many other centres of population in the North American lake region in the practice of taking its water supply from the same lake into which its sewage is emptied. Professor W. T. Sedgwick, of the Massachusetts Institute of Technology, lectured to the members upon the bacteriological features of the situation thus created. He explained the results of the thorough study of the entire sanitary problem which he was instructed by the Water Board of Burlington to make in 1892. He found, greatly to his surprise, that the vital statistics of the city showed it to have been remarkably free for many years from typhoid and other diseases attributable to polluted drinking water; comparing in this respect very favourably with many cities having wholly unpolluted drinking water. This happy result appeared to be due to the configuration of the lake at the points of sewage discharge and water intake; the former being so situated that the sewage had time to settle or get purified and the germs of possible disease to die, "or otherwise disappear," before entering the lake proper. Nevertheless, the growth of the city necessitated the removal of the water intake (previously less than a mile from the sewer basin) to a distance of three miles from the sewer outfall; and since this has been done, the bacterial tests show that all fear of contamination of the water supply by the sewage has for the present been removed. The people of Burlington evidently have no pedantic aspirations for an ideally uncontaminated water supply.

Preventing the Electrolysis of Cast-Iron Mains.

The general subject of the electrolysis of gas and water mains by currents employed for traction has been investigated by Professor Storrs, of the University of Vermont. He observes that to prevent the electric current returning by the pipes, these must be made not readily available paths for it. This work must begin with the electric railway itself. If the rails are properly bonded from end to end of the track, and the track connected to the negative side of the generator by a wire of proper conductivity, a very large part of the electricity used by the car-motors will avail itself of this easy path back to the generator. If this means proves insufficient, then additional paths must be provided in the shape of some large copper wires called "return feeders." Yet sometimes, in spite of this precaution, the current will jump from the rails through the earth to the pipe. In such cases, direct metallic connection of the rail to the main should never be permitted; but where the rail is found to be electro-positive to a neighbouring main, so that the latter is exposed to the electrolytic action, a special return wire is provided connecting the pipe itself back to the generator. This device appears to be effectual, according to Professor Storrs. It was not long ago, however, that another authority declared the evil of electrolysis to be incurable.

Testing Cement by Specific Gravity.

In a recent article describing certain French appliances for determining the specific gravity of Portland cements, the *Engineer* observes that, within the last few years, this method of testing cements has "passed out of the category of methods of assay to be occasionally used into that of modes of testing habitually employed in the evaluation of this class of constructional material." The change has been brought about by the increased fineness to which cements are now ground, which has

altogether upset the old-fashioned requirement of so much weight per bushel. Consumers were not slow to perceive that the more finely ground, and consequently the more perfectly prepared, cements must necessarily weigh less per bushel, other things being equal, than those which are coarser and therefore less efficient. It has also been found impossible to formulate a satisfactory sliding-scale, with the object of creating a standard of relation between fineness and weight per bushel. At this juncture, appreciation of the fact that the specific gravity of a cement is unaffected by the degree of fineness to which it has been ground led to a general disparagement of the old standard of weight per bushel, and to the adoption of the determination of specific gravity in its place. It is now accepted that the specific gravity of a cement will give all the information respecting its quality which was derivable from the older method of taking the weight per bushel, besides indicating some points not derivable from other methods of testing. With regard to the degree of accuracy with which the specific gravity of a cement must be determined in order to yield useful results, it may be stated that very roughly approximate figures will suffice to relegate a product, of which the origin and history are unknown, into its proper class. Thus a specific gravity of about 3·15 at once stamps the article as true Portland cement. With ordinary skill and care, the specific gravity of a cement can be determined to 0·005, which is amply sufficient to detect slag sophistication and underburning.

Water-Meters on Hire.—The system of hiring out water-meters has come into regular practice in New South Wales. The number in use is now 5082.

The Action of Light on Dyed Colours.—At the recent meeting of the British Association, the Committee appointed some time ago to investigate the subject of the action of light upon dyed colours presented the report of their proceedings during the year 1894-5. The previous investigations of the Committee have been already noticed in the JOURNAL. Certain groups of colouring matters which could not be included in the Committee's earlier experiments have now been examined, as well as some additional coal-tar colouring matters recently introduced. The results of the exposure experiments are tabulated in an appendix to the report; the colours being divided, according to their behaviour towards light, into five classes—very fugitive, fugitive, moderately fast, fast, and very fast. These are again divided into other chemical groups. With respect to the popular notion that, generally speaking, coal-tar dyes are fugitive, it is found that, while there are some fast and some fugitive colours from natural sources, it is possible to select a larger number of fast colours from coal tar than can so far be obtained from natural sources.

Golden Wedding of Mr. and Mrs. Thomas Clapham.—On Monday, the 23rd ult., Mr. and Mrs. Thomas Clapham, of Aireville, Keighley, were the recipients of the very cordial congratulations of their numerous friends on reaching the fiftieth anniversary of their wedding-day. These felicitations will, we are sure, be joined in by many of our readers, for the name is well known in the gas profession. Mr. Thomas Clapham is one of four brothers, two of whom were associated with him some years ago in establishing the business which has developed into the extensive undertaking carried on under the style of Clapham Bros., Limited. Though a septuagenarian, Mr. Clapham possesses remarkable vigour. Mrs. Clapham's health, however, is less robust; and on this account the festivities on the above-named occasion were of a quiet nature. But the good wishes expressed on all sides were none the less hearty; and to them we have much pleasure in adding our own. In looking back over their half-century of wedded life, it must be a cause of thankfulness to both Mr. and Mrs. Clapham that not one of those many years was saddened by death in their family.

High Masonry Dams.—This subject was discussed in a paper presented by Mr. J. D. van Buren to the American Society of Civil Engineers, and published in the Society's *Bulletin*. The author is of opinion that five different conditions of safety are to be considered in relation to masonry dams—viz., (1) against overturning; (2) against sliding; (3) against crushing near the toe; (4) against ice and waves; (5) against undermining. After the engineer has fixed upon these conditions of stability or safety, which express his scientific and practical judgment, the design of the section is easily made by the aid of simple mathematical formulæ. In addition to the usual forces assumed to act on a dam, the author considers water pressure on the base under full head. This force is usually ignored in designing the section, under the supposition that the masonry can be either made practically water-tight or drained in such a way as to relieve this pressure. The author thinks nothing practical is gained by considering any other section than the triangle, which is the true shape at all levels for stability against overturning and sliding. The following five assumptions are made by him as the basis of his mathematical dissertation: (1) That there shall be a full water pressure on the base at all levels; (2) that the ground pressure shall be a uniformly varying force; (3) that the coefficient of friction shall be known; (4) that the pressure at the toe shall not exceed a certain amount per square foot; (5) that there will be a known ice pressure per linear foot of dam at the crest.

TECHNICAL RECORD.

NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION.

Half-Yearly Meeting at Hexham.

The Thirty-Sixth Half-Yearly Meeting of the North of England Gas Managers' Association was held on Saturday, at Hexham, where the President for the year—Mr. HERBERT LEES—is stationed. The company assembled at the works of the Hexham Gas Company at eleven o'clock, where they were met by Dr. Thos. Stainthorpe, the Chairman of the Directors of the Company, Mr. W. R. Riddle, and Mr. Dixon Pratt, both Directors of the Company. Mr. Lees conducted the visitors over the works, which have been almost entirely rebuilt during the past fifteen years, and are now particularly well housed. Though the site is a small one, the arrangement of the buildings is such that the most has been made of the ground. The system of retort-firing is regenerative. The Gas Company have all along followed a liberal policy towards their consumers, in the matter of discounts and otherwise. Their reward is seen in the fact that, whereas in 1872 the make of gas was about 4 million cubic feet, it is now about 25 millions per annum, and that, too, although the population of the place has not increased; and also in the fact that they have a ready sale for all their bye-products—the coke-heap being small, and there being no tar in evidence.

VISIT TO THE ABBEY.

After inspecting the gas-works and partaking of light refreshments which were provided by the President, the party walked to Hexham Abbey, a venerable ecclesiastical building in great part in a wonderful state of preservation, and presenting some fine architectural features. A very interesting historic account of the Abbey was given by Mr. Robert Robson, the custodier.

THE MEETING.

The party were then driven to the Tynedale Hydropathic Mansion, a fine building in beautiful surroundings, where the meeting was held. There was a large attendance of members.

The PRESIDENT expressed the regret of his Chairman at not being able to be present at this portion of the proceedings. Many of them saw him at the works, and they would see him again; but he was a busy man, and had many duties to attend to. The Chairman, however, gave them a very hearty welcome, and asked him to say so for him. He did the same himself. It gave him great pleasure to see so many of the members there; and he hoped they would have a very successful meeting. He had letters from Mr. W. R. Chester, the President of the Incorporated Gas Institute, regretting his inability to be present; and also from Mr. R. Wallis, J.P., of South Shields, who, on account of advanced years, felt compelled to stay away.

NEW MEMBERS.

The following new members were admitted, on the recommendation of the Committee: Mr. T. Settle, Manager of the Gas-Works, Knaresborough; and Mr. C. B. Newton, Engineer and Manager of the Gas and Water Works, Carlisle.

PROPOSED REVISION OF THE RULES.

The PRESIDENT said that, since their last meeting, the question of the revision of the rules of the Association had been before the Committee; and it was necessary that notice should be given before this could be done. He, therefore, gave notice that, at the next meeting, something should be done as to the revision of the rules.

THE PRESIDENT'S ADDRESS.

The PRESIDENT delivered the following

INAUGURAL ADDRESS.

Gentlemen,—The position to which you elected me at your last annual meeting is one which I should be unworthy to occupy if in any degree I was lacking in appreciation of the honour conferred upon me. I again thank you for the confidence you then reposed in me; and if the Association should in any sense suffer by the selection you have made, I can assure you that it will not be for want of effort, so much as of ability, on my part to maintain the prestige to which it has now attained. I am deeply sensible of the responsibility attaching to the office; and when I look back upon the long line of my predecessors, many of them men of eminent ability, you will not be surprised if at times I have had "misgivings." I know, however, that I can rely upon the sympathy and support of the general body of members, who have always proved their loyalty to those gentlemen they have elected to this and other official positions.

As one of the younger members of the Association, I should like to urge those of my own class to take a more practical interest in its affairs. This is a matter which ought to need no pressing. Within recent years, many have joined our ranks who are capable of increasing the usefulness of the Association; and I hope that during my year of office some of this latent talent will be developed, either by contributing papers or in discussion. Let it not be inferred from these remarks that it is thought that all the wisdom and experience is "bottled up" in the youth of the profession. We should greatly regret—and it

would be an irreparable loss—if the men of ripe experience should abate their interest one whit, or in any sense relax their efforts to advance the objects of the Association. It is not necessary that one should give place to the other, but rather that the younger members should emulate their seniors, and they in turn lead us on to greater triumphs than have yet been accomplished, and thus still further enhance our position among kindred societies.

The duty which more particularly devolves upon me at this point—namely, that of placing before you material for thought and consideration on questions of a technical or administrative character relating to the manufacture and distribution of coal gas—is one that does not get easier as the years revolve. We are so well supplied with technical journals, that nothing of interest to the gas engineering profession is allowed to escape notice therein; and so many presidential addresses and other communications are written every year, that it seems next to impossible to advance a new idea, or clothe an old one in new language. I am not in the fortunate position of being able to unfold to you the details of some new invention which is destined to revolutionize the gas industry, and make the electric light sink into pale insignificance before the brilliancy of our future prospects; nor am I pessimistic enough to suggest to you the extreme course of making serious preparation for adopting some other means of obtaining a livelihood. I hope, however, that I shall, before closing my remarks, be able to give some tangible evidence of the advance that has been made, and of the reasonable expectations to which we may look forward.

It will perhaps not be out of place if some reference should be made by me to the undertaking with which I am connected, and the works you have had an opportunity of seeing to-day. The history of the gas supply of Hexham dates back for a period of over sixty years; and during that time, the undertaking has passed through many vicissitudes. It is, however, many years since it was established on a sound basis. From that period, its record has been one of steady progress; and it now occupies a prominent position among the smaller gas companies of the North of England as a means of investment. This result has been achieved not by methods which are foreign to other gas companies, but by the application of those principles which contribute very largely to all successful undertakings of a similar character.

At a comparatively early date, the question of utilizing gas for purposes other than lighting was prominently brought before the consumers, by means of an exhibition of gas appliances; and from time to time this has been supplemented by smaller exhibitions and cookery lectures, and a free use of the literature so familiar to all of you. The result is that during the past eleven years—without any increase in the population of the town—the gas consumption has grown to the extent of 80 per cent.

The number of appliances in use for purposes other than lighting is as follows: Cookers, 132; grillers, boiling-rings, &c., 129; gas-fires and heating-stoves, 91; gas-engines, 9—making a total of 361. The total number of consumers is 866.

In addition to the development shown by these figures, there has been a decided improvement in the illumination of shops and private houses, although there is room for further advancement. In some cases, this has been brought about at a reduced cost. I wish it were possible to record a corresponding advance in the public lighting of the town. The increased consumption referred to will seem more important when I tell you that for the previous twelve years there was a growth of 196 per cent., making a total increase in 23 years of 433 per cent.

Rather more than two years ago a further advance was made, when the "penny-in-the-slot" system of supplying gas was introduced; and although we have not been able to obtain so large a consumption per consumer as is reported from some towns, the system has fully justified its adoption. As from the first we have supplied the fittings and a griller—and in some cases a small cooker—it has also become an advertising medium for cooking by means of gas.

It is not possible for us to do too much in the way of advertising, and of educating our consumers; only our advertising should be judicious and persistent. I have no novel method to offer you. My plan is to keep in touch with the consumers as much as possible, and see that they are well supplied with literature; and if some of this should find its way into the waste paper basket, not to be discouraged, but send more.

I am of opinion that we ought, not only as individuals, but as an Association, to do more in the way of arranging popular lectures on methods of illumination and other means of utilizing gas. As an Association, we have done nothing in this matter outside the limits of our ordinary meetings; but is it not possible to arrange for a series of lectures to be given in various towns during the winter months? While it would be impossible for many of us to prepare a course of lectures in addition to the worry and strain of a winter's work, it might not be too much to take up one phase of the question; and by arrangement, interchanges could be made, so as to give a full course in a given town. If such a scheme could be adopted, I believe it would receive the sympathy and support of the proprietors of gas undertakings, and could not fail to be beneficial in its results. It would be fallacious to suppose that all this would tend to "bring grist to the mill," unless the internal administration of the concern was of a popular character. We want, as far as possible, to remove those "relics" of a bygone age which, under the guise of safeguards, are really obstacles to the development of business.

If it should be necessary to adopt or retain the "deposit" system at all, let it be *only* as a safeguard, and not be applied all round as a mere matter of red-tapeism. Then there is the question of initial charges before a person can become a consumer. It has been the custom here for a good many years for the Company to bear all charges for service-pipes and meter fixing, unless under very exceptional circumstances as to distance. This I believe to be of far more importance than the abolition of meter-rents; and yet there are some who concur in the payment of at least a certain portion of these outlays, and at the same time talk of the system of charging meter-rents as unjust and injurious to the development of consumption.

This question of meter-rents has been invested with an importance far beyond its merits. It has served many an embryo town councillor with an election cry; and if we could trace its origin, it would probably be found to have made its *début* on some platform at a ward meeting, during one of those annual campaigns which take place in our boroughs about the end of October. It has, however, passed beyond this stage; and now that the largest gas company in the world has included it in its policy, others will no doubt be not less slow to adopt it in consequence. I am bound to say that, in my experience, I have never found the meter-rent to be an obstacle to the growth of gas consumption; but I have frequently met with complaints of charges for fixing meters. But how would the change affect our consumers? We know that it would make little or no difference to the shareholders. If meter-rents are abolished, the price of gas will be maintained to give the equivalent. The result will be that one consumer will be benefited at the expense of another. The following table will show how the question would apply to Hexham:—

TABLE I.—*Ratio of Meter-Rents to the Consumption of Gas at Hexham.*

Consumption per Annum.	No. of Consumers.	Total Consumption per Annum.	Average Consumption per Annum.	Total Meter-Rents.	Meter-Rents per 1000 Cub. Ft.
Cubic Feet.		Cub. Ft.	Cub. Ft.	£ s. d.	d.
5,000 and under	146	373,200	2,555	15 19 4	10·27
Above 5,000 and below 10,000	123	814,800	6,624	15 3 9	4·47
,, 10,000 ,, 25,000	182	2,866,600	15,750	25 0 0	2·09
,, 25,000 ,, 50,000	65	2,236,700	34,411	10 12 0	1·13
,, 50,000	72	6,845,900	95,082	19 4 6	0·67
Consumers using own meters	133	6,958,800	52,322	..	..
	721*	20,095,800	27,872	85 19 7	0·91

* Prepayment consumers not included.

It will be seen by a glance at this table, that the 146 consumers who are the least lucrative under present circumstances would receive a most abnormal concession—equivalent to a reduction of 10¼d. per 1000 cubic feet—if meter-rents were abolished; while the 72 consumers of 50,000 cubic feet per annum and upwards, and the 133 who provide their own meters, and who are the mainstay of the Company's consumption, would have to pay at a higher rate to meet this. This is contrary to the accepted principles upon which business is conducted.

These small consumers are not by any means confined to the working class, but are largely composed of tenants of offices and small lock-up shops, where it is convenient to have gas in readiness, and where, unfortunately for us, it is seldom used. The abolition of meter-rents would mean the removal of many of these consumers from our books; otherwise they would be retained at a distinct loss. I am afraid the subject has not received the careful consideration it deserves; and where public opinion may have appeared to influence abolition, surely it is for want of accurate knowledge, and that we ought to be in a position to supply, as it affects our respective districts.

What is of far greater importance as influencing the consumption of gas than the question of meter-rents, is the price at which we can sell. There will always be some difference of opinion between the buyers and the seller as to what is a reasonable figure; hence none are entirely free from complaints on this head. The smaller companies probably suffer most in this respect, doubtless because comparisons are made with the larger undertakings, the circumstances of which are widely different.

Whatever conduces to economy of manufacture or distribution of gas should receive the consideration of those responsible for such undertakings. Like other industries, we are to a certain extent subject to fluctuations in the price of raw materials; and we are also affected by the sale of residual products at our disposal. These are influences over which we have no control. Economies of manufacture naturally begin in the retort-house. It has been said that profits are made or lost there; but it would be unwise to assume that it is the only place where profits are made or lost, and hence the necessity for giving the most careful attention to every detail up to the point of consumption—not forgetting the small savings, which in the end prove very important.

Some of you may perhaps remember a leading article which

appeared in the JOURNAL OF GAS LIGHTING about eight years ago, under the heading "A Drop of Solder." This article is stated to have been suggested to the writer by the story of an American workman having invented a method of wiping off the spare drop of solder, which previously had been allowed to remain on the tins made for use in preserving fruits, &c. It was a little thing; but it produced marvellous results. The moral is obvious. But we might do worse than re-read that article occasionally; and if we could also get its principles firmly impressed upon every workman and member of the staff, the gas industry would be the richer for it.

We have endeavoured to do something to reduce the cost of manufacture here. Rather more than two years ago, we introduced the system of gaseous firing to the retorts, and last year made a further extension in the same direction, so that all the retorts are now heated by means of generator furnaces, with very satisfactory results. Coke sales have increased to the extent of about 2½ cwt. per ton of coal carbonized, equivalent to a saving of at least 1s. 3d. per ton of coal; while the cost of carrying out the necessary alterations did not exceed £250. The erection of a coal-store has conduced to greater safety and more comfortable working—factors upon which it is difficult to fix a money value; but they possess one, and something more. The cost of purification is kept within very reasonable limits, by an adequate provision of purifying space and a good sale for spent lime. The adoption of the "air process" has not been entirely overlooked. Some experiments have been conducted; but the results have not yet proved satisfactory, although I have reason to believe that, when the initial difficulties—probably due to local circumstances—have been overcome, we shall be able to carry on purification with still greater economy, and with less nuisance from the spent lime.

Placed as we are in the centre of an agricultural district, it was natural that we should turn our attention to the manufacture of sulphate of ammonia. This has proved a right step, even at the low prices that have ruled during the past season. It is somewhat surprising that farmers do not use sulphate of ammonia to a greater extent than is done at present, especially so at the prices at which it has been sold this year. Its more extended use would probably do more towards relieving agricultural depression than either bimetallism, protection, or a good many more of the remedies the State is asked to apply, in order to spare ndividual effort. A series of experiments carried out under the direction of Professor Somerville (the details of which are given in a report to the County Councils of Northumberland and Durham) go to prove that sulphate of ammonia and nitr ate of soda are about equal in value per unit of nitrogen —*i.e.*, 8 6 lbs. of sulphate of ammonia is as effective as a fertilizer as 112 lbs. of nitrate of soda. In certain seasons, sulphate produced the best results; while in others, nitrate had the advantage. Therefore, when nitrate of soda was quoted at £8 5s. per ton, sulphate of ammonia possessed a value of £10 15s.; and yet at that time the latter was selling at £9 5s. per ton, and in some cases even less. We can only hope that, as the knowledge of these facts becomes more widely disseminated among the farmers than it appears to be at present, we shall to some extent share the benefit.

It is important that occasionally we should, in a general way, review the work of past years, mark the progress that has been made, and ascertain where it is possible to strengthen our position for the future. I have endeavoured to do a little in this direction by a study of the published statistics relating to some of the principal gas undertakings in England, whose accounts are analyzed annually by Mr. Field; for progress that does not show itself on our balance-sheets is not of a very satisfactory character. The advance made in economical working by these undertakings during the past ten years (the period taken) is not so great as some might expect; but it must not be forgotten that the nearer we approach to perfection in any system, the slower will be the progress.

In manufacture, some of the factors that have been prominent are gaseous firing, labour-saving machinery, and enrichment by means of oil, tar, and similar liquids. With regard to gaseous firing, it must be remembered that the comparative progress made in individual works must necessarily depend upon the results previously obtained with the open furnace; and these have varied considerably in different works. It is not my intention to make comparisons between one individual works and another, but rather to show the relative positions of the works under consideration in 1884 and 1894 respectively.

The following table shows the quantity of coke sold per ton of coal carbonized for the years 1884 and 1894 respectively in the various groups of undertakings dealt with in Field's "Analysis."

TABLE II.—*Coke Sold per Ton of Coal Carbonized in* 1884 *and* 1894 (*Field*).

	1884.	1894.	
	Cwt.	Cwt.	Cwt.
Metropolitan Companies	9·16	9·47	Inc. 0·31
Suburban Companies	9·25	9·62	,, 0·37
Provincial Corporations	8·27	8·29	,, 0·02
Provincial Companies	8·39	8·31	Dec. 0·08

The improvement shown in the Metropolitan Companies' accounts is about ⅓ cwt. per ton of coal carbonized; and though this may seem small, it amounts to a saving of nearly 60,000 tons of coke per annum, which has a monetary value of about £35,000. The most striking feature of this table is the wide difference between the results obtained in and about London and those in the Provinces. There may be some other explanation; but on the surface it is suggestive of the need for a further extension of gaseous firing. Possibly one disturbing element is the larger proportion of cannel used by the provincial undertakings, some of which has a very low yield of coke per ton.

Other advantages claimed for gaseous firing, are the increased life-time of the retorts, and improved yield of gas per ton of coal. The latter, of course, assumes that under the old system low heats have been the rule. In the undertakings referred to in Table II., there has not, however, been on the whole any improvement in the yield per ton; and this would suggest that, under the present system of carbonization, we have approached the maximum results. I am, of course, dealing with averages, which infers that some are higher than others; and it should be our aim to reach the highest results. Till we have accomplished this—making a justifiable allowance for different classes of coal—we have not exhausted the resources of present-day systems.

The extended use of labour-saving machinery—and under this heading I would include inclined retorts—has been concurrent with an advance in carbonizing wages; and in some degree it has been adopted as the outcome of, and a safeguard against further, labour troubles. The advance in wages has either been greater than the economies derived by the introduction of machinery, or a very small proportion of the coal carbonized has been dealt with in this way; and consequently the carbonizing expenditure has been on the upward grade. The stoker has within recent years had a very good "innings." But there will necessarily be a limit to the growth of expenditure in the matter of increased wages; and as it will doubtless be found that he is paid for his work as well as, if not better than, any other unskilled labourer, we may expect that a reasonable view will be taken of the position.

It cannot truly be said that the proprietors of gas undertakings generally have not looked after the welfare of their employees. They have seen their duty in this matter, and have done it, not grudgingly, but even generously in a large number of cases. Further claims for advance where anything like the maximum rates are being paid would, in all probability, bring about a more extended use of labour-saving plant; and therefore the stoker would not be the gainer. As a rule, these labour difficulties are not seriously felt in small works; but that, of course, is no reason why justice should not be shown all round.

I am not able to speak from experience as to what extent stoking machinery and inclined retorts may have been an advantage; but there is no evidence in the published accounts referred to to show that the system has as yet had any material influence upon the cost of manufacture. There may be solitary cases where it has; but a perusal of the statistics will show that it is not general.

The enrichment of coal gas by means of oil, tar, benzol, &c., has received considerable attention within recent years. We are not limited to one particular process. Many are now on the market; but perhaps the one known as the "Peebles Process" has so far met with the greater favour. Others will no doubt claim the further attention of gas engineers; and their respective merits will be settled by experience.

I do not think we have yet made the most of our own product, tar, for enriching purposes. It is a substance perhaps not so easily dealt with as oil; and possibly this may have something to do with our comparative neglect of it. But the difficulties are not insurmountable; and when they have been fully met, we shall have in our possession another weapon that will be useful, not only for its enriching purposes, but as an aid, to some extent, in controlling the prices of that once valuable commodity.

Benzol enrichment was ably dealt with by my predecessor in the chair (Colonel Sadler) at our last meeting; and experiments were shown as to its value and ready adaptability. The one difficulty of Colonel Sadler's method of applying benzol which was suggested to my mind, is that of controlling the requisite amount of enrichment. It does not seem to me that this can be done satisfactorily by means of a bye-passing arrangement as described to us. This, however, is a minor difficulty—if it is one at all; and the ingenuity of the profession is, we trust, not so far exhausted as to be overcome by it. It was my intention to make some experiments on a small scale during the summer; but a good many other duties, which of necessity had to be performed, prevented my doing so. Benzol has been used on a fairly large scale in one or two works, and I believe with considerable success; but as yet I am not aware that any definite figures as to cost have been published.

This question of enrichment is one that does not apply largely to undertakings supplying gas of 16-candle power or under; but even in these cases, it is a question worth considering as to the possibility of using an inferior and cheaper class of coal, and improving the quality of the gas by means of liquid enrichers. With such a choice of enriching materials, we should be safe against any abnormal advance in the cost.

An important point in regard to these enriching processes was clearly shown during the very severe weather of last winter.

Where the processes were in use, an entire absence of naphthalene deposits was experienced. Who would not have been glad to turn on the oil process during that period, to have given relief to suffering consumers? Some such silent and effective remedy would be very useful also when troublesome deposits of naphthalene assert themselves on the works. There are few of us who could not relate experiences of anxious moments over this "insidious foe;" and you will all agree that it is pleasanter to talk of the event when it is over, than to be engaged in the conflict with such a treacherous opponent. Any process which possesses the advantage of subduing the naphthalene trouble, will be looked upon with more favour in consequence.

There has been a satisfactory reduction in the proportionate amount of capital employed within recent years, and a very marked advance in the price of gas shares and stocks. In a recent issue of shares, the prices realized were such as to give rather less than 4 per cent. per annum on the investment; and in at least one more instance, a fraction over this amount was the result. These are factors which have an important bearing upon the general results of a gas undertaking, and may certainly be taken as signs of prosperity and confidence.

When we come to the question of methods of illumination, and the prospects of gas for other purposes, we have every reason for congratulation. It is not many years since the standard Argand burner was accepted as the one which gave the best lighting result; but since then it has given place to the regenerative lamp, and this in turn has been surpassed by the incandescent burner, which gives a lighting power of about six times that of the standard Argand. When consumers begin to realize the possibilities of gas lighting, and members of all local authorities learn that it is their duty to give the ratepayers that system of public lighting which is the most economical and effective when properly applied, the progress will be still greater. With such weapons as the incandescent and other burners now on the market, we have nothing to fear from the electrician; and, on the other hand, we should be able to meet our more modest—if not more powerful—rival, the oil-lamp by means of the "penny-in-the-slot" meter.

We have reason to believe there is a great future for the supply of gas for heating purposes. Professor Lewes informed his audience, at the meeting of The Gas Institute in Edinburgh, last June, that gas-heating stoves were made on the Continent which gave a heating result greatly in advance of anything we have in general use in this country. We may be sure that we shall not long be behind in this matter; and when we are in a position to supply a gas fire or stove that will be as economical as a coal-fire when in constant use, there is a very wide field for further developing the consumption of gas. The demand for gas as a motive power is still on the increase; and this is a field in which electric lighting and gas engineers may find mutual ground to meet upon—probably to the advantage of both. The gas-engine has made great strides; and there are still further possibilities before it.

The parliamentary returns of statutory gas undertakings in the United Kingdom show that during the past ten years the aggregate consumption of gas has increased no less than 45 per cent. This is a result which cannot be other than satisfactory to us; and, with the advantages we now possess, we should be able to maintain an equally good rate of progress. In order to still further this, let us emulate each other in our efforts to produce the best possible results. The value of our meetings will be in proportion to the general improvement shown as the result of our deliberations. It should be the ambition of each one, not to be satisfied with attaining the average standard of efficiency, but to aim at the "high-water mark" of gas-works management. I believe this ambition does exist very largely among the members of this Association; and while it is so, there is also a willingness to impart to each other any information that is likely to be of mutual benefit. Consequently, the industry at large is the better for such opportunities as are given by meetings of this character.

Mr. Holliday's Paper.

Mr. J. Holliday (Scarborough) read the following paper:—

On the Encouragement of the Small Consumer.

That there is a wide zone into which practically no advance has yet been made by gas for illuminating or any other purposes, is well known to every person who takes an interest in present day gas supply; and many of the responsible heads of various gas undertakings throughout the country have each some pet scheme whereby this unproductive area has to be caused to fructify.

One of the questions of the day, as it has indeed been more or less a question for years, is the danger of the oil-lamp. With the number of deaths resulting from accidents with mineral-oil lamps—reaching in London alone nine in one week—there is little wonder that matters have arrived at an acute stage; and whatever may result from the deliberations of the Commission promised by the Home Secretary, to investigate the causes and suggest remedies, either in the way of a more perfect method of construction of the lamp itself, or by a regulation as to the quality and "flash" point of the oil, it appears to me that we members of the gas industry have an exceptional opportunity at the present juncture. My own view is that, whatever improvements may be effected in oil-lamps, the source of danger itself will always be present. As the writer of a leading article in one of our trade journals succinctly put it recently: "The manufacture of small arms has been perfected and carried to such a pitch as to be almost a fine art; but when they are loaded they are as dangerous as ever they were, and so will 'loaded' safety lamps be."

The matter being so prominently before the public, it occurred to me, when asked by our President to read a paper at this meeting, that it might possibly be of interest if I laid before you briefly a sketch of a twelvemonth's actual returns from two systems we have in vogue in Scarborough for reaching occupiers of small cottage property who are almost by heredity oil-burners.

Some five or six years ago, a system of short accounts was introduced among small consumers; and, as far as it goes, it has answered extremely well, as may be judged from the following figures taken out for the twelve months ending June 30, 1895:—

Number of monthly consumers	271
Total consumption per annum by above . .	3¾ million cubic feet (approx.)
Average consumption per meter, about . .	13,000 cubic feet per annum.
Bad debts on a total rental of £499 0s. 1d. were	£4 2s. 6d.

= 0·39d. per 1000 cubic feet sold, or somewhat under 1 per cent. in the aggregate.

With regard to the details and conditions under which we work this system, I may explain that our gross price for gas being 3s. per 1000 cubic feet, with a rebate of 3d. per 1000 cubic feet for prompt payment, we supply our monthly consumers at the net price—*i.e.*, 2s. 9d. per 1000 cubic feet—without deposit or other security; the only condition being that the account is paid on presentation by the collector, or within three days therefrom at latest. Failing this the gas supply is discontinued without further notice. No outlay is incurred beyond that of providing and fixing a meter and main-tap.

This system works extremely well, and is a safe source of income in cases where the tenants are provided with house-pipes and the necessary fittings, or are prepared to purchase them. But in the case of houses unprovided with fittings, it of course fails to meet the necessities of the situation. Recognizing this fact, my Directors about eighteen months ago authorized me to fit up a few installations of prepayment meters, with a view to testing the possibilities of the system in Scarborough; and it is of a few of the results and experiences gained during this period that I will now speak.

The first condition imposed was that the applicant's house should not contain more than six rooms, and that the service and house pipes should be laid in. With regard to the latter qualification, however, we have found it much safer and more satisfactory to ignore it generally. As a matter of fact, in almost all the first cases we had to deal with, the pipes were found to be in a very unsatisfactory condition—leaking either from bad joints or from nail punctures. We have therefore in most cases relaid the house connections entirely from the outlet of the meter. The slight extra cost of the piping and labour certainly repays us, through having a perfect and satisfactory job to commence with. The form to be signed is of the usual type—the applicant, of course, signing the declaration as to liability for the return of the various articles in good condition, over a sixpenny stamp. It was decided to supply 22½ cubic feet of gas for each penny; and to provide each consumer with a meter, one good slide pendant, one bracket (fitted with governor burners), and at option a small breakfast griller or a boiling burner.

We have at the present time between 350 and 360 prepayment meters in action; and out of these I have taken the first seventy which had completed not less than one full twelvemonth's working upon which to base my observations. In the return relating to these seventy meters, the first matter of significance is the great fluctuation of consumption per meter—varying from a minimum of 1700 cubic feet to a maximum of 23,000 cubic feet per annum. In this respect the following table may be of interest to you:—

2	consumers	between	1,700	and	2,000	cubic feet	per annum.
3	,,	,,	2,000	,,	3,000	,,	,,
2	,,	,,	3,000	,,	4,000	,,	,,
5	,,	,,	4,000	,,	5,000	,,	,,
6	,,	,,	5,000	,,	6,000	,,	,,
6	,,	,,	6,000	,,	7,000	,,	,,
11	,,	,,	7,000	,,	8,000	,,	,,
13	,,	,,	8,000	,,	9,000	,,	,,
5	,,	,,	9,000	,,	10,000	,,	,,
7	,,	,,	10,000	,,	11,000	,,	,,
2	,,	,,	11,000	,,	12,000	,,	,,
2	,,	,,	12,000	,,	13,000	,,	,,
2	,,	,,	13,000	,,	14,000	,,	,,
2	,,	,,	14,000	,,	18,000	,,	,,
1	,,	,,	15,000	,,	23,000	,,	,,
1	,,	,,	23,000	,,	24,000	,,	,,

The mean average consumption per meter is equal to 8187 cubic feet per annum—a low figure compared with the returns reported by some other companies.

As I said before, we allow 22½ cubic feet for each penny; and as every installation costs us, on an average, £3 to £3 5s., even this consumption leaves us with just a fair margin of return for the purpose of covering wear and tear on fittings.

With regard to the consumption per meter per month, the return is most favourable, as the same level is maintained fairly

well from January to December, with the exception of March and April. This is shown by the following table :—

	Cub. Feet.		Cub. Feet.		Cub. Feet.
January	662	May	507	September	685
February	601	June	591	October	841
March	474	July	731	November	934
April	452	August	834	December	875

Giving an average of 682 cubic feet per meter per month.

With regard to the meters themselves, my own opinion is that, though considerable advances have been made even during the past two years, we cannot call the system an absolute success until rather more reliance can be placed on the coin attachment not going either faster or slower than the meter index. At one of our recent monthly collections, there were 51 cases where money had to be returned to the consumer, and 100 cases where it was necessary to request the consumer to pay sums varying from 1d. to 3s. 8d. where the cash in the box was deficient.

The number of what may be termed subsidiary complaints received at the office, and attended to, from Jan. 1 to Aug. 31 of the current year was 123 ; and their nature as follows :—

Bent pennies and coins stuck	42
Complaints as to rubber connections for griller	20
Foreign and silver coins used	8
Stoppage in fittings and other repairs	53

In the case of the item "foreign and silver coins used," I may mention that the meter had in one case been put to a use never contemplated, I feel sure, by the makers—viz., for the purpose of a savings bank; the good lady having inserted four two-shilling pieces into the box in place of four pence, so that they would be, for some time at any rate, safely under lock and key. The majority of the complaints named above are due to the insertion of bent pennies, and people being nervous when they are putting the coins in, and consequently allowing them to fix. Another point is that very few people will prepay more than two or three pennyworth at once; and, unfortunately, with most of the meters we have had experience of, we find that, unless something like the full complement of coins is inserted together, the attachment index and the meter index beg to have different views on the situation.

Before sending out any meter, we run it through a test, in the first instance to see if the valves are closed ; it is then attached to the test holder and a gas-fire, and four pence inserted in the slot. The amount to be consumed at the rate of 22½ cubic feet per penny is therefore 90 cubic feet; and they are allowed to pass if they do not give less than 83 or more than 93 cubic feet for the 4d. If not within these limits, they are rejected. The following table shows the results of 356 tests made with five different makers' meters on these lines :—

	Meters Tested.	Number Rejected.	Per Cent.
A	213	13	6·10
B	31	1	3·22
C	56	4	7·13
D	28	2	7·13
E	14	1	7·13

One interesting fact in connection with the introduction of coin-meters into Scarborough is that houses in older parts of the town, which years ago were the domiciles of the more affluent members of the community, and fitted up with gas, but which, owing to the march of events and extensions of the town, have been on the down-grade and left to the fisher-folks, have, after a lapse of 20 to 25 years, again become illuminated through the agency of the "penny-in-the-slot" meter.

That the principle of the prepayment meter system is undoubtedly right, and that, as far as it has gone, the gas world have scored a distinct success with it, appears to me to be indisputable. What we now require is to have the details rather more fully perfected, so that the troublesome readjustments with the consumers at present necessary may be done away with. I feel sure that, with the adoption of a broad and generous policy, we shall be able to make the use of oil quite unnecessary, and that gas will become not only the universal light in the class of property under consideration, but that it will also become the medium of all their culinary operations as well.

That, in my own town at least, there is plenty of scope, is evident, as out of 9000 inhabited houses in the borough we only number at the present time some 5133 as gas consumers ; and I have no doubt whatever the large proportion of our other towns are in much the same position in this respect.

Discussion.

The President said the subject of the paper was now before them. It was one upon which many of them had had experience —both with penny-in-the-slot meters and in the encouragement of small consumers in other ways.

Mr. H. Tobey (Malton) had listened with much pleasure to the paper Mr. Holliday had given them, and the interesting details in it. Mr. Holliday began by speaking of the benefit which was likely to accrue to humanity by the adoption of the penny-in-the-slot meter, on account of its being free from the dangers of the oil-lamp. The danger of oil-lamps was very great indeed. He saw by the report of the Metropolitan Fire Brigade, recently issued, that the number of fires occurring from lamp accidents in London alone was something like 450 a year. The number of lives lost amounted to about 33. Of course, this did not include a great many of the minor casualties which occurred, but were all the cases which were reported to the Fire Brigade, and dealt with by them. There must, however, be a vast number of cases which never were reported—small accidents which did not come before the Fire Brigade. He thought they might take these as at least double the number reported; so that the total would be about 1000 in London in one year. If these accidents could be decreased by means of the use of gas through penny-in-the-slot meters—and most of such accidents occurred in small dwellings—no doubt the loss of life and property arising from lamp accidents would be very much less. He had had some experience himself with prepayment meters. He must say that with the meters with which he was first supplied he had some difficulty; but with those he was now getting he had not the same difficulty. The meters were now so improved that he thought they could be used without incurring much annoyance, either from pennies getting fast or people getting gas for, perhaps, two or three days, or longer periods, and they not being aware of it, and then having to ask the consumer to pay up the difference, which was always a matter of annoyance. He had formerly known a consumer put in six consecutive pennies before he was able to get a supply of gas; but now the improvements in construction of the meters enabled them, he thought, to rely upon the meters giving the exact quantity of gas for which they were rated. He found that the average consumption per meter was something like 10,000 cubic feet per annum. This was not a very large quantity; but still he thought it was a quantity which paid. Of course, the extra rate charged should be sufficiently high to yield a return for the extra cost of the meter and the cost of the service to the small consumer. Their charge for gas at Malton was 3s. per 1000 cubic feet; and they rated the gas supplied by prepayment meters at 25 cubic feet for 1d., which was 3s. 4d. per 1000 cubic feet. But he should remark that, in addition to this, they did not charge meter-rents to ordinary consumers, which was equal to about 2d. more. So that, really, the difference between the two rates would amount to about 6d. per 1000 cubic feet. Of course, there were consumers and consumers; and what might be considered a large consumption in one place might very well be reckoned small in other places. He found, in his own case, that the average consumption per meter was about 30,000 cubic feet per annum. Some might not consider this as large; but in districts like theirs, they reckoned that 30,000 cubic feet was a considerable consumption.

Mr. E. H. Millard (Durham) said he had listened with great pleasure to the paper; and he was only sorry that the title did not lead them to infer that the prepayment system was to be referred to; otherwise he should probably have been prepared with some details on the subject. He thought that perhaps Mr. Holliday had some new system which he was to enlighten them upon; but he found it was the well-known penny-in-the-slot meter which stood in the foreground. With respect to monthly consumers, he might say that, before going to Durham, he had a very similar system at work. He used to collect every fortnight; and those consumers were charged the same price as the ordinary ones. In approaching this question, it was evident they must take into consideration the cost of producing the gas, as well as the selling price. In this, he thought, lay the whole *crux* of the question. Some of the engineers of large works had been twitted with not being up to date with the prepayment system. He confessed himself that, if he were selling gas at (say) 2s. 6d., he should be chary of going in for either prepayment meters or monthly collections, unless there was a considerable margin. He had worked out the number of consumers and the consumption for several works, confined to the county of Durham; and he was surprised to find that, in taking out the leakage, the leakage per consumer ranged very high. They were all agreed, he thought, that the leakage question was largely dependent upon the services; and he did not think they lost more, per service, with the large consumer than they did with the small one. Therefore, the leakage, which amounted, on an average, to about 2500 cubic feet per service per annum, was large. Wrought-iron services would give way; and they might expect the leakage to go on. He did not know whether Mr. Holliday made a separate charge for meter-rent. With the small consumers, it was quite evident that the 10d. per 1000 feet extra alone would not cover that. He saw that Mr. Holliday had had to come round to fitting up the houses. He did not think the automatic supply system, without the companies taking up the gas-fitting, was worth anything at all. Another point which was well brought out in the paper was that, without a griller, a penny-in-the-slot meter was not worth much to Mr. Holliday, as would be seen from the large consumption he obtained during the summer months. With regard to the money not tallying with the meter registration, he did not know whether it was altogether wise to insist upon the few extra coppers being paid, or to give the consumers back the few coppers which were in excess. He was afraid that any such policy would tend to destroy the confidence of the user in the penny-in-the-slot meter. Although at Durham they had had experience of both too little and of too much money, they had not yet instituted the principle of charging a penny for a pennyworth of gas. The idea as to making the money-box a savings bank, he did not think would be strange. They frequently found that a two-shilling piece had been dropped in for a penny ; but the consumer always knew that he had put it there. He found himself very

much in agreement with Mr. Holliday in his paper. The only thing he had doubt about was whether even 9d. or 10d. per 1000 cubic feet was sufficient to cover the difference between supplying small consumers, on account of the low average consumption, and the leakage they would have per consumer.

Mr. J. Hall (West Pelton) said that, with regard to the leakage which had been referred to, it had not yet been explained how it arose. Was it from the time the penny was put into the slot till the meter started again that it went on? He had had no experience in the matter. If there were a waste on that account, it would be judicious on the part of gas companies to make their charges so as to cover any such loss.

The President said he did not think the intention of the paper was to raise a discussion upon leakage. Mr. Holliday, he thought, referred to leakage in connection with the difference between the amount of money in the box and the quantity of gas consumed. It was not so much a question of leakage in the services as of the difference between the coin put in and the quantity of gas used. But let them discuss the matter in a general way. He knew that a good many gentlemen had adopted the prepayment system, and some of them had had considerable experience with it; and he hoped they would take this opportunity of stating what they knew about it.

Mr. Tobey said he would just like to add the fact that the number of consumers in Malton had increased by 20 per cent. since they adopted the penny-in-the-slot meters.

Mr. J. Whyte (Seaham Harbour) said his experience with prepayment meters was not very great, but such as it was he should be very pleased to lay it before the Association. He had somewhere about seven dozen of them at work. With reference to the discrepancy between the cash and the quantity of gas consumed, he had had some difficulty in that way. In the case of one or two meters, which were the first fixed, the gas and the money agreed to a penny piece. But he had given back as much as 8d. and 9d.; and in one instance they were about 3s. 9d. short. In that case he simply took out the meter, and said nothing about the matter. His conviction was that if they once said the meter was wrong, it would be altogether condemned by the people; and he considered that the best and easiest way out of the difficulty was to lose the 3s. 9d. He wanted to try to press the business a little. This summer they had been at considerable expense in laying down plant for the public lighting of a neighbouring parish; and he meant to try to push business there. He proposed to put in the fittings. He knew that in some cases they would lose as much as 15d. or 18d., and in other cases they would make a few coppers. But his contention was that they ought to get in prepayment meters, and obtain an increased consumption. They charged only 3d. extra for them. Their price to ordinary consumers was 3s. 6d. per 1000 cubic feet, with no meter-rents; and with prepayment meters, their charge was 3s. 9d.

Mr. T. Bower (West Hartlepool) said he could not add anything to the discussion in the way of experience; but he was exceedingly glad to have had the pleasure of listening to the points that had been put before the meeting. In his town, they had done nothing whatever in the way of adopting prepayment meters; but he was inquiring into this, and the matters mentioned that day would be of use to him. He once had some experience with "slot" meters; and one of the things he found was that the money did not agree with the gas consumed. In one or two cases, when they asked for the balance, they were told to take out the meter; but the suggestion was made that, if the consumers were satisfied with the gas consumption except on the point in dispute, they would take out the penny-in-the-slot meter, and put in an ordinary one at a reduced price. This brought them several new consumers; and for them, credit ought really to be given to the penny-in-the-slot meters. If meter-makers would now turn their attention to making these meters more perfect, there was a wide field for them. He had no doubt the makers would do what they could. He was sure they were all very much indebted to Mr. Holliday for bringing his experience before them; and he believed they might profit by it when the time came for taking up the matter.

Mr. Whyte said he would like to add that in some cases consumers had to put in from 4d. to 6d. before they had any gas.

Mr. J. H. Penney (South Shields) considered they were very much indebted to Mr. Holliday for the facts he had placed before them with reference to encouraging small consumers. He thought that one very important phase of the question for most of them was, seeing that the electric light might, sooner or later, claim many of their larger consumers, such as manufacturers, they should do all they possibly could to get hold of the smaller consumers. No doubt these, along with the middle classes, would be the backbone of their rental; and he regretted to learn, from Mr. Holliday's paper, that the prepayment meters were not such a great success as they were led sometimes to believe them. The fact that the prepayment meters showed such variations as he had mentioned was not satisfactory at all. He thought that the letting out, free, of a ring burner or a simple gas-bracket, to small consumers, would be of great advantage. They generally found that the rental to a poor consumer was a great bar to his commencing the use of gas; but if they "wrapped it up," in some way or other, with the price, he had no doubt at all that these people would adopt gas. By so doing, gas suppliers would add to their receipts. They had had no experience with prepayment meters at South Shields; and therefore he was sorry that he could not add anything more to the discussion.

Mr. Millard said he should like to supplement his remarks with one point. The grillers which they supplied along with prepayment meters had been so much appreciated by the consumers that they had come to consider that they could not have a griller without a prepayment meter, and they asked to have their own grillers exchanged so that they might get a prepayment meter. In order to meet their views, he brought the matter before his Directors, and suggested that they should fix the grillers and make a charge of 6d. per half year for them. They had now a large number of these grillers out, solely through the penny-in-the-slot meters advertising them. He might say that they invariably put the gas-fire down by the side of the fireplace, resting on the fireplace during the summer, and any fumes that came from it went up the chimney. He thought it might be worthy of the consideration of any of them whether they should not adopt the method of hiring out grillers, and charging 6d. per half year for fitting them up.

Mr. W. Ford (Stockton) said he really would not have risen, unless it had been to confirm an expression of opinion by Mr. Penney. In his town, he was sorry to say, the electric light in large works was superseding the use of gas to some extent; and though they were a corporate body, he was afraid they would not be permitted to do as their friends did at Durham or Seaham Harbour, in introducing gas-fittings. Corporate bodies were subject to the ratepayers; and ratepayers sometimes indulged in such reflections as: "He may supply the gas, but not the fittings." That might have some effect upon the introduction of penny-in-the-slot meters. A working man might find a griller a very useful thing to have, in enabling him to get something hot before he went out in the morning; and especially if his wife were ill. Penny-in-the-slot meters seemed to be condemned—he thought rather hardly—by Mr. Holliday; but it was a new industry, introduced very recently. The manufacturers of the meters had displayed a great amount of ingenuity in their construction; and they must have a little patience with them. Give them time to perfect the instrument, and he had no doubt that, before a few years had passed away, the penny-in-the-slot meter would be quite as reliable as any meter they now had. He was very sorry indeed he could not add anything to their experience. About five years ago, his Corporation authorized him to introduce the penny-in-the-slot meter. He did that by advertising. He put the meters into every plumber's shop in the town, with a large placard stating that they could be had at the gas-works, free of charge—no meter-rent and all connections made free. Yet, notwithstanding that this advertisement continued for twelve months, the total applications made to the Gas Department were for only three meters. One of them was returned on change of tenancy; another was sent back because it was too much trouble to put the penny in the slot, and an ordinary meter was demanded; and the third one, he was sorry to say, broke down. He thought, as had been said, that where gas was cheap—say, 2s. per 1000 cubic feet—there was not that inducement to corporations or companies to persevere with the introduction of prepayment meters, because, if the production of gas were at the maximum, and they increased the output by these meters, they would have to enlarge the works to supply the small consumers. He was very pleased indeed that Mr. Holliday had shown so clearly to them that the rising generation were not going to be behind those of them who had passed through the greater part of their experience; and he wished all their young friends every success.

Mr. J. Coates (Ottawa) said he had no right to speak, because he was not a member of their Association. He had come from Australia, and he was now Manager of a large gas-works at Ottawa. He should like to ask the reader of the paper, or some member of the Association, what the experience was with those who would not pay. If they cut off a man's supply of gas, he took to electric light; but if they just said to him, "We will not supply you with gas on the ordinary terms, but we will put in a prepayment meter," he would be bound to pay. He did not know if they had any experience of this kind—whether they had tried it upon consumers who could afford to pay but would not. He was fighting three electric light companies at Ottawa, and was doing well; so that, if gas could beat them on the water-power question, surely they could beat them on the coal.

Mr. Tobey said that, when they found a consumer who would not pay, they gave him the option of two things—he must either make a deposit, or he might have a penny-in-the-slot meter; and he would not have any more gas unless he accepted one of these alternatives.

The President, before calling upon Mr. Holliday to reply to the discussion, made a few remarks. He thought the title fully bore out the text of the paper. The encouragement of the small consumer naturally suggested, in the first place, the penny-in-the-slot meter, although it did not confine itself to that. He noticed that Mr. Holliday's average sale of gas per meter was about 8000 cubic feet per annum. This corresponded very nearly with his own experience. They had something like 120 of these meters in use, which was about 16 per cent. of their total consumers. Last year they had an average consumption with these meters of 7500 cubic feet. This year there had been an increase; and he thought the average might now be quite 8000 cubic feet. This increase was due to the introduction of more cookers. When they introduced the system, they let out

grillers on hire; and he quite agreed that, without letting out fittings and some appliance for cooking, the penny-in-the-slot meters, in small towns, could not make much headway. The meters had been the means of advertising cookers and other methods of consuming gas, as had been mentioned by himself already, and by another speaker. At the time of introducing the system, they had a number of old cookers, which had probably been in use for nine or ten years, and which it was difficult to let out, as people preferred to have new ones. The penny-in-the-slot meters enabled them to place them in the district; and in this way, they had been very lucrative for them. He had now gone beyond this, and had put in a few new cookers of small size; and he was disposed to think that the more they went in for the supplying of gas-cookers to the smaller class of consumers, the more they would benefit. He thought they had a wider range than Mr. Holliday; but he did not intend to have it long. If they did not go beyond 2000 cubic feet per annum, he thought they were hardly worth the capital outlay involved; and they should take the meters out, and place them where they would be more remunerative. As to the reliability of the prepayment attachment, he was very glad that Mr. Ford had spoken about it. There was no doubt that prepayment meters had been hurried on the market—not so much by the meter-makers as by the demand; and there was no doubt, too, that the meters were not perfect. But they were improving rapidly. Each series of meters which came out from the various works was an improvement on what had gone before; and he believed they would soon reach to a system of perfection as near as possible. They were allowed a range of 5 per cent. with ordinary meters; and they were told that the range for prepayment meters only went up to about 7 per cent. These were the points he wished to emphasize before getting Mr. Holliday to reply; and he would now ask them to accord to the author a very hearty vote of thanks for coming forward with his paper.

Mr. Holliday, in reply, said that with regard to what had been taken as adverse criticism of the prepayment meter, he was sorry if his paper had given such an impression, because he could say that nothing was further from his mind than to do so. He believed that the prepayment meter was one of the things they should forward as much as they could. All he had said he had based, as far as he could, on facts. There was no doubt that as soon as the makers of meters had had time to perfect them more—and they were doing so every day—they would get a thing of practically automatic working. With regard to the returning of money, or the asking for more money, they in Scarborough came to the conclusion that the best thing to do was to let the matter run for three months before adjusting the money. If there was more money than there should be in the box at the end of the first month, they informed the consumer, but left it in; if there was less money, they told him, equally, that there was not enough in, but left it. In the bulk of the cases, it righted itself by the end of the three months; and they did not trouble themselves with demanding payment if it did not. On the question of waste, he might say that it was not waste, but simply a question of the quantity of gas consumed, and the amount of the coins not tallying. Of course, there was no waste so far as the gas itself was concerned. As to the introduction of penny-in-the-slot meters in cases of bad payers, they found these meters worked very well indeed. In a great many instances, with ordinary meters, they were called on to put pressure upon consumers, quarter after quarter, to get the money in; and they had had in this way to put penny-in-the-slot meters into houses larger than they had ordinarily to deal with in their town.

Vote of Thanks to the President.

Mr. J. H. Cox (Sunderland) proposed a hearty vote of thanks to the President for the very able address he had favoured them with. He was sure it would be found to contain a great many useful thoughts which would repay consideration afterwards. Altogether the meeting had been a great success.

Mr. Ford, in seconding the motion, said it was one of their greatest pleasures that one of the younger members should come forward and take office. He hoped that other young members would come forward similarly, in their turn.

The President thanked the members for the vote. He said that, if in anything he had written he had added to the interest or improvement of the Association, he could assure them that it had been a great pleasure to him. This visit of the Association came at a very busy time of the year to him; but he had somehow managed to get through it all. He hoped the members would leave Hexham with pleasant recollections of their visit. When he accepted the presidency of the Association, he had the assurance within him that from the gentlemen with whom he was associated they would have a very hearty welcome. He was quite sure that his Directors welcomed them all heartily to Hexham; and he did the same.

The members of the Association and a number of friends were afterwards entertained to dinner by the Chairman and Directors of the Hexham Gas Company, in the Hydropathic Mansion. Dr. Stainthorpe, the Chairman of the Company, presided over a company of about eighty. The visitors were, at the conclusion of a hearty and generous entertainment, driven to the railway station in time to catch the evening trains going east and west, and all left Hexham highly gratified at the success of the meeting and the cordiality of their welcome to the ancient and interesting place.

MR. VERNON HARCOURT ON GAS PRODUCTION AND CONSUMPTION.

The educational facilities offered to students by the Goldsmiths' Institute, at New Cross, are undoubtedly among the most complete in London; and the evening classes cover many subjects, the instruction in which is both theoretical and practical. The work of the session which has just commenced includes a course of 28 lectures on gas manufacture. The first twelve will be devoted to the chemical side of gas production and consumption; and they commence next Friday with destructive distillation, and proceed week by week to the finished gas, including the chemical principles of enrichment, and conclude with the treatment of residuals. This series will be in the capable hands of Mr. A. G. Bloxam, F.I.C. Mr. A. J. Lineham will deliver the remaining sixteen lectures, which will deal very completely with the plant and apparatus on a gas-works and the means of distribution and consumption. The work of this particular branch of study was opened, last Friday evening, by an introductory address by Mr. A. G. Vernon Harcourt, F.R.S., one of the Metropolitan Gas Referees, on which occasion the Prime Warden of the Goldsmiths Company, Sir Frederick Abel, Bart., K.C.B., &c., presided.

Mr. Harcourt, in his opening remarks, said it could not be necessary to explain to those who were attending, or going to attend, the classes of the Institute, how desirable it was to blend knowledge with practice. To understand as far as possible the reason for what we do, and the nature and causes of what we see, was the natural desire of every intelligent and well-directed mind. But we can only work out a little for ourselves. To discover what were the essential conditions, and what was the nature of such changes of matter as happened in the manufacture and consumption of gas, had occupied the attention and thought of many observers during several generations. The discovery was far from complete. What the real changes were which took place in a gas-flame was at the present moment a matter of active controversy among professors of science. Still there was a large body of well-established truth; and it was only those who had learnt these general truths who could rightly understand what they saw, or could hope to add to the sum of knowledge.

Dealing with the need and nature of artificial illumination, Mr. Harcourt said the gradual development of mankind, and his advance in civilization, had had the effect of increasing the importance of those pursuits in which the sense of sight was needed. There were few things, besides sleeping and listening to music, that could be done best in the dark. The natural supply of light was excellent in quality; but the duration of sunlight during more than half the year was insufficient. We need at most eight hours sleep; but we have, on an average, eleven hours of darkness. Therefore, civilized man had learnt to provide himself with artificial light. Fire (which, whenever man first lit one, or saw one which the lightning had kindled, must have been recognized as a source of light, similar to the sun by day) was first used for such purposes as cooking, pottery and metal work, and also served as a source of light as a beacon of communication or warning. The need of domestic light, and skill in supplying that need, was one of the later accomplishments of man. What might be taken as a type of artificial light was an iron bar that had been heated in a forge—that was to say, a solid substance which would bear a strong heat without being dissipated, and without any other necessary change than that of growing bright. Nearly all the sources of light used were of this kind. The substances that had this property of remaining unchanged at a high temperature were those that we use. The carbon, not quite pure, but retaining some hydrogen, in ordinary flame lights, and both the carbon of the arc electric light and the filaments of the electric incandescent or glow lamp were similar to those substances which gave light to gas-flames. To these must be added certain earths or oxides, which were the solid substances of the brilliant incandescent gas-light, and also of that which had been used much longer—the lime-light. A substance was needed that not only could become incandescent, but was a source of heat. The sources of heat were either gas-flames or the electric current. All the flames used in the lighting of houses were gas-flames. The oil which rose in the wick of the lamp was changed by the heat of the flame into gas before it burned; and the grease of the candle was changed by the heat of the candle flame first into an oil (which was the liquid grease in the cup of the candle), and this afterwards becoming very strongly heated and decomposed at a high temperature constituted the flame. That which happened in the wick of the oil-lamp or candle was done on a large scale in the retorts of the gas-works. Solid or liquid substances were there partly converted by a strong heat into gas, which was then distributed through pipes before it was burnt.

Turning to the substances which furnished light when daylight failed, Mr. Harcourt said that, generally speaking, they

were products of life. Just as, almost without exception, the substances which were used for food were products of either the animal or vegetable world, so the substances employed to give light after darkness set in were similar substances—namely, compounds mainly of hydrogen and carbon. Of such substances, some gave more gas and more brightly burning gas than others; and only those had been chosen as sources of light which were most suitable, and could be obtained most abundantly. The fat of animals gave liquid oil for lamps and solid grease for candles; and, again, the vegetable world yielded oil. Many seeds, for instance, when very strongly pressed, gave off oil. There was another source of such substances. By the gradual change of temperatures, or by the effect of the interior heat of the earth, the relics of a former vegetation were changed into gas (which gas had been used extensively in America), and very largely into liquids of the paraffin class, called petroleum. Long before petroleum came largely into use, a similar substance was made by the heating of shale, by which solid paraffin and liquid of a similar composition were produced and employed for lighting. The great store of the remains of living things were the deposits of coal. That which had been stored, and still remained to us, seemed to be only that which, under particular conditions, had been so enveloped that it had been preserved for us; and it was this remnant of former life which served us for gas illumination and for many other things. The abundance of these deposits made them the chief source of artificial heat, light, and mechanical energy. The mining and carriage of coal formed a part of the complete history of manufacture of almost every industry; and therefore could not be regarded as forming specially a part of the manufacture of gas. Still, in the manufacture of coal gas, coal played a double part; being used, as in other manufactures, for heating the material dealt with and under the boilers of the steam-engines, while it was also the raw material of the manufacture.

The processes and chemical changes by which the coal was made to produce gas for use were next lightly dealt with by Mr. Harcourt. In this connection, he said that the change that took place in the retorts at the high temperature employed was most complete. The elements that had been living together for a long time in the coal entered into new combinations—forming a large number of the combinations of which they were capable. The products, or rather the chief part of them, were of the simpler kind, because of the prolonged exposure at a high temperature. There was this complication, however, that they did not have, as the product of this destructive distillation of coal, only those substances which would be permanent at the high temperature ultimately obtained; but the great mass of material gradually passed through the whole range of temperature lying between that which the charge had in the open air and the bright red heat of the coke when drawn. During this time, there were being given off a great variety of substances—some owing their origin to the heating of the materials at one temperature, and some at another. He had checked himself in saying that it was only the simpler compounds that survived, because it happened that they had in the coal tar that came off a great variety and complexity of materials. Broadly speaking, the substances divided themselves into two classes—those that were solid at a high temperature, and those that were volatile at a high temperature, and went forward into the hydraulic main.

Condensation and purification having received attention, the use of the gas as an illuminant was enlarged upon. Alluding to the batswing and fishtail or union burner, Mr. Harcourt said that, owing to the great economy found in first starting to use these burners, and their simplicity, he believed that the chief part of gas lighting would, for long to come, be of this kind. There had, however, been many improvements. Of the great advances that had been made, the first was that which was due to one of the brothers Siemens—that was, the heating of the air supplied to the gas; the heat being derived from the combustion of a portion of the gas itself. He believed one of the earliest proposals of this kind was an Argand burner provided with a double chimney; the two chimneys being so placed that the air to feed the gas burning within the inner chimney had first to flow downwards between the chimneys, and so pass over the surface of the inner one. The air was thus heated; and it was proved that the yield of light so obtained, in spite of the slight obstruction of the two chimneys, was considerably more. In the regenerative burners, of which many types had been introduced since the first one by Mr. Frederick Siemens, the principle was in all cases the same—viz., the heat of the gas was applied to a metal structure; and the air was thus heated before coming into contact with the flame. The principle was the same as that which had been used in furnaces in obtaining a higher temperature. By the use of burners of this kind (which had been a good deal simplified, and made less unsightly) a large gain—approaching perhaps the doubling—of the light which the gas would otherwise have yielded had been obtained. But far the greatest advance was the introduction of the incandescent gas-light. That really passed out of competition with any of the other contrivances for increasing the amount of light that could be obtained from gas. He tested one of these in the Quadrangle in which he lived at Oxford. The burner seemed to give its best result with a consumption of 4 cubic feet of gas per hour; and, when burning this amount (which in an ordinary, fairly good burner, would afford a light of something like 12 candles), the light given, after the gas had been deprived of its light-giving power by the mixture of air, and then caused to play on the mantle, was 60 candles—that was to say, the light was multiplied by five. The enormous gain in the relation between the gas consumption and the light which was realized, made it difficult not to believe that it would come—as, indeed, it was coming now—very largely into use. To the chemist the incandescent gas-light was an extremely interesting subject.

In describing next the methods by which the illuminating power of the gas is measured and the quality estimated, Mr. Harcourt pointed out that our eyes are quite incapable of judging of any other relation between two brightnesses than that of equality; and, in proof of this, he referred to the experiments (in which he took part) at the South Foreland some years ago to compare the relative excellence of an electric arc, a large oil-lamp, and a large gas-lamp for lighthouse purposes. Night after night, and especially on foggy nights, they observed and measured these lights. The Elder Brethren of the Trinity House, who had chief charge of the experiments, issued instructions which were circulated among the captains of vessels that were sailing by the South Foreland, and asked them to put down what, in their judgment, was the relative brightness of the three lights. There was great discrepancy between the results so arrived at and the results found by photometrical measurements. Man was not, Mr. Harcourt said, capable of forming such an estimate. The only way of estimating the brightness of lights was to get two illuminants, and bring them together so as to make them equal. There was, he mantained, one considerable difficulty in photometrical measurements when applied to the object of knowing what was actually the value and use of the light—viz., that the measurements of the light given by different burners were almost always made simply in the horizontal plane; while consumers always avoided using gas in the horizontal plane. The gas when tested was burnt at a certain rate—viz., 5 cubic feet an hour, and with a particular burner, because the same quality of gas, burning at another rate or in another burner would give a totally different value. This was a matter that could not probably be changed. The present mode of describing the quality of the gas had this disadvantage, that most consumers of gas did not understand what difference it made to them that the gas should be of one or other quality. Any gas consumer would say, and say quite truly: "It is said the gas is sometimes a good deal better, and sometimes not up to the proper quality; but I do not notice any difference." There were two reasons for this—one that we have a very small appreciation of the difference of the brightness of flame, and the other that, until it was seen at what rate the gas was burning, as well as the brightness of the flame, nothing was known about the quality. It should be understood that the real way in which the lowering of the quality affected the consumer was that, in order to get the same amount of light, he wanted, and had to pay for, more gas. If they took the quantity of gas a consumer had to burn, and pay for, to get the light that he required, the qualities and differences would be better understood than they now were. It had been proposed by Mr. George Livesey, and he (Mr. Harcourt) thought there was a great deal in the proposal, that gas should be supplied of a somewhat lower quality than that distributed at present in London. It was required that the gas should have an illuminating power of 16 candles. He believed it was certain that gas of a rather lower quality could be produced at a considerably less cost than that of 16-candle gas. In order to obtain a gas of the value of 16 candles from the coal ordinarily used, it had to be enriched, or it would not reach that standard. It was said it would be better not to do this; and he was inclined to hold that those who said so were right. Naturally, the gas consumer would demand that, if a change were made, such an alteration should also be made in the price of gas that he would be able to obtain as much light as now for his money, using the same burners. That would not be at all a difficult matter. The Gas Referees had been devoting some attention to this question, to find out what the difference would be—how much more gas would have to be burned, in order to procure the light that was now got from 16-candle gas. This being ascertained, it was purely a matter of rule-of-three to find out what the price of the gas should be. Two great reasons for this change, he thought, were the increasing use of gas as a source of heat both for cooking and motive power, and its use for lighting by means of the incandescent burner. No doubt, the more highly illuminating gas was productive, volume for volume, of a greater amount of heat; and therefore it was the better gas for warming houses or for mixing with air and burning with the incandescent mantle. But he believed it would be possible to get a great gain as far as any of these processes were concerned—the obtaining of mechanical energy, heat, or incandescent gas lighting—by burning a larger quantity of gas of a lower grade, which would cost less than the slightly smaller quantity of more valuable gas which was now used. For all purposes, the change might be made with advantage, if proper consideration was given to the necessity for lowering the charge for gas.

In concluding his address, Mr. Harcourt referred to the valuable bye-products of gas manufacture. Alluding to coke, he remarked that the late Sir William Siemens used to hold that the proper way for heating houses was not by burning coal, and that, if the use of coal could be superseded, it would rid the London atmosphere of smoke, which would be a great

advance. Sir William's opinion was that the coal should be converted into coke, which could be consumed in fire-places in conjunction with a certain portion of gas. He (Mr. Harcourt) believed that, in a properly constructed grate, this mixture could be used with great advantage. Although it might not have quite the brightness and variety of a coal fire, still it would be a considerable benefit. The gas could be turned down, and the coke allowed to burn on; and then it could be brightened up again by increasing the supply of gas. Whether such a process would not entail too great an increase of expenditure to balance even the advantage of the smokeless air might be doubted, as only to a partial extent would the disadvantages of the coal fire be got rid of. The other residuals produced in the manufacture of gas were also touched upon.

On the motion of Sir Frederick Abel, a cordial vote of thanks was passed to Mr. Harcourt for his kindness in being present and delivering his interesting address.

Mr. J. S. Redmayne, B.A., the Secretary of the Institute, proposed a vote of thanks to the Chairman for presiding; and this having been seconded by Mr. Harcourt, was carried with applause.

Incandescent Gas Lighting for Railway Stations.—The Paris, Lyons, and Mediterranean Railway Company have decided to adopt incandescent gas lighting at a number of their stations. Something like 4500 lights will be required for the purpose.

Prizes for Original Research.—The Royal Society of New South Wales offers its medal and the sum of £25 for the best communications on original research in certain specified subjects; among them being "The Chemical Composition of the Products from the so-called Kerosene Shale of New South Wales," and "The Mode of Occurrence, Chemical Composition, and Origin of Artesian Water in New South Wales." The competition is open to all, and is not subject to any restriction, save that the communication, to be successful, must be either wholly or in part the result of the competitor's own original observation or research. Particulars may be obtained from the Hon. Secretaries of the Society, 5, Elizabeth Street, Sydney.

The Respirability of Flame-Extinguishing Atmospheres.—Professor Frank Clowes, of Nottingham, recently gave, before the Chemistry Section of the British Association, an account of further experiments carried out by him on the respirability of air in which a candle-flame had burnt until it was extinguished. An atmosphere containing 16·4 per cent. of oxygen, 80·5 per cent. of nitrogen, and 3·1 per cent. of carbon dioxide would, he said, extinguish the flame of a candle, yet would not only be respirable, but might be breathed for some time without injury by a healthy person. An atmosphere, however, which would extinguish a coal-gas flame appeared to approach closely the limits of respirability, so far as its proportion of oxygen was concerned. Professor Clowes expressed the opinion that candle and lamp flames should be discarded, as tests of the respirability of air, in favour of the flame of coal gas.

Testing for Sulphur in Gas.—Herr Collan has been investigating the subject of the estimation of sulphurous and sulphuric acids in the products of combustion of illuminating gas; and he has recorded his conclusions at some length in the *Zeits. für Anal. Chem.* It has been maintained by certain experimentalists that the sulphur in illuminating gas is burnt directly, and almost completely, to sulphur trioxide or sulphuric acid. The author has shown that these conclusions are open to criticism, on the ground that sulphur dioxide in alkaline solution is easily oxidized to sulphur trioxide in contact with excess of unburnt oxygen; and that, as a matter of fact, upwards of 90 per cent. of the sulphur is burnt to sulphur dioxide. Four experiments gave the following results: (1) 93 per cent., (2) 89, (3) 99, and (4) 93. The first three were made with a smoky flame; the fourth, with the flame of an ordinary Bunsen burner.

The Temperature of Visibility of Hot Bodies.—Signor Pettinelli has published in the *Nuovo Cimento* a new determination of the lowest temperature at which a hot body becomes visible. He heated a cast-iron cylinder 30 centimetres long and 14 centimetres broad in a wrought-iron jacket over a Bunsen burner to a temperature of 460° C., as indicated by an air thermometer, and then observed its flat end in a dark room from a point 60 centimetres above it. When it had cooled to about 415°, the red heat vanished, and gave way to an indefinite hazy glow. This glow completely disappeared at 404°; and repeated observations gave an error of only 3°. Highly emissive substances, such as the mantles used for incandescent gas lighting, became visible at the same temperature. Reflecting surfaces, however, had to be heated 20° higher before they appeared to the eye; and glass still more. These low-temperature rays were found to traverse glass and water like ordinary light-rays; but they suffer a comparatively greater absorption. Different eyes vary slightly in their capacity of seeing them—the maximum divergence being about 6°. But then the extent of surface must be the same. Signor Pettinelli found that, if he screened off all but 1-40th of the surface, the body had to be heated 6° higher than before to become visible; if 1-200th, 20° higher; and if 1-800th only was exposed to view, the minimum temperature of visibility was 460°. Hence he rightly concludes that the contradictory results obtained by previous experimenters are due to differences in the areas of the hot bodies investigated.

REGISTER OF PATENTS.

Incandescent Gas Lighting.—Friedlander, H.; a communication from C. M. Lungren, of New York. No. 16,925; Sept. 5, 1894.

This invention relates to the manufacture of the bodies or frames placed over gas-burners, which become incandescent by the heat from the lighted gas.

The incandescent bodies as now made, says the patentee, are produced from various earths "by saturating an open-meshed textile fabric with the solution or emulsion of such earths, and incinerating the fibre. They, however, present the defect that the composition of the materials gives a peculiar greenish white colour, and makes the light unsuitable for some purposes; and moreover the method of manufacture adopted makes these articles extremely delicate, so that they readily break or become damaged, and hence unfit for use."

For producing incandescent bodies according to this invention, a mixture of the oxides of thorium, lanthanum, and didymium is used. Suitable proportions are as follows:—

Oxide of thorium	96 to 98 per cent.
" " didymium	1 to 2 " "
" " lanthanum	1 to 2 " "

This gives a white light with a slightly yellow tinge. The proportions of the didymium (causing the yellowness) must be small, as this substance causes a considerable coloration of the light; but the proportions of lanthanum may, if desired, be increased. Thorium oxide makes the article capable of resistance and durable. Lanthanum oxide may, however, be substituted therefor without sacrifice of that advantage. Thus, 98 per cent. of lanthanum oxide and 2 per cent. of didymium oxide may be employed in the manufacture. By increasing the proportion of didymium oxide, the colour of the light is made more yellow. About 5 per cent. will probably be the limit of such addition.

The manufacture of such incandescence bodies from the oxides of thorium, lanthanum, and didymium, or of those of lanthanum and didymium alone, is effected as follows: The materials are finely pulverized, and mixed in the above-indicated proportions, and then made into a dough or paste by a cementitious material—say, liquid glue. The dough or paste is forced out from a press cylinder in threads, which are afterwards woven into a net; and from this tapering cap-like bodies are made, which, by suitable holders, are fixed over the flame of a gas-burner. By adding glycerine to the dough or paste, it is kept elastic after it is pressed out to shape, and will not readily become hard and brittle.

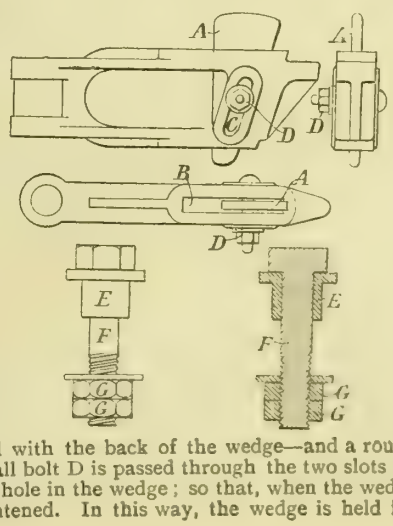
The net-like structure made as above is next dried, and then burnt to remove the glue or other cement; and this makes the thread-like material hard and rigid. To burn the cap, it is put on a mould corresponding to the shape required, consisting of platinum wire, or other fireproof material—say, porcelain, clay, or fire-clay; and the cap and mould are heated to such a degree as to entirely remove the lime or the like. The material of the article is then hard and firm, and can be handled for fixing on the burner without falling to pieces.

Atmospheric Gas-Burners.—Newton, H. E.; a communication from R. N. Oakman, of Greenfield, Mass. No. 21,348; Nov. 6, 1894.

This invention relates to "an improved burner-device for illuminating gas, natural gas, or combustible gas, which device is particularly adapted to be placed in the fire-boxes of stoves, hot-air furnaces, steam-heating furnaces, and boilers." The object is to provide for simultaneously controlling the supply of gas and the primary supply of air to the mixing tube and chamber, and also to control the secondary supply of air to the burner-nozzles, by means of a gas-valve and a sleeve and damper for the air supply. The gas-supply valve, and the air-inlet ports, are simultaneously controlled by one lever, and by a single movement thereof, whereby complete combustion of the gas is always ensured, and, at the same time, lighting-back is prevented. The secondary air supply to the burner-nozzles is also controlled by the same lever handle and connecting-rod. Perfect control is thus had of the gas supply, the primary air supply for mixing with the gas, and the secondary air supply for causing complete combustion at the burner-nozzles.

Adjustable Catch and Cross-Bar Attachment for Retort Mouthpieces.—Braidwood, J. F., of Greenwich. No. 22,850; Nov. 26, 1894.

This adjustable catch for the cross-bar of retort mouthpieces is somewhat similar in shape to those now in use, but is capable of adjustment by means of a wedge A, passing through two slots B, in the end of the catch, in a vertical position, by means of which the adjustment is effected. There is also a slot C on either side of the



catch—parallel with the back of the wedge—and a round hole in the wedge. A small bolt D is passed through the two slots in the cheeks and the round hole in the wedge; so that, when the wedge is adjusted, the bolt is tightened. In this way, the wedge is held in the position

required; thereby ensuring perfect adjustment of the lid, and enabling the eccentric lever to tighten in any desired position.

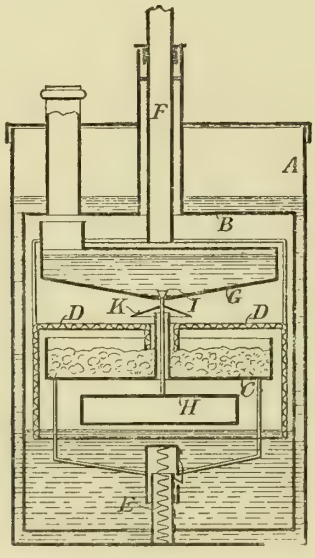
The usual method of adjusting the distance of the cross-bar from the lid, says the patentee, is by means of an eccentric bolt, which is first turned on two different centres; the nut end being $\frac{7}{8}$ inch diameter, while the upper half of the bolt is $1\frac{3}{8}$ inches diameter. Throughout the bolt on one side there is a straight line; the whole of the projection in the centre being on the opposite side—thus forming an eccentric. The bolt is passed through a hole in the bracket on the lid; while the small end is passed through the cross-bar underneath the bracket. By turning the bolt by its head, the eccentric portion affects the cross-bar, and removes it to or from the lid. In place of the eccentric bolt, however, a metal bush E with a flange on the upper side is inserted in the bracket on the back of the retort-lid, with a hole in the centre, $\frac{3}{4}$ inch in diameter, through which and the cross-bar a bolt F is inserted, and secured in position by two lock-nuts G.

Preventing the Freezing of Water-Supply Pipes.—Curtis, H. P., of Oadby. No. 5931; March 21, 1895.

This invention is designed with the object of effecting such improvements in the construction of water-supply pipes as will prevent the freezing of the water therein during frosty weather. The essential feature of the invention consists in surrounding the pipes with a stationary volume of air, which may be effected by enclosing the service-pipes in one or more outer or casing pipes of larger diameter, and then subsequently soldering (or otherwise securely stopping up) the ends or joints of the pipes, so that the air is imprisoned between the service-pipes and the outer or casing pipes.

Acetylene Gas-Lamp.—Rossbach-Rousset, F., of Tempelhof, near Berlin. No. 11,783; June 17, 1895.

This invention relates to a gas-lamp in which acetylene is obtained by the decomposition of carbide of calcium in such a manner that "the water required in the decomposition is (proportionately to the quantity of gas burnt at the burner, or to the pressure of the same) drawn through wicks and supplied direct from a water container past a valve operated by a float, or is conducted to the carbide of calcium by one of these means."



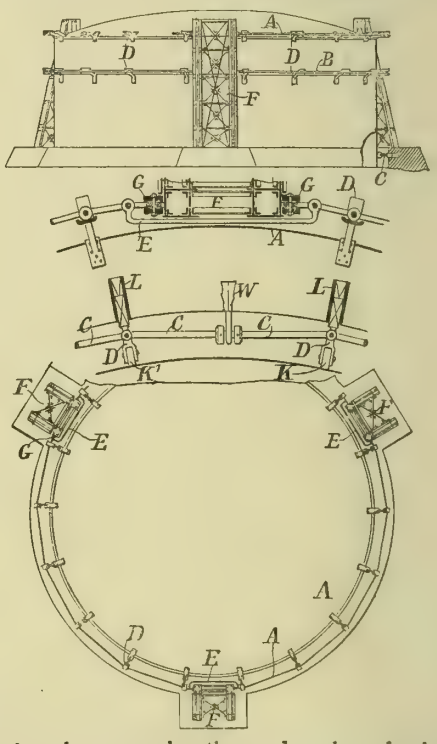
A is an outer casing; B, a pressure casing; C, a carbide of calcium container; D, a wick or wicks; E, a spring with a catch or pawl; F, the pipe leading to the burner; G, a water container; and H, a float, with a valve I. The container in which carbide of calcium is placed is normally pressed upwards by the spring E, and moves downwards against the resistance of the spring according as the volume of the decomposed carbide of calcium increases. Its upward movement is limited by a spring catch taking against one of several projections on a tubular part which encloses the spring, but disengageable when desired.

The water for the decomposition of the carbide of calcium is drawn partly from the water in the lower part of the casings through the wicks D, and distributed in fine particles over the carbide of calcium, and partly supplied direct from the water container G past the valve I, which is operated by the float H. The water first falls upon the guide-cone K, and then spreads out on to the wick. Upon the commencement of the evolution of the gas, the float lifted by the water will open the valve I, and water will flow past this to the carbide of calcium through the wicks in the form of fine particles. When the requisite gas pressure is attained, the float falls, lowers the level of the water, and the valve closes. The further supply of water then takes place through the wicks; so that the supply of water to the carbide of calcium is regulated automatically by the pressure of the gas.

Guide-Framing for Gasholders.—Hacker, H., of Berlin. No. 11,981; June 20, 1895.

This invention has for its object to overcome certain "defects" in the construction of gasholder guide-framing as known at the present day.

In his specification, the patentee remarks: Guide frames of gasholders at present generally consist—except in cases where the latter are surrounded by walls—of vertical pillars or standards erected around the holders. As these pillars are very expensive, they have sometimes been replaced by ropes and chains, passed over rollers, and arranged so as to surround the holder in both a vertical and a horizontal plane. In some cases, ropes and chains have been used inside the holder; such ropes and chains being connected to a ring guided in its up-and-down movements by an internal pillar or hollow column. Guide-framings such as these have the following defects: (1) They are accessible only with considerable difficulty for inspection and repairs. (2) As the whole strain due to wind pressure, or weight of snow, is liable to be thrown on one part of the structure, it necessitates the whole being very strongly built, and so that any one part will be capable of resisting (when necessary) the whole strain. Such construction is both laborious and expensive. The ordinary guide-framing erected above the water-tank, and consisting of a large number of columns connected together by rings and tie-bars, has also the defect that, owing to expansion and contraction, due to changes of temperature, the guide-rollers are not always in contact with the sides of the bell. Moreover, in the case of very large holders, they are apt to alter their shape slightly under changes of temperature; and they also have a tendency to assume a slant position, owing to accumulations of snow, or pressure of wind on one side, or to friction in the guides. Experience teaches that, even when the guide-rollers are accurately adjusted at first, they have to be subsequently loosened, in order to prevent any possibility of the holder, when raised, remaining suspended, and to avoid too great frictional stress, during the up-and-down movements of the holder. As a consequence, it usually happens that only two or three of the guide-rollers transmit the pressure to the columns. This is very dangerous, as the roof of the holder, when the latter is swayed about by shifting winds, exerts a powerful thrust, which requires to be received by the various parts of the columns, since the roof, on account of its stiffening, cannot descend within the fixed columns. Therefore, to prevent any possibility of accident, all the columns have to be made very strong, as the wind pressure may be exerted in any direction.



The engraving shows an elevation and a plan of a holder having three stays or supports; also detail views drawn to an enlarged scale.

The holder is surrounded by the rings A B C, consisting of ropes, chains, rods, or the like. The rings A and B are carried by brackets D secured to the holder. These rings are provided with coupling-straps E, which pass along inside of, and partly round, the standards F, in such manner as to be capable of moving in a vertical direction only. When the holder is moved laterally by wind pressure, the rings at the side opposed to the wind are placed in tension. Consequently, they bear against all the brackets at that side, so that contact between the holder and the rings is effected at a great many points.

The rings are carried in the ends of the brackets D, so that the latter are only subjected to horizontal strains in a radial direction, and receive (apart from unavoidable frictional strains) no other horizontal strains. Moreover, between each pair of standards F, all the brackets exert the same pressure on the holder, except in those cases where frictional strains may make a slight difference. The rings thus transmit the pressure exerted by the holder to the front sides of the standards F, where tangential rollers G or bronze-plates are interposed, for the purpose of reducing friction. Therefore a holder with three standards only requires six rollers or bronze plates, instead of, as in other cases, 18 or more.

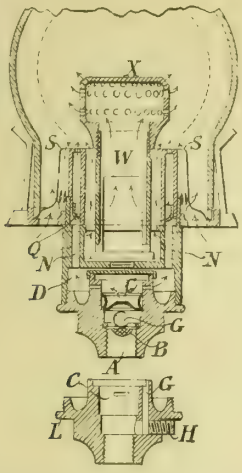
Between the front or inner sides for the standards and the parts E of the rings, there is sufficient space left to prevent contact between them ever taking place. The standards are therefore only acted upon in one direction—that is, if the friction of the rollers is left out of consideration; and as the rollers are at both sides, a state of equilibrium is produced, in consequence of which these standards need not be made so strong as similar guide-frames. It is also unnecessary to have so many of them as usual.

Instead of the standards F, iron columns can be used for small holders, and be fixed at their lower ends or be stayed by ropes or wires, in the same manner as high iron chimney-stalks. Rings E^1 are so fitted on the columns as to be capable of sliding up and down; and to these rings (which replace the friction plates) the large rings A and B are fixed. Instead of such rings, a rope can be used, passed right round the holder, and fixed to it in such a manner as to be raised and lowered therewith. The rings are connected by rope ends, or the like, to the rope passed round the holder.

The lower guide-ring C is arranged just above or below the water-level in the tank, so that either no water at all, or a very little, need be allowed to escape in order to get at it. The ring C differs from the rings A and B, inasmuch as it is not raised along with the holder lifts, but maintains its position, while the lower lift (should there be one) passes through it. Such a ring is shown formed of chains, ropes, or rods held in place by bars and brackets D, secured in the wall of the water-tank. The bars, which are fitted securely in the wall at intervals, perform the same function as the standards F. The brackets, which have rectangular shanks, and carry on their ends bearing-rollers K, are capable of sliding in and out of rectangular guide sockets or liners L fitted in the wall. The rectangular shape of the liners and shanks prevents the brackets having any movement other than a radial and horizontal one. With this arrangement, should the holders move sideways, that part of the ring C which faces the wind is subject to tension, so that all its rollers K bear against the holder.

Gas-Heating Burners.—Goodson, J., of Vauxhall Bridge Road, S.W. No. 13,879; July 20, 1895.

This invention relates to burners of the Argand type—specially applicable for heating purposes. It has for its principal object to "so regulate and distribute the gas and air supply as to produce perfect combustion of the gas, and consists essentially in supplying the air necessary to support combustion centrally and externally in a particular manner, and in automatically regulating the gas supply to suit varying pressures."



The gas enters at A, and passes through a gauze disc B into a governor-valve chamber C, closed by a cap, and in which works a valve having a perforation for the passage of the gas to the chamber. A side passage or bye-pass G, whose cross area is regulated by a screw H, also conducts gas to the chamber C, from whence it escapes to the burner. The central portion of the valve is cut away, so that the top and bottom portions only come in contact with the surface of the chamber C, in order to reduce frictional resistance. To a flange on L is screwed an intermediate piece, having two passages N, which convey the gas to an annular space O at the base of the steatite portion of the burner. At the lower portion of the burner, a perforated metal ring Q is placed, which acts as a distributor, and causes the gas to flow evenly through the burner before it issues at the points of ignition. Around the upper portion B is attached a gallery, having at its lower side a series of holes for supplying air to the outer portion of the flame. Attached to the gallery, and concentric with the burner, is secured a deflector S, having a series of holes near its base. In the central part of the burner is secured a tube W, having portions cut away to enable air to be supplied to a head X screwed on to the top, and having a series of perforations around it for distributing the air. The gallery also has attachments for holding a chimney in position.

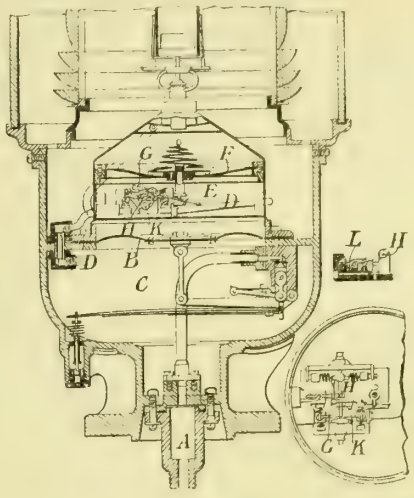
The action of the burner is as follows: The gas supply, on entering the burner, first flows through the gauze disc B, then a portion passes through the central orifice in the governor-valve, and operates it in the usual manner. Another portion flows through the passage G, which acts as a bye-pass; the amount passing this way being regulated by the screw H, so that the burner can be set to consume a certain amount of gas in a given time. The gas which flows from the chamber C into the annular space D now enters the passages N, and passes through the distributor Q and steatite portion of the burner, and is ignited at the orifices. A current of air is thus induced through the several openings (as shown by arrows), and "causes the gas-flame to be highly charged with oxygen, and so produce an intense heat." This, says the patentee, can "be utilized for many purposes, and especially for heating living-rooms where syphon or other gas-stoves are used, as, owing to the perfect combustion of the gas, no smoke or smell is produced."

Intermittent Gas-Lights.—Rickman, W. B.; a communication from R. & O. Pintsch, of Berlin. No. 14,115; July 24, 1895.

This invention relates to apparatus employed on buoys, beacons, and elsewhere, for giving intermittent or flashing lights; the gas which supplies the flame being freely admitted to the burner for a time, and then for a time nearly stopped, and so on alternately.

The drawings show a vertical section of the automatic intermitting apparatus, a plan of the valve-gear, and a part section of the graduating valve.

The gas entering at A passes a regulating-valve, and into a chamber C covered by the flexible diaphragm B, to which is connected the lever of the regulating-valve, acted on by an adjustable spring. According as the diaphragm is raised or lowered by the pressure in the chamber C, the valve closes or opens more or less the gas-inlet, so as to maintain the pressure constant (or nearly so) in the chamber. From C, the gas passes by a pipe D to an opening furnished with a valve which, when open, admits gas into an upper chamber E. This valve is on the one arm of a lever K, the other arm of which carries a valve covering the opening to a pipe which leads to the burner. When one is open, the other is shut; and conversely. The chamber E is covered by a flexible diaphragm F, pressed down by a spring. To this diaphragm is attached a vertically sliding stem, having a pair of collars, with a pair of sharp-edged studs, between which is engaged one arm of a lever. The other arm G is made as a fork, engaging somewhat freely between its prongs a stud projecting from an arm of a rocking-shaft H, which has springs bearing against its arms. On H, there is a pair of arms with adjustable screws, between which is engaged a stud projecting from the lever K.

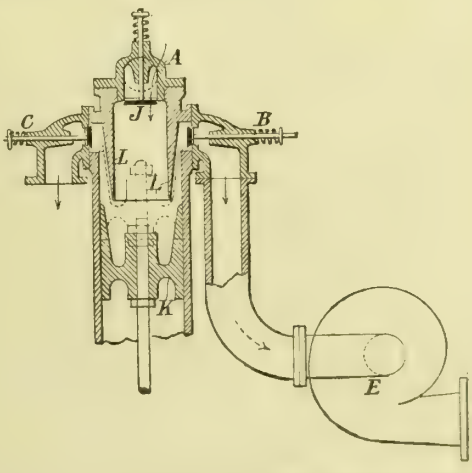


Assuming this lever to be in the position shown, gas entering the chamber E by the open valve causes the diaphragm F to rise, and raises with it the stem and the studs. By this action, the lever G is moved, and also the rocking-shaft H; its arms compressing the springs until they pass their horizontal position. They then cause the shaft to make a sudden movement—such that one of the screws is rapidly withdrawn from, and the other is rapidly brought against, the stud on the lever K, so as to cause one valve to close and the other to open. As the gas passes to the burner, the diaphragm F descends—producing a reverse action of the valve-gear; and this action is automatically repeated as long as gas is supplied, the flame burning brightly when E is open, and being all but extinguished when E is closed.

As so far described, the valve mechanism is known, and has only been detailed in order to make clear the improvements which form the subject of the present invention. In the first place, each of the valves is mounted between a pair of side springs, which, on passing the point of maximum compression, cause the valves to close and open suddenly. It has been found, however, that the sudden opening of one valve causes an increase of flame so rapid that sufficient air could not at once reach the burning gas—the combustion being so imperfect that the lamp glass soon became blackened. In order to provide against this, a small coned valve is held down by a spring closing a passage L leading to the burner. On the rocking-shaft H is fixed a stud which, as the shaft turns slowly through the first portion of its stroke, before it receives the sudden movement due to the springs, moves a pair of levers, so as to slowly lift the valve, and allow a gradual supply of gas to the burner before the valve opens to give its rapid supply. The flame thus has a gradual increase—"permitting access of sufficient air to effect complete combustion."

Gas-Engine.—Dürr, F., of Berlin. No. 14,385; July 29, 1895.

This invention relates to a gas-engine in which the ways to be taken by the combustible and the products of combustion, and the valves, are arranged in such a manner that the engine makes a complete cycle in two strokes of the power piston.



The power piston K is shown in one of its extreme positions or dead-centres—after it has completed the outstroke. The dotted lines show the other extreme position of the piston—after it has completed the in or return stroke. At the beginning of the return stroke (preferably during the first quarter), the gas-valve A, and the discharge-valve B, are opened simultaneously. The valve A is actuated by any suitable automatic valve-gear, and serves to admit the combustible gas

mixture; while the valve B communicates with any suitable suction apparatus E, operated automatically by the engine. The combustible gases drawn into the engine enter first the chamber J, and drive the waste gases or products of combustion resulting from the previous working period to the valve B, from which they are rapidly drawn off by the suction apparatus E. The bottom of the working cylinder has a cylindrical inward projection J, which extends into the cylinder, and forms between the inlet and outlet a guide, partition, or shield adapted to prolong the way of the combustible mixture. The valves A B close again, after having remained open during about a quarter of the stroke of the power piston.

The combustible mixture, which then remains in the cylinder, and cannot escape, is compressed during the remainder of the piston stroke; and when the latter has been completed (the piston being in the position indicated by the dotted lines), it is ignited by any suitable mechanism, so that the work of expansion begins when the piston commences the following outstroke. As soon as the piston again approaches its outermost position, so that it leaves only about one-quarter of the stroke to be completed, the automatic valve-gear opens the valve C, so as to relieve the pressure in the cylinder, and closes again at the end of the piston stroke. When this has taken place, the processes of charging, compressing, and expanding are repeated.

APPLICATIONS FOR LETTERS PATENT.

17,382.—Gibb, D. M'C., "Gas cooking-stoves." Sept. 18.

17,385.—Brookes, W. H., "Gas and other similar globe holders." Sept. 18.

17,472.—Lyon, J. H., "Apparatus used in connection with the manufacture of gas, and commonly known as the hydraulic main." Sept. 19.

17,533.—Gardner, H., "Supporting or holding incandescent gas lighting filaments." A communication from the *Société Française de l'Héliogène.* Sept. 19.

17,670.—Cayrol, J., "Gas-burners." Sept. 21.

11,848a.—Lake, H. H., "Apparatus for mingling gas or air and acetylene gas or other enriching gas for illuminating purposes." A communication from E. N. Dickerson. Sept. 23.

17,728.—Schroeder, A., and Wehner, J., "Liquid-meters." Sept. 23.

17,742.—Cutler, S., "Safety fittings for water-gas generators." Sept. 23.

17,746.—Gabe, H., "Decomposing calcium carbide." Sept. 23.

17,795.—Voelker, W. L., "Incandescent gas-lamps." Sept. 24.

17,848.—Sexton, M., "Pipe-joints." Sept. 24.

17,849.—Tobler, A. C., "Gas-regulators." Sept. 24.

17,850.—Greenall, J., and Heaton, T. T., "Meters for fluids." Sept. 24.

17,878.—Lister, F., "Road or other vehicles propelled by gas, steam, electric, or like motor mechanism." Sept. 25.

17,927.—Thompson, W. P., "Bunsen burners, incandescent burners, and the like." A communication from A. Bandsept. Sept. 25.

17,973.—Ramsbottom, R., and Rofe, H. J., "Cartridge for illuminating purposes." Sept. 26.

17,974.—Sternberg, F., "Lamps." Sept. 26.

17,977.—Morton, J., "Manufacturing tapered gas-retorts." Sept. 26.

17,997.—Holliday, T., "Gas-burners." Sept. 26.

18,012.—Kent, H. A., "Self-lighting gas-burners." Sept. 26.

18,018.—Croizat, V., "Incandescence, electric, and gas lamps and lanterns." Sept. 26.

18,025.—Bagshawe, B., Worth, F. G., and Fox, S., "Generators for the production of acetylene gas." Sept. 26.

18,041.—Schneider, H., "Generation of acetylene gas." Sept. 26.

18,060.—Bickerton, H. N., "Gas-engines." Sept. 27.

18,076.—Illingworth, C. R., and Arthur, D., "Recovery of ammonia from sewage and other ammoniacal liquors." Sept. 27.

18,090.—Hill, J. K., "Fluid meters and turbines." Sept. 27.

18,188.—Mayer, E. L., "Detecting and indicating the pressure of fire-damp or other noxious gas or gases in the atmosphere of mines and other places." Sept. 28.

The Price of Gas at Sowerby Bridge.—A proposal was made by Mr. J. Greenwood, at last Wednesday's meeting of the Sowerby Bridge District Council, that all resolutions respecting the price charged for gas, except those relating to Luddenden Foot, Mill Bank, and Brearley, be rescinded, and that the price be reduced, from October 1, as follows: Mills at Triangle and beyond, 2d. per 1000 cubic feet; to all other consumers inside and outside the district, 3d. Mr. Greenwood said the price now charged in Sowerby Bridge was 2s. 6d., and at the mills at Triangle 3s. 2d. The present consumption of gas was, inside the district, 60 million feet, and outside the district, 17 million feet. The consumption of the mills at Triangle, &c., was 8 million feet. Should these figures be maintained, the result of making the reductions he proposed would be a loss of revenue amounting, roughly speaking, to £1100. The gas profits last year were £3346, including a balance of £500 brought forward from the previous year. Deducting £1741 paid to the sinking fund, this left them with a net profit of £1605. He, however, estimated that this year they would effect a saving of £300 in the price paid for coal. Then there would be a reduction of £125 in interest; and he calculated that they would have an increased consumption of gas amounting to 4 million feet, the profit on which would be £100. He was willing to admit that they would probably have losses on other heads; and he thought he was making a liberal estimate in allowing £588—viz., £243 for reduction in receipts from coke, and £345 on the income from sulphate of ammonia. These figures showed that, even after the price of gas had been reduced as he proposed, they would still have a profit from the undertaking of about £412; and he held that it was their duty to sell gas at as near cost price as they possibly could. Mr. Wood admitted that the profits last year were as stated by Mr. Greenwood; but he found that, for the past five years, the average profits, after paying the amount due to the sinking fund, had only been £456. It was generally thought it would not be wise to reduce the price at present; and the motion was rejected.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Question of Gas Finance.

Sir,—The exceedingly important question raised in the first of your "Editorial Notes" on the 10th and the 24th ult. deserves the most careful consideration by the directors and managers of gas companies who wish to keep their place in the race, and to hold their own against all competitors. The last sentence—"This is, in a nutshell, the case for making all gas capital redeemable"—is startling, if it means that the redemption or extinction of *all* gas capital is contemplated; for that would mean the extinction of the companies themselves, and would leave the property without an owner, and with no one interested in its prosperity except the consumers. In short, the Collectivism of the Socialists, so far as the gas companies are concerned, would be an accomplished fact. I do not for a moment suppose this is your desire. I believe you are utterly opposed to Socialism, of which Herbert Spencer stated quite recently his "belief to be that the advent of Socialism will be the greatest disaster the world has ever known, and that it will end in military despotism." I believe Socialism to be impracticable, impossible; though the propagation of the idea has done, and may do very much more, mischief. I therefore protest against any tendency in that direction.

"All gas capital" can only be redeemed by the authority of Parliament; and that authority will never be given to the companies. The shareholders would have to be compelled to accept cash for their shares or stock; and it would be necessary to make the consumers find the money, for the only source from which it could be obtained would be by an excessive charge for gas. The premiums on the issue of new stock could never do it, because these are only obtainable by the issue of new and additional stock or shares. You cannot reduce and increase at the same time. But if redemption were possible, it would be neither desirable nor just. If gas consumers are to be supplied at less than cost price, which equally includes cost of manufacture and interest on capital, it must be at the expense of others—either the providers of the capital or those who have redeemed it. Such an unjust system, like injustice of all kinds, cannot be desirable; and it is doubtful whether it would be beneficial to the consumers themselves, because the motive of self-interest, which now prompts gas directors and managers to do their best for the consumers, would be entirely absent. Redemption, therefore, or even (what is the same in kind) any absolute reduction of capital, being out of the question, there remains the possibility of a relative reduction or its practical equivalent—a reduction in the amount required to pay interest on capital per 1000 cubic feet of gas sold. This being one of the most important questions gas directors have to face, I will now show what has been done, and what may be done, in this direction.

The capital charges of gas companies consist only of interest on loans or debenture stock and dividend on capital. The charges of corporations are for interest on loans, sinking or redemption fund, and appropriations in aid of rates—the last in England, but not in Scotland, where gas undertakings are not worked for the benefit of the ratepayers at the expense of the consumers. In 1884 and 1894, according to "Field," the average charges per 1000 cubic feet sold were as follows:—

	1884. Pence.		1894. Pence.
Metropolitan companies	15·17	..	13·00
Suburban "	14·79	..	12·03
Provincial "	10·49	..	9·32
Corporations	11·55	..	9·19

The average reduction in the case of the companies in the ten years is, as near as may be, 2d. per 1000 cubic feet; while that of the corporations is a trifle more. Averages, however, must only be taken for what they are worth; and in this instance they do not show what can be done. Those companies that were lowest in 1884 have not, of course, as a rule, decreased their charges at the same rate as those which were highest. One of the Suburban companies which was very high has come down nearly 7d., but in this case the business has increased 100 per cent; while the company which was lowest has only come down 1d., and its business increased but 50 per cent. There is, however, one Suburban company (the Wandsworth) whose charges in 1884 amounted to only 11·42d. per 1000, which has come down to 8·34d. in 1894. But here, again, the business has doubled in the ten years. This general progress is satisfactory. One cannot but feel, however, that, if special attention had been given to the question, it might have been considerably greater; and let us hope that it will be greater in the next decennial period.

There are three legitimate ways in which this relative reduction of capital, or of interest upon capital, can be effected. Starting with the axiom that capital ought to be represented by value in the shape of works, plant, and cash in hand for working capital, it follows that where this is not the case—and it is nearly everywhere—the capital ought to be reduced until the amount per ton or per 1000 feet sold is represented by assets. This can, and may fairly be done by gradually making extensions, and renewing obsolete with more efficient plant out of revenue until the balance is restored. The question naturally arises: What is a fair proportion of capital, or at what cost per ton of coal, or per 1000 feet sold, could a given company be now started? £5 per ton has for a long time been the figure in men's minds; and, as an average, it is perhaps not very wide of the mark. But since this figure was first used—and it was referred to as a standard, to my knowledge, quite thirty years ago—great changes have taken place. On the one hand, apparatus has been improved, and some parts, such as gas-holders, greatly cheapened; and certain materials—especially iron—are lower in price. On the other hand, more elaborate and more costly apparatus is required, such as labour-saving machinery, which, with cooking-stoves and the supply of weekly tenants on the automatic system, has created a new and additional demand for capital. I do not think that companies of first-class magnitude could be started now, and completely equipped, at much less than £4 per ton—say, between £3 10s. and £4; while for medium-sized concerns, between £4 and £5,

according to circumstances, would be necessary, and small undertakings again would require (say) something between £5 and £6 per ton of coal used in the year. It would be quite safe, at any rate, to take these figures as points to which to work down, partly on the plan above mentioned, and partly by using the utmost economy in laying out capital on additional works. If the growth of business is met by a capital expenditure of £2 10s. or £3 a ton on the increase, there will, in a few years, be a perceptible relative reduction of capital, dependent, of course, on the rate of increase.

The other, and perhaps the most effective, plan for reducing the charges for interest is not by way of a relative reduction of capital, but by raising all new stock at the lowest possible rate. With one or two exceptions, where it has already been done, gas companies have a grand opportunity in this direction. The amount of capital raised in the form of debenture stock is much less than they can well carry. Therefore they should not issue any more ordinary stock until they have raised debenture stock equal in amount to not less than one-third of their total paid-up ordinary capital. The rate at which such stock can now be raised is about 3 per cent., which, in a fairly increasing business, will soon pull down the average interest on the capital, and thus materially reduce the charge per 1000 cubic feet sold. In one case, this operation alone has brought down the average charge for interest and dividend about 3 per cent., with about another 1 per cent. by premiums on the sale of ordinary stock.

When these possibilities are considered, and one thinks of what might have been done, and is even now possible, the question arises what is the real use of directors; for, with few exceptions, they seldom give attention to these points. They cannot be expected to know much about gas management, but are generally fortunate in being served by capable officers. They, however, should know something about finance. They are well paid. The fact is, gas profits come too easily. There is not sufficient stimulus to cause directors to give anxious thought and earnest effort to the business, to make them give attention, among other very important questions, to this vital one of finance, and its bearing on the price of gas. It is now thirteen years since Parliament first sanctioned the issue of debenture stock equal to one-third of the total paid-up ordinary capital; provision being made that debenture stock only should be raised until these proportions were attained. But how little has this important precedent been followed. It has been repeatedly urged upon gas companies; but they have usually regarded the suggestion with absolute indifference—evidently not seeing either its necessity or its value.

Gas companies cannot be considered to be in a perfectly sound condition until their capitals are represented by actual value, nor until the charge per 1000 feet for interest is brought down to a reasonable figure, which will be found to be much below the amount now required in nearly all cases. Probably from 5d. to 8d. per 1000 feet might be regarded as reasonable, and to be worked for; and then they need have little fear of comparison with municipal gas undertakings. This will give most gas companies an object for some time to come.

In your "Editorial Note" in the JOURNAL for Sept. 24, you say "that the London gas consumer has still to pay for every penny of gas capital raised in the dawn of the industry, and to a very large extent unrepresented by assets." In the days—more than thirty-five years ago—when competition existed, and dividends were not so large or so secure as they have been since, the companies were very sparing in the issue of new capital, with the result that in the twenty years from 1840 to 1860 the capital lost in the early days was very largely redeemed. The capital per ton of coal of the South Metropolitan Company was reduced from £18 in 1840 to £5 in 1860; and in the latter year the Chartered Company's capital was only £5 per ton. The mischief from which gas companies now suffer was mainly done in those so-called prosperous years—but which, in another sense, were most unfortunate for the industry—from 1860 to 1875, when full dividends on any amount of capital were practically guaranteed, and there was every inducement to encourage, with nothing to check, the propensity to issue additional capital. The figures I have given, showing the reduction in the charge for interest during the last ten years, prove that some progress has been made; and now that you have drawn attention to the question, it will be the fault of directors if it is allowed to drop.

Whether it is right that consumers under local authorities should be called upon to redeem capital for the benefit of the next generation, is a question that it would be useless to discuss. I do not think any municipal trading is advisable or justifiable; and certainly it is just that the consumers of any article should pay such a price as will cover not only the cost of manufacture, but also the equally fair charge for interest on the capital required to carry on the business.

Reigate, Oct. 2, 1895. GEORGE LIVESEY.

The Oil-Gas Experiments at Bradford.

SIR,—We regret that Mr. Lewis T. Wright's letter of Sept. 14, which we saw for the first time on the 28th ult., and certain conclusions which have been drawn therefrom, compel us to state the actual facts of this unfortunate controversy.

On March 28 last we reported to the Gas Committee upon a 33 days' continuous working of the Dvorkovitz process, and, as the result of that trial, gave the cost of enrichment as 0·42d. per candle-thousand.

We purposely used the expression "candle-thousand" as being the simplest, and as the one which Mr. Herring adopted in his paper of May, 1894. This value of a "candle-thousand" has, to our knowledge, only been applied to "the quantity of enrichment required to raise the illuminating power of 1000 cubic feet of gas by one candle." The Gas Committee were familiar with Mr. Herring's paper and with the value of a "candle-thousand."

In a communication sent on April 4 to a private member of the Gas Committee, Mr. L. T. Wright stated that the result "0·42d. per candle-thousand" was "incorrect," and that the correct cost was "*five times as much.*" This serious blunder, so persistently adhered to by Mr. Wright (as also by Mr. Frank Wright), and now as persistently evaded by him, has been the cause of all this unpleasant dispute.

We at first thought that this error of Mr. Wright's arose from his unfamiliarity with the use of the term "candle-thousand;" and we expected that, when he found out his mistake and the confusion it had caused, he would be anxious to at once correct it. Unhappily, however, Mr. Wright declined to discuss the question with us; stating, in a letter dated April 13, that "if the Committee thought the cost per candle-thousand was brought out fives times too low, there was no misinterpretation to correct."

Mr. Wright attempts to obscure the mistake he made by comparisons with our use of the term "foot-candles" in a former report. We have for many years invariably used the term "foot-candles" to represent cubic feet multiplied by illuminating power. We have all along admitted that the value

$$\frac{\text{cubic feet} \times \text{illuminating power}}{5}$$

has generally been called "foot-candles," or "candles," instead of by the correct name of "candle-hours." This customary use of the term "foot-candles" we maintain is technically wrong; but this question shall be dealt with on some other occasion.

Mr. Wright complains that our opinions on the cost of cannel enrichment vary from time to time; but so do the prices of cannels and of their residuals. Mr. Wright's calculations of the cost of cannel enrichment in Bradford in recent years are very amusing. Taking the illuminating power of the gas at the four Bradford works from 1890 to 1893, and the illuminating power of the coal gas made at the Thornton Road works during the abnormally severe weather of February, 1895, Mr. Wright calculates (?) the enriching value of the cannel purchased by the Corporation two months ago. Mr. Wright was furnished with full particulars of the coals used in Bradford; and he, having "special knowledge on the subject of coals and cannels," must surely be aware that many of these Yorkshire coals, being of the very best quality, yield 17 to 18 candle gas, instead of 15½ candle as he assumes. It is therefore clear that all his calculations and deductions upon this assumption are utterly worthless.

Mr. Wright thinks 0·84d. per gallon a fair price for 10-oz. ammoniacal liquor. We think that most gas managers would be glad to obtain this price at the present time, when liquor is quoted at less than half this price. The figures from which Mr. Wright has calculated his value of liquor represent the profits of our chemical works for the year 1892-3, and include profits on the manufacture of acid and other products. Mr. Wright also forgets that some of the coke from the cannel at 13s. 3½d. is practically unsaleable. Mr. Wright appears to think that estimates of cannel enrichment, once made, should hold for ever; and he combines cannel prices of one year with calculated enriching values of another, and with calculated values of bye-products of a third year, in a most delightfully original manner. We prefer to modify our estimates according to the actual values at the time.

The concluding paragraphs of Mr. Wright's letter are based upon two more "fallacies." First, "that our letter of Sept. 3 deals with a case of the enrichment of 18¾ to 23 candle gas." This, however, is not so. It deals with the enrichment of 15¾-candle gas to 18¾ candles, in precisely the same way that Mr. Wright calculates the enrichment by oil gas in his report. We took the increase in bulk of 18¾-candle gas, due to the addition of cannel gas, at 14·44d. per 1000 cubic feet, because Mr. Wright in his report valued the increase in bulk of 17·73-candle oil gas at 13·66d. per 1000 cubic feet. In the second place, Mr. Wright's remarks are based upon the "belief in an impossibility"—namely, that the whole of the 23 candles in a 23-candle gas can be utilized for enriching 15¾-candle gas. Mr. Wright has forgotten that, if the mixture is to be of 18¾-candle power, the cannel gas forming part of this mixture must also be 18¾-candle power. Therefore, only 4¼ candles (= 23 − 18¾) are available for enriching the 15¾-candle coal gas. If all the 23 candles of the cannel gas could be taken for enrichment, then this gas would have absolutely no illuminating power left.

In conclusion, we must express our sincere regret that Mr. Wright should have shown such a lack of professional courtesy as to refuse to discuss the matter with us in a friendly spirit, while writing privately to a member of the Gas Committee to discredit our report and statements. Had he agreed to our request in the first instance, most of the succeeding unpleasantness would have been avoided.

Gas Office, Bradford, Oct. 2, 1895. WM. WOOD. CHAS. WOOD.

SIR,—Were it not for Dr. Dvorkovitz's offensive references to myself in connection with his oil-gas process under trial at Bradford, and my report upon the misuse of figures regarding same, I would not have troubled to reply to his letter in your issue of Sept. 24, nor you to insert the same in your columns.

It is true that, about the commencement of April, I was consulted by the Chairman and members of the Gas and Electricity Committee of the Corporation of Bradford to advise them upon the calculations used in regard to the Dvorkovitz oil-gas process; and in justification to them, as well as myself, I must say that the matter was put to me in a thoroughly unprejudiced manner, without mention of names, or the production of any documents. I was simply asked to adjudicate between the calculations put forward by a certain person A in contradistinction to those of another, B.

In order not to extend this letter to undue length, I will give the problem as it was submitted to me—

There is a difference of opinion existing here between A and B, as to the proper way to calculate the cost of enrichment. I append the calculations as worked out by each of them. Would you kindly oblige by looking over the same, and mark in red ink which is correct, and so help us out of our difficulty. If both are wrong, would it be too much to ask for you to correct us?

The problem is:

400 gallons of oil, labour, &c., cost £8 3s. 4d.

400 gallons produce 27,200 cubic feet of gas of 105-candle power, and 160 gallons of bye-products.

160 gallons of bye-products being equal to 35,000 cubic feet of gas, what is the cost per 1000 foot-candles of enrichment?

A's Calculation.

35000 c. ft. of gas.
160 gallons.

2100000
35000

5600000

27200 c. ft. of gas.
105 c. p.

136000
272000

*2856000 foot-candles.
5600000

8456000 total.

27,200 × 105 . . . . . = 2,856,000
160 gallons of bye-products × 35,000 . = 5,600,000

8,456,000 foot-candles.

Cost $\frac{£8\ 3s.\ 4d.}{8456}$ = 0·25d. per 1000 foot-candles of enrichment.

B's Calculation.

35000 c. ft. of gas.
160 gallons.

2100000
35000

5)5600000

1120000 foot-candles.

27200 c. ft. of gas.
105 c. p.

136000
272000

5)2856000

571200 foot-candles.

27,200 × 105 ÷ 5 = 571,200
35,000 × 160 ÷ 5 = 1,120,000

1,691,200 foot-candles.

£8 3s. 4d. reduced to farthings.
20

163
12

1960
4

1691)7840(4⅝ farthings.

6764

1076

4⅝ farthings per 1000 foot-candles of enrichment.

My reply was as follows:—

Taking A's calculation, the figures I have underlined and marked* should read "one-fifths of candles per cubic feet," and not "candles per foot," or "foot-candles." I must confess to not thoroughly understanding how the 5,600,000 foot-candles added to the first product are arrived at. *It seems to me that the gallons have been indiscriminately multiplied with cubic feet without any regard to candle power; yet the* 5,600,000 *are carried to the credit.* In B's calculation, the product of 27,200 × 105 ÷ 5 = 571,200 is correct, and indicates foot-candles; but B has evidently been led into error when he multiplies the 35,000 apocryphal feet of gas by the 160 gallons.

Further I stated:

I do not wish you to think for a moment that I endorse any of the calculations for cost, as I consider the statements upon which they are based could not be supported in practical working, and more especially would say that I have never seen such barefaced misuse of figures to give value to an invention as instanced in A's calculation.

My investigations go to prove that a fairly good class of mineral oil of a specific gravity of ·885, if burned to deletion in ordinary air without leaving any bye-products in the shape of residual oils, only yields 501,760 candles per ton; and it is apparent that, if distilled into gas, one could not get more. Indeed, the Peebles process only claims 422,400; whereas, assuming the oil in this case to be somewhere about ·885 specific gravity, then we have a total weight of oil of 3717 lbs., or, 1 ton 13 cwt. 21 lbs. And working this out on the Peebles basis, one should obtain from your 420 gallons of oil 700,920 foot-candles; whereas in the second problem the figures stated claim 3,177,000.

It amuses me to think that Dr. Dvorkovitz, with his advisers, after a period of three months for digesting their figures and my comments thereon, should only now be sufficiently competent to think they see a loophole out, and to say that my statements are "entirely wrong and misleading;" although it will be remarked that he has never for a moment attempted to controvert them, but suggests the calling in of another expert for the purpose.

It should be apparent to the humblest worker in the gas industry that if 1000 cubic feet of nominal 16-candle gas cost 16d., 1000 candle-feet, or foot-candles, will cost, not 1d., but 5d.

$$\frac{1000 \times 16}{5} = 3200$$

Therefore 3200 foot-candles cost 16d., and 1000 foot-candles cost 5d.

$$\frac{1000 \times 16}{3200} = 5d.$$

The onus, therefore, is on Dr. Dvorkovitz to substantiate his figures of 8,456,000 foot-candles as the product in illuminating power of his 400 gallons of oil.

Does he still mean to say that he can supply 1000 foot-candles for 0·25d., or, in other words, supply a gas company with 16 candles' enrichment for 0·8d. per 1000 cubic feet?

FRANK WRIGHT.

Old Queen Street, S.W., Sept. 27, 1895.

[As mentioned last week, the above letter came to hand too late to appear in our issue of the 1st inst. Other letters bearing upon the subject dealt with will be found in our "Miscellaneous" columns to-day. ED. J. G. L.

* The figures referred to are marked with an asterisk in above calculation.

LEGAL INTELLIGENCE.

Conviction of a Gas Collector for Embezzlement.

At the Marylebone Police Court last Thursday, Thomas C. Lovett was charged on remand with embezzling and stealing various sums of money, amounting to £78, belonging to The Gaslight and Coke Company. The facts were given in the JOURNAL last week (p. 677). Mr. R. Humphreys again prosecuted; Mr. Muskett defended. Three cases having been gone into, Mr. Muskett said his client pleaded guilty to the charge. The prisoner's case was a very sad one. He had married a widow in poor circumstances with three children; but at that time he was in receipt of only £85 a year, and this not being sufficient to maintain them, they were obliged to enter the Spalding Union. Upon being promoted, however, to the post of collector, he brought them to London, only to find later on that he was unable, even with a salary of £150, to meet his extra expenses. It was then that he had recourse to his employers' money. When his dishonesty was discovered, he made his way into Lincolnshire, and, failing to borrow the amount he had embezzled, he sold up his house in London, and took a small place at Gosberton, where he maintained himself—his wife and her children having again entered the Union—by working in the fields as a common labourer. Mr. Curtis Bennett, having regard to the fact that the prosecutors did not wish to press the case, sentenced the prisoner to six months' hard labour.

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

The Ordinary Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. J. BLACKET GILL in the chair.

The SECRETARY (Mr. H. D. Ellis) having read the notice calling the meeting, the Directors' report and the statement of accounts, which were published in our last issue, were taken as read.

The CHAIRMAN said he did not think he need detain the proprietors at any length; for the half year had been a somewhat uneventful one—not that they were sorry for that—and the history of the Company was really before them in the report and accounts. From these, the proprietors would learn that for coal £6835 more had been spent than in the corresponding period of last year. They had received an additional £4797 for gas. This was an increase of about 7 per cent., which he thought must be regarded as very satisfactory. When he told them that their large neighbour was somewhat under this figure, he thought it spoke very well for the Commercial Company. The increase of the South Metropolitan Company was considerably more; but, as the proprietors were aware, their district was far better than the East-end. Stove and meter rentals were £318 more; and there was an increase of £1400 on tar. But residuals generally had not served them very well; for he found they had obtained £3938 less for coke, and £5344 less for sulphate of ammonia. The total receipts for residuals showed a difference of £7883 between this and the corresponding period of last year. As to sulphate of ammonia, the trade had been in an extraordinarily dull condition for some months; but those who knew something about the business, told them there was a prospect of revival. A quantity of sulphate was sent abroad—largely to Germany. It was used for the cultivation of beet-root; and he was told that the trade was not in a good condition. They were, he supposed, suffering there, as in this country, from great depression; but still the Directors hoped that this important product would command a good price in the market before long. Rates and taxes had a happy knack of increasing; and they were, on this occasion, £425 more. They had now touched something like 8s. 2d. in the pound, which was a very serious demand upon the Company; but they had to pay them, and look pleasant. The profit of the half year was £5857 less; but they were able to take £48,680 to profit and loss, which was within a very small amount (some £70 or £80) sufficient to pay the same dividend as before—viz., 13½ and 10½ per cent. respectively on the old and new stocks. Inasmuch as they were entitled to receive, under the sliding-scale, ¼ per cent. more dividend, the Directors proposed to take this ¼ per cent. from the balance of undivided profits, and add it to the reserve fund; and he was quite sure the proprietors would approve of this course. Regarding gas-stoves, they had a further 255 out in the district, making a total of 4810. As to incandescent gas lighting, it had been employed in Poplar for some time; and now certain streets in Whitechapel were to be lighted by means of the new burner. The Company did not push this system, though they were pleased to see it used in place of electricity; and he had no doubt it would be a useful handmaid to gas. Perhaps their most pleasing feature was the constant increase of prepayment meters. They had now 2118 in the district, which meant an increase of something like 548 since the last meeting. He had no doubt that some of the proprietors had seen that there had been a deputation to the Home Secretary, requesting him to appoint a Select Committee to inquire into the best method of preventing the frequent accidents which occurred through petroleum lamps. In his (the Chairman's) opinion, there was no need for a Select Committee; and the Home Secretary might have told the deputation that all that had to be done was simply to get a coin gas-meter, and so obtain for a penny a light for six hours. And what could be cheaper or safer? It appeared to him (the Chairman) that the matter was entirely in the hands of the public. Some people had a fancy, which they knew was as changeable as a fickle goddess; and possibly coin meters would go out of fashion. But he did not think so. He believed gas companies would find these meters a great boon; and he thought it was their duty to make known their usefulness wherever they could. The profit per meter was cut very fine; but if they made a small profit on one meter, and they had a number in use, the total profit reached a satisfactory amount. By means of these meters, they had got together a fresh class of consumers in the poorer districts, and they appeared to be a great boon. The British working man was rather slow in taking to some of these ideas, and he went on

in the same jog-trot kind of way. It struck him (the Chairman) that gas companies would have to do what Lord Sherbrooke said would have to be done when the franchise was lowered—that was, "educate our masters." They would have to educate the public, and show them the advantages that were to be derived by procuring a supply of gas through a coin meter. He did not think there was anything more for him to dwell upon in connection with the report and accounts; but he might say, as to the future, that he thought it was fairly satisfactory. The Directors had made coal contracts for the ensuing year at a low price—in one respect almost as low as they had ever made them at. This spoke very well for them, though he did not think it spoke so well for the trade of the country. The Company were also to the fore with a small amount of capital per ton of coal carbonized. It was less than any other Company—either London or Suburban—with one solitary exception. This was a source of great strength to them, and was a matter upon which they might congratulate themselves. The capital now averaged £420 per million cubic feet, as against £440 last year. The works were all in thoroughly good order. They had been laying out a considerable sum of money at Wapping, which was their best station for working; and there they were building a new retort-house, with many modern improvements. Their workpeople were, he believed, contented, as they ought to be; and he saw no reason why the Directors should not have as good an account to lay before the proprietors for the current half year as they had had for the past half year. He then moved the adoption of the report and accounts.

Mr. T. Bevan seconded the motion.

Mr. E. T. E. Besley, Q.C., thought there ought to be some expression of congratulation from the shareholders upon the state of the accounts. The Directors were not proposing to divide to the fullest extent the amount to which the proprietors were entitled, but recommended that ¼ per cent. should be carried to the reserve fund. If the Chairman could tell them the total sum that would go to the reserve fund, the matter would be more easily understood. It would also be interesting if they knew the maximum amount at which the reserve fund had stood in former years. He believed it had been reduced in bad times; and if the proprietors had this information, they would be able to estimate the time during which they would have to forego a portion of the dividend to which they were entitled to make the reserve fund equivalent to what it had been in past years. The best testimonial to the Directors was the price at which the stock stood in the Stock Exchange "Official List," because it showed the thorough confidence of the public in their management.

Mr. G. Ennis said he saw by the balance-sheet, under "Stores in hand," that tar, sulphate, and ammoniacal liquor were calculated at £21,799. He wanted to know whether the proprietors might assume that the valuation of sulphate had been taken at the present price, and not at any abnormal rate that might have been ruling during the half year. He also asked whether the Directors had taken any steps to dispose of it. In the profit and loss account, there was an item of £637 for income-tax. Of course, this was not the income-tax on the dividend; and he should like to know whether it arose from any ingenuity on the part or the Commissioners of Inland Revenue.

Mr. Simpson Rostron endorsed Mr. Besley's remarks as to the satisfactory nature of the accounts, and the prosperous position of the Company. In regard to coin meters, he could support the Chairman's remarks; and he thought they need be under no apprehension as to these meters going out of use. One curious result observed in South London (and possibly it had been noticed in the East-end) was that a number of the quarterly consumers had asked to have their ordinary meters replaced by coin meters. He was glad to see, though some shareholders might view it in a different light, that the Directors were not proposing to raise more capital. The exceptional powers possessed by the Company were not without a drawback, because they had to raise capital at a high rate of interest.

Mr. Gellett said the Company's stock was quoted at 305 to 310; and he asked whether any transfers had taken place at this price.

The Chairman, in answer to Mr. Besley, said the amount they put aside for the reserve fund was ¼ per cent., which was equal to £1787 a year; and as the reserve fund had stood as high as £44,000, it would take two-and-a-half years, putting by ¼ per cent., to bring it up to that figure. Some years ago, when the Company were not in such a happy position as now, and they had to draw large sums to assist in paying the dividends, the proprietors would remember that these sums came from undivided profits; and they had not to encroach on the invested reserve fund. Then regarding the question as to income-tax, it was simply put in the statement of profit and loss instead of another part of the accounts; and it represented income-tax on the surplus profits of the preceding year. As to the stock of sulphate question, the Engineer assured him that all the values were taken at the lowest current rate. Of course, this was a serious question for the Company; and the Directors always dealt with these matters from a business point of view, and would take the earliest possible opportunity of selling the sulphate at a fair and reasonable figure. Respecting the price of the stock, the Secretary informed him that the highest figure on a transfer was about 304; but the books had been closed during the past fortnight, and no transfers had been made since the last rise. As to Mr. Rostron's remarks, they did find that some consumers preferred the penny-in-the-slot system; but the Directors would rather keep them as ordinary consumers.

The motion was unanimously carried.

The dividends recommended having been declared,

On the motion of Mr. Besley, seconded by Mr. Ennis, the Chairman and Directors were thanked for the satisfactory way in which they had managed the affairs of the Company during the half year.

The Chairman acknowledged this mark of confidence; and, continuing, he proposed a vote of thanks to the Engineer, the Secretary, and the other officials. He observed that, of course, the "burden and heat of the day" fell upon Mr. Jones; and, in the past half year, he had perhaps had rather more than usual to contend with in the troublesome matter of the quinquennial assessment of the rates. This was a very heart-breaking business, as the rates always exhibited a tendency to increase; but the matter could not be in safer hands than those of Mr. Jones, as he was a perfect master of the subject. As to Mr. Ellis, he was always to the fore in doing everything well, and in a most effective manner.

Mr. Cecil seconded the motion, which was carried.

Mr. Jones, in responding, remarked that the Chairman had referred to some of his duties in connection with the rates. He (Mr. Jones) thought the shareholders would sympathize with the position which they were in in the East of London, in which poor district the rates were rising as though it was a rich one. The average rates five years ago were 6s. in the pound; but in one district they had now risen to 8s. 2d., and in another to 7s. 11d. The last Assessment Committee he had to visit, he found installed, instead of in the old Union workhouse, in a perfect palace, the building of which, he ventured to say, having knowledge of the state of trade in the East of London, ought never to have been undertaken. Last year, the Company were doing handsomely; but this year down had come sulphate of ammonia. With regard to the comforting views of the position, the incandescent light seemed to be fighting against the upper class of competition; while coin meters were fighting the lower class. Those who had been buying oil were now purchasing gas; and those who had been using electricity were also turning to gas. They were getting a hold at both ends of the string. They had always had a grip on the commercial or mercantile lighting; but on the luxurious and democratic lighting, they were now getting a grip. With regard to coin meters, they could not keep pace with them at present, notwithstanding that they had made increased provision for dealing with them. Although they could not show the enormous increase that obtained with other companies in more prosperous districts, they had plenty of work before them; and he believed, in a few years, they would be able to point to a large number of these meters. There was an old saying about aiming at the pigeon and shooting the crow; but it seemed to him they had been aiming at the crow and shooting the pigeon. They found that quite a different class to the working man was asking for a supply through coin meters; as they had received requests from consumers to do away with the ordinary supply, and put them on the prepayment system.

Mr. Ellis also acknowledged the vote; and the proceedings then terminated.

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Meeting of this Company was held on Monday last week—Mr. Edward Fottrell, J.P., in the chair.

The Secretary and Manager (Mr. W. F. Cotton, J.P.) read the Directors' report, which, with the accounts, was noticed last week.

The Chairman, in moving the adoption of the report and accounts, said, were it not for the depressed state of the market for residual products, the accounts would have shown a more favourable appearance. In comparison with the same period of last year, there had been a falling off of £2174 in the receipts for residuals. However, there were signs of improvement in the trades in which these articles were utilized; and the Board had hopes that an improvement would take place. Regarding the gas made and consumed, there had been a fair increase. The amount received under this head was in excess by £5481. The working showed good results from the coal carbonized. The expenses on manufacture had been kept at a reasonable rate; and the Board looked forward to an increased consumption. They had entered into contracts for coal on favourable terms; and these would be in full operation next quarter. Under these circumstances, the Directors had resolved to reduce the price of gas 2d. per 1000 cubic feet over the whole of the gas limits, to take effect from the December quarter. It would be within the recollection of the shareholders that, at the time the Board were obliged to increase the price of gas, it was not so much in consequence of an advance in the price of coal; for at that time the Company had three years' contracts running at very low rates, of which the consumers obtained the benefit. The chief cause was due to the fact that they were obliged to adopt what was known as the eight-hour shift, and to raise the wages of a large number of the workmen; the result being that the wages account increased to the extent of £10,000 per annum. In addition, the price of cannel (of which the Company used about 20,000 tons per annum) increased to the extent of 10s. per ton; and, at the present time, it was about 5s. per ton in excess of what they formerly paid. He, as Chairman of the Rathmines Commissioners, had induced that body to try the incandescent gas-burner in the large lamp at the head of Rathmines. At many places he had seen these burners in use; and he noticed that further improvements were being made in the mantles. The system would, in a measure, place gas and electric light on a fair trial; and possibly gas might be in the ascendant.

Mr. Maurice Brooks, D.L., seconded the motion, which was adopted.

The Chairman next proposed that dividends at the rate of 10½ and 7½ per cent. per annum be declared on the old and new shares respectively.

Mr. D. Drummond seconded the proposition, which was carried.

Mr. Brunker asked whether the Company would identify themselves with the incandescent light.

The Chairman said that the Company would supply the gas; and the consumer could use which burner he liked.

Mr. Gill said as the Chairman had alluded to the trial of the incandescent burner in Rathmines, he might mention that he had recently been in Belgium; and he found one of the large cities there lighted with these burners. They were more brilliant-looking than the electric light in Dublin.

Mr. Brunker moved a vote of thanks to the Chairman, Directors, and Secretary. He said, as an Auditor of the Company, he had an intimate knowledge of the way the concern had progressed under the superintendence of the Chairman; and he thought they might congratulate themselves on having such a gentleman at the head of their affairs.

Sir George Owens seconded the motion, and said they ought to feel very much obliged to the Directors and to their invaluable Secretary.

The Chairman and Mr. Cotton having replied, the proceedings terminated.

THE GAS AGITATION AT LIVERPOOL.

The Illuminating Power Question—Proposed Competitive Gas Supply.

At the Meeting of the Liverpool City Council last Wednesday—the LORD MAYOR presiding—some important business connected with the gas lighting of the city was introduced by Alderman F. Smith on behalf of the Special Lighting Committee.

Alderman SMITH first proposed a resolution, relieving the City Engineer from all responsibility in connection with street lighting and the inspection of gas, appointing as Gas Inspector Mr. C. R. Bellamy, who has hitherto performed the duties of Assistant Inspector, at his present salary, and varying accordingly the resolution passed in 1890 appointing Mr. Boulnois as Gas Inspector. This, Alderman Smith explained, was caused by the extension of the city, and the necessity of taking up the lighting arrangements of the out-townships.

Mr. BROWNHILL seconded the proposition, which was agreed to.

Alderman SMITH, in submitting the report of the Special Lighting Committee on the illuminating power of the gas in various towns (which has already been referred to in the JOURNAL), said it would be seen that the average price of coal per ton paid by the corporations cited in the memorandum was 12s. 6d. The average price of coal in the case of gas companies was 12s. 3d.; whereas Liverpool, with its close proximity to the Wigan coal-fields, paid 20s. 7d. per ton. By coal he meant the inclusive term as it was used in the accounts of the companies—including the cost of carriage, of unloading, and all expenses of depositing on the works. They had been endeavouring to press this matter on the attention of the Gas Company ever since June last; but, so far, having only had with the Directors one interview of three-quarters of an hour's duration, they had not had sufficient opportunity to discuss the question. A communication had been received from Mr. Garnett, on behalf of the Company, stating that the figures published by the Committee would be immediately investigated. Under these circumstances, he had thought it right to bring the matter before the Council in the form of a special resolution. He was sorry they had not been able to supply in the memorandum any explanation from the Company of what Mr. Austin Taylor had very properly described as the phenomenal price Liverpool paid for coal. Another matter in regard to this report was the great waste of gas (30 per cent.) by the consumers through improper consumption. The public were constantly grumbling about the gas; but the fact was they were furnished with as rich gas as had ever been supplied by any other company. The gas was extremely good; and there was no reason whatever to complain of it. In regard to the cost of coal, he invited the attention of the Council to the recently published bluebook on the mineral statistics of the United Kingdom. The bluebook showed that the average price of coal at the pit mouth in 1894 was 6s. 7·43d.; and in 1893, 6s. 9·51d. But an increase of 2d. in the average price of coal certainly did not justify the Company in placing upon the consumers the burden of an increase of 4d. per 1000 cubic feet in the price of gas. The bluebook also showed the value of coal at the principal shipping ports since 1876, and proved that the highest price in Liverpool was reached in 1893, when it was 14s. 8d. This, however, included bunker coal, which was brought from South Wales by rail, and could hardly be compared with the gas coal brought from Wigan. Another point was that while coke, as he was informed, was sold in Liverpool for 11s. 8d. per ton, large quantities of it were disposed of elsewhere for a much less price. In a speech delivered in 1891, the Chairman of the Company (Mr. E. Lawrence) was reported to have said that 2d. per 1000 cubic feet in the price of gas was equal to something like £25,000. Therefore it appeared that at that time, when the Company had to face a deficit of £48,000, they raised the price 4d. per 1000 cubic feet; yet, now there was a saving of £60,000, they only reduced the price 2d., which did not seem to be at all satisfactory. He thought the Company ought to show more consideration for the interests of those who had helped them so materially in the past, and enabled them to attain their present prosperous condition.

The report was accepted.

Alderman SMITH next moved the following resolution, of which he had given notice: "That, in view of the high price paid for the coal, &c., used by the Liverpool United Gaslight Company, and the consequent high price of gas and coke, the Town Clerk be, and he is hereby, instructed to do all that is necessary to enable the Council to promote a Bill in the forthcoming session of Parliament, to obtain powers to establish and maintain a competitive gas supply, and that Standing Order No. 61 be suspended accordingly." He said he put this motion on the paper because they were not able to get any nearer to a solution of the questions between the Corporation and the Gas Company, except by putting that body into Parliament. The paid-up capital of the Company was under two millions; and their income for the year ending June 30, 1894, was £616,930, which was more than the Corporation spent upon the whole of their municipal government, except payment of interest. In Manchester, where the gas undertaking was owned by the Corporation, they were able not only to make a profit of £134,000, but to light the streets free, and to abolish meter-rents, and at the same time reduce the price of gas 3d. per 1000 cubic feet, and carry £54,000 to their general account. During the year 1894, the consumers in Manchester were charged 2s. 6d. per 1000 cubic feet, as against 3s. 4d. and 3s. in Liverpool. There was no reason why the Company, with its two millions of capital, and that mainly Liverpool money, should be allowed to handicap the trades to the extent of something like 1s. per 1000 cubic feet more than they need do. It might be asked, Why not buy them out? The reply was that the transaction with the Electric Lighting Company was not such as to encourage them to repeat it. He would refer to one point—although it was only a small one—as an instance of the management of the Company. For inspecting the lighting of the church clocks, the Corporation had paid the Company £40 a year; and when the Lighting Committee took over this work themselves, they found it had been so well attended to before that the saving in gas for part of one quarter was 56 per cent. in the case of St. Peter's clock, 76 per cent. in the case of St. Nicholas's, and over 80 per cent. in the case of St. Luke's. He was quite aware of the difficulties that might be suggested with regard to carrying out a competitive scheme; but he had in his possession an analysis by Mr. W. King, the Engineer of the Company, showing that gas from Wigan cannel had, when consumed through Sugg's patent steatite batswing burner, an illuminating power of 25·87 candles, or 5 candles more than the Liverpool supply. A sample of Orrell or Arley coal yielded gas that had an illuminating power of 18·3 candles. The former could be delivered at Garston at from 24s. to 25s. a ton; and the latter at from 10s. 6d. to 11s. a ton. The question was whether the Council were going to allow the Company to hold them in bondage not only in respect of the portion of the city now built upon, but of that other part which would soon be included in the city. The Lighting Committee had already carried on negotiations with the Company to reduce the illuminating power of the gas. They had one appointment; but owing to the holidays of the Engineer, the indisposition of the Chairman, and the holidays of the Secretary of the Company, they had been unable to get any nearer, or to fix any new appointment during the last three or four months. He thought this was an entirely unreasonable delay. It was only when the Secretary of the Company communicated to the Town Clerk that he had no present intention of making any further appointment, that he (Alderman Smith) put this motion on the Council summons. The price paid for coal and cannel was a matter which, as far as he was concerned, the Company only could explain. There was a difference of 4s. per ton in the prices paid by Manchester and by Liverpool for coal; and, on the amount of coal used, this meant something between £60,000 and £100,000 a year. Were they going to allow the Company to pay what was really their maximum dividend but which they had always taken to be their minimum dividend, and also to pay what price they liked for coal, without their taking any step whatever in the interests of the public? He would pass over the dereliction of duty on the part of the Company in not telling consumers how best to make use of the article they supplied; for anyone who had had experience of the autocrats of Duke Street knew perfectly well that the interests of the consumers had been treated in a very cool manner and oftentimes with a very high hand. He was perfectly aware of the length of arm and the strength with which the Company could act; but this ought not to deter the Council from adopting the resolution he now submitted, and thereby placing the new Council in a position of dealing with the matter should they think it desirable. They did not wish to do serious damage to the Company; but they wanted a cheaper supply of gas which would be beneficial alike to the shareholder, who would receive his dividend in the ordinary way, and to the consumer who would get a nearer approach to value for his money. They could borrow £2,000,000 of money for £50,000 a year; and were they going to pay the Company anything they liked without taking some step?

Mr. R. D. HOLT, in seconding the motion, said they were very much indebted to Alderman Smith for the trouble he had taken in the matter of the gas lighting of the city. He believed, if the Company would only get to work, they could produce gas at a very much lower rate than at present. They, however, had a monopoly, than which there was nothing more dangerous for a community. He was very warmly in favour of pressure being put upon the Company to consider the more economic production of gas; and, though they were a moribund Council, he did not think that they could do any better work at the closing of their term of office, than the bringing of such a motion as this before the town.

Mr. PURCELL considered the gas consumers had a grievance which ought to be redressed, and trusted that, unless the Gas Company were brought to their senses, the Council would go to Parliament, and, if necessary, have gas-works of their own, which could be managed for the benefit of the community.

Alderman RATHBONE and Mr. BALL also supported the motion, which was unanimously agreed to.

SALFORD CORPORATION GAS SUPPLY.

A Discount on Consumers' Accounts.

The following motion was proposed by the Chairman of the Gas Committee (Mr. Holland) at the meeting of the Salford Town Council last Wednesday: "That a discount of 2d. per 1000 cubic feet of gas be allowed to all customers, within and without the borough, who pay their gas bills within one month from the date of the delivery of the account." Mr. Holland explained that the step which it was proposed to take would cost the Gas Committee rather more than £8000 per annum. Large profits were made by the Committee last year; and it was thought that they were likely to be about equally large this year. This being so, it was felt that the consumers should benefit; and, by their present proposal, the Committee sought to put a premium on the prompt payment of accounts. It was sought, in fact, to make every man his own gas bill collector. The motion was seconded by Mr. Phillips. Mr. Linsley asked whether the £8000 was to be all lost, or whether it was proposed to reduce the number of collectors. Mr. Holland answered that the Committee were not blind to the possible effects of the proposal now submitted. Changes would no doubt come round; but it was not well to be over-precipitate. They did not yet know how many people would avail themselves of the allowance for prompt payment. Mr. Mandley, though not desirous of opposing the motion, inquired whether it might not be well to devote the £8000 a year to helping to remove the borough out of its present melancholy financial position rather than to the purpose contemplated. It seemed desirable to do everything possible to remove the financial pressure on the people. Mr. Luckman pointed out that the proposal really meant a reduction of 2d. per pound in the rates to people who paid their gas accounts promptly. Mr. Snape said the question was whether they could afford to present £8000 a year to the wealthy gas consumers. He feared that it was only the wealthy ones who would earn the discount. In six years' time, if they devoted the £8000 to the purpose, they would wipe out the deficiency of £50,000, and thus avoid the necessity of going to Parliament for the purpose. Mr. Yearnshaw disagreed with Mr. Snape as to the class of people who were likely to benefit by the allowance; and said he believed it was the poor people

who would chiefly reap the advantage. The Gas Committee hoped to make up the £8000 by means of the increased consumption of gas. Mr. Mansfield said it was not £50,000 that was wanted to make good the deficiency in the finances of the borough; considerable sums had to be deducted from that. At present the borough was under a cloud; and they knew what might happen if they went to Parliament. It would be better to work along quietly for two or three years, and keep trying to right themselves. The motion was carried.

THE BOLTON CORPORATION AND THEIR GAS STOKERS.

Alleged Breach of Faith by the Men.

At the Meeting of the Bolton Town Council last Wednesday, a discussion took place with regard to the recent dispute between the Gas Committee and the stokers at the Lum Street works. The matter was introduced by Mr. Battle, a labour representative; and he asked the Chairman of the Gas Committee for an explanation of the affair. The Town Clerk, at the request of Alderman Miles, the Chairman of the Committee, read a communication which had been received from the Secretary to the Bolton and District Gas Workers' Association. This document set forth that the stokers at the Lum Street works had unanimously decided that they could not carbonize 3 tons 12 cwt., and that they declined to return the extra pay they had been receiving in accordance with an arrangement made last April. Upon this the Gas Committee passed a resolution regretting the action taken by the men, and expressing the opinion that the refusal to refund the additional wages was a breach of faith. Mr. Battle declared that the stokers performed an amount of work which justified the payment they had received, and yet, because they did not agree to the suggestion sent forth some time ago as to carrying out certain conditions, they were required to pay back the extra money they had had. He thought the "game" was scarcely "worth the candle." Mr. Tootill (the Secretary to the Bolton Trades Council) disagreed with the last speaker, and argued that the men had not treated the Corporation honourably. He reminded the Council that the men voluntarily offered the conditions to which they objected in their letter. Mr. A. H. Taylor did not think the Committee were right in asking the men to refund the money they had got. Mr. Kearsley remarked that the men first approached the Committee, and offered, in the event of the Committee giving additional remuneration for Sunday labour, to carbonize 3 tons 12 cwt. instead of 3 tons 8 cwt. of coal. Failing their being able to carbonize the additional coal, the men arranged to refund the extra money paid them. Alderman Miles, replying upon the discussion, said that prior to last April the men asked that double time should be paid for Sunday labour to all employees at the gas-works. Hitherto they had been paying time-and-a-half for two shifts on Sundays. As the result of negotiations, the Committee said they would be willing to pay time-and-a-half for the three Sunday shifts, if the men would carbonize a little extra weight of coal—the quantity fixed being 3 tons 12 cwt. instead of 3 tons 8 cwt. This last, he added, had been a bugbear to the management of the Gas Department ever since it was introduced, simply because it was considered that this quantity did not represent, under the conditions prevailing, a fair day's work per man. It had also the effect of not enabling the Lum Street station to turn out the work of which the plant was capable. The men agreed to the conditions of the Committee, and an arrangement was entered into whereby the men were to receive time-and-a-half for all three Sunday shifts from April 4 to Aug. 1, when the men would commence to carbonize the extra quantity of coal. Not a pennyworth of extra work was done between those dates by the men; and when, on the 1st of August, they were asked to carbonize the 3 tons 12 cwt., one shift tried, and then reported that it could not be done. He believed that it was never intended to be done, and that the men did not try. The men had received in the aggregate something like £50 extra between the dates given; and in the opinion of the Committee, the men did not give the new arrangement an honest trial, and, according to promise, they should have returned the £50. In his opinion, the men had been guilty of a breach of faith; and this winter the Gas Department would be placed in the position of having a large number of retorts not being allowed to carbonize the quantity of coal they were capable of doing. He said publicly that it would be unwise to risk any complications with labour at the gas-works at this time of the year; but the Council and the public would readily see what this action on the part of the men would lead to. He was of opinion that they had made a great mistake in their present action. Before concluding, he intimated that the question of mechanical stoking, which was deferred owing to the promises made by the men, would have to be considered at an early date

Bathing in Water Reservoirs.—At the Waltham Abbey Petty Sessions last Tuesday, an application was made by Mr. G. Kebbell, on behalf of the East London Water Company, for process against certain persons who had been found bathing in the Company's reservoirs. Mr. Kebbell said it was a serious matter for both the consumers and the Company; and the latter were desirous that it should be known that such bathing, which had become very common during the hot weather, was, by statute, a criminal offence. The application was granted.

Uxbridge Water Supply.—The Uxbridge District Council have resolved to obtain the opinion of an expert as to the best means of providing a constant service of water to the town. This step, however, will not be taken until negotiations are completed for wells on premises owned by Messrs. Stagg, which are capable of yielding some 1800 to 2000 gallons of water per hour. The supply of the town has for some time past been deficient; and this auxiliary source would put the Council in the same position as they were in two or three years ago, and give the consumers 20 gallons per head per day. But this is only regarded as a temporary measure. That the Council should now seek an additional permanent source is shown by a statement by the Surveyor (Mr. Eves) that two years ago they pumped 185,000 gallons per day; but now they are only obtaining 145,000 gallons.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

Mr. Lewis T. Wright asks us to publish the following letter, which he has addressed to Mr. W. C. Dixon, the Chairman of the Gas Committee of the Bradford Corporation:—

Oct. 2, 1895.

Sir,—The publicity that has been given to all kinds of reports, documents, &c., relating to the above process, the rumours and erroneous statements that have appeared in various newspapers from time to time—and even during the course of the actual experiments, when good sense, fair play, and etiquette demanded that silence should be observed, at least until the result was known to the gentleman engaged by the Corporation to conduct the inquiry—and the attacks made upon myself, compel me to break the silence that, under ordinary circumstances, it would be my duty to observe.

The real matter that was technically at stake—the real issue that had to be threshed out—is left in the background by those who have been busy in publishing information that I shall be able to show contradicts itself. In now answering the attacks and criticisms that were made upon me at a time when my mouth was closed, I find myself in the agreeable position of being able to refute my opponents by means of their own words—so much have they contradicted themselves and each other. It is impossible to shake their printed matter over my office table without their contradictions rattling down on the paper on which I now write.

It will be remembered that, when the Gas Committee invited me to examine and report on the process in question, I made it a condition that I should have liberty to apply the tests I thought proper, and that the plant should be run by the inventor.

On the commencement of the first trial, in addition to the inventor, many other persons were assembled—including the Messrs. Newbigging, of whose intended presence in the affair no notice had been given to me. By the contract with the Corporation, Mr. Smith was entitled to a representative. He brought several. You wished to clear the works in order that the trial might begin; and as it was my opinion that he ought to have all the technical advice he might need (other than that of the officials of the Corporation, and my own had he required it) in showing off to the best possible advantage all the advantages of his process, I intervened, and said that I would have much pleasure in meeting Mr. Newbigging in connection with the affair. Thus it happened that Mr. Newbigging was present during the whole of the first and abortive trial. The trial was suddenly stopped by Dr. Dvorkovitz, with his own hands; and I was compelled to retire.

This incident threatened to result prejudicially to the owners of the process. It was, however, amicably arranged that there should be another trial, and that Mr. Smith should be represented by "Mr. Newbigging." On the commencement of the new trial, Mr. Newbigging, jun., presented himself, and explained that he was the Mr. Newbigging under the terms of the Gas Committee's permission, and asked me if I would have any objection if his father came over occasionally. My reply was, as on the previous occasion, that I would have great pleasure in meeting him.

In order to avoid the recurrence of the wild and irresponsible rumours that were carried out of the works during the first trial, I requested that Mr. Newbigging, jun., should refrain from expressing any opinion of the result until it was definitely known. After the result was known, he was free to say what it best pleased him to inform his client.

The process, as I saw it at the Thornton Road works, consists of two parts—viz., the retorting process and the carburetting apparatus. This latter part has since been disowned by Mr. Shaw.* I found that the oil gas had an enriching value of 1139 candles per gallon of oil passed through the retorts, or 1753 candles per gallon actually gasified (Mr. Newbigging, jun., gave it a value of nearly 1 per cent. more). The result given by good lamps, the wicks of which are not less perfect gas-works than an oil-gas process, is about 1400 to 1700 candles. The result, as judged by the direct combustion of petroleum in good lamps, would be favourable if the process could gasify the whole of the oil instead of gasifying but (as I have mentioned in my report) from 40 to 65 per cent. of the oil. The American carburetted water-gas plants give about 1200 candles, with a gasification of from 85 to 90 per cent. of the oil. This higher result of the Dvorkovitz process is due to the result having been the enriching value, and not the "naked" or *per se* value, as stated in my report. The result, so far as the oil-gas alone is concerned, is good, though not so high as was promised by the inventor in his letter of July 4, 1894. It will be observed that in those days Dr. Dvorkovitz had not adopted the candles used by Mr. C. Wood, but those as used by myself. He promised 105 cubic feet of $57\frac{1}{2}$-candle power gas per gallon of oil retorted. This calculation is evidently $\frac{105 \times 57\frac{1}{2}}{5} = 1207\frac{1}{2}$ (1210 rounded off). The difference between his promise and what I found for the oil gas is not of any moment.

Mr. Newbigging, jun., has confirmed my tests. When, as the average of the three days' test, I found a difference due to the enrichment of the oil gas of 1·91, he gives 1·93. On the 27th of July, 1895, Mr. Newbigging, sen., writes: "My son has shown me the results of the tests. I am glad that yours and his agree so well. It is highly satisfactory." This proves that there is no ground for complaint about the oil-gas test.

Of quite different character is the result obtained with the carburettor—a subject that Messrs. Newbigging have not mentioned in their reports. On the 20th of last month [September], Dr. Dvorkovitz, in a letter to the JOURNAL OF GAS LIGHTING, declares I ought to have tried the carburettor as he wished in accordance with the thirty-three days' test, which he insists is correct; but on the same day Mr. Shaw writes that the carburettor is not part of their oil plant, but a suggestion of the Corporation's Engineer.

Dr. Dvorkovitz commenced in July, 1894, with his candle values in order. On the 1st of April, 1895, his candles are five times too

* See JOURNAL, Oct. 1, p. 680.

numerous, because he no longer divides the product of cubic feet and illuminating power by 5, as is correct to do, in order to bring that product into candles.

It was found, in the course of trials with the carburettor (repudiated by Mr. Shaw on the same day when Dr. Dvorkovitz treats it as an essential part of his process), that the oil-gas tar had an enriching value of 35,000 candles (*vide* Mr. Wood's report of the 23rd of January, 1895).* This high quantity must be divided by 5 to bring Mr. Wood's candles to the correct ones and to those employed by the inventor in 1894. In the carburetting, the whole of the tar is not evaporated into the gas; and it has never been claimed that more than a portion can be so evaporated. From the book of the carburetting trials, it would appear that the enriching value of the portion so evaporated has reached 350,000 feet-candles per gallon. These enormous values are the cause of the wrangling spoken of by Mr. Newbigging, and not the discussion about the figure 5 that excites their ridicule. It was no question of 5, but of 100. It was easy to see by an inspection of the various reports that two different candle-values had been employed.

In the presence of the representatives of Mr. Smith, I made a test, which, in my opinion, is the most favourable to the oil-gas tar that could be designed. It is described in my report. This gave 1550 candles per gallon of oil evaporated. Mr. Newbigging, jun., after consultation with the official in charge of the works, asked to have a test made on the lines of the previous carburetting tests. I consented, of course. The result was much lower than that I had obtained; and I did not make use of it in my calculations. Messrs. Newbigging have adopted as a method of valuation of the oil-gas tar its analysis.

How does it happen that Messrs. Newbigging, who have confronted me, as I will show, with all sorts of irrelevant matters that have not even a remote relation with the subject under discussion, have not produced the evidence, not of the carburetting experiment made by the request of Mr. Newbigging, jun., but that afforded by Mr. Wood's results? They have found no difficulty in digesting the candles that are five times too high. They say in their report of the 6th of August, 1895, that generally their results bear out those obtained by Mr. Wood. The basis they have chosen is an analysis of the tar—an analysis that I do not think they understand. The analysis shows that the tar has been separated into four crude products—viz., a crude naphtha 54/91, which they called benzol, and value at 11d. per gallon; a light oil, at 11d.; a heavy oil, at ¾d.; and a pitch, at 2d. per gallon. The pitch has no agglomerating properties; and, in a recent letter, they say that an allowance has been made for cost of distillation by taking something lower than the current rates on the secondary products. I must say that I see no evidence of any allowance having been made; and even if the 54/91 benzol could be properly described at all as 90 per cent. benzol, Messrs. Newbigging must have a vague notion of distilling and refining tar if they think ½d. per gallon will cover those expenses, and the cost of casks and carriage to port of shipment, &c.

I now come to Mr. Wood's letter of Sept. 3.† I may say that the Mr. Wood I refer to is, in every case, not the Mr. Wood who signs the reports and the letters relating to the matter in question, but Mr. Charles Wood. Mr. Wood commences by opening an attack upon me. It appears that, in April of this year, a gentleman in Bradford wrote to me about certain calculations which he described under A and B. I had not the faintest idea that they were related to the Bradford Corporation, or that the calculations that were wrong could have been made by anyone connected with the gas-works; and I was astonished afterwards to learn that they were Mr. Charles Wood's. I constantly receive such letters, asking me about matters relating to gas and the distillation of coal. There was nothing in the letter to indicate that it referred to any actual case. Mr. Charles Wood says that the chief difference between my estimate of 0·76d. per 200 candles and his of 0·42d. per 1000 feet-candles (which he, no doubt, means also to be 200 candles) is due to the different values given to the bye-products. Mr. Wood's 1000 feet-candles, or his candle-thousand, is, according to my way of thinking, 200 candles; and now that I know that it is 200 candles, I certainly decline to take him literally. If, however, he insists that I do take him literally, then his costs must be inevitably multiplied five times. As a fact, the main difference is due to the value given to the bye-products. I do not, however, think that anything is gained by calling this tar bye-products. The term appears to me quite unnecessary, as the material is known already as oil-gas tar. The letter I refer to is dated the 3rd of September, is addressed to the Gas Committee, and is published in the *Bradford Observer* of the 5th of September. In that letter he refers to the price offered by the Syndicate, of 6d. per gallon. This offer, which I have never seen in writing, I was told, was not an offer without conditions. One of the conditions was the right of supplying the oil at 4d. per gallon; and Mr. C. Wood can hardly have forgotten that, at a previous meeting, the offer for the oil-gas tar had been reduced by a gentleman, speaking with some appearance of authority, to 3½d. This probably refers to the 3½d. spoken of by Mr. Shaw (*Bradford Observer*, Sept. 21). I never had any offer put before me that I could advise the Corporation to accept, nor did I have more than a hearsay report that such an offer had been made or would be; and I gave everybody to understand clearly that I would advise the Corporation to reject any offer that was not quite free from all conditions. It would be reckless for a corporation to enter into a contract for a gas-enriching process that was to give a certain quality and quantity of tar. They would always have hanging over them the fear that a deviation from what the inventor might say was his process, would leave them in the position of having the tar left on their hands. This is especially the danger in this process, wherein it is claimed that all the merit depends upon the degree of temperature employed; and there is not provided any automatic arrangement for the control of that temperature. It is a question of skill; and no inventor, when he sells his plant and leaves it, can leave his skill behind him. A slight increase of temperature, and the tar thickens; and on a decrease of temperature, the tar thins. The Corporation require oil gas enrichment and not bye-products to sell. If anything went wrong with the oil gas, the Corporation would say that it was due to the quality of the oil supplied; if anything went wrong with the bye-products, the contractors would say the process was not being worked in accordance with the intention of the inventor.

Mr. Wood complains that, in my experiment, the bye-products were distilled too rapidly. I ask if it is now worth while to reopen this question of the carburettor? If Mr. Wood feels that he must still insist upon his ability to extract 350,000 feet-candles from a gallon of oil vaporized, or that the whole bulk of the tar is worth 35,000 candles per gallon (*vide* report of March 28*), then I must discuss the matter on the basis of his carburettor book. I was not aware until my report had been published, that the carburettor I found in the Thornton Road works, and in connection with which Dr. Dvorkovitz protested (*vide* his letter of Sept. 20 to the JOURNAL OF GAS LIGHTING), because I declined to test it in conjunction with the oil-gas plant, until I had time to apply a test for permanency, would be afterwards disowned by Mr. Shaw.

When Mr. Wood criticizes my cannel estimate, he must not be surprised if I reply with some detail. He has found it necessary to change his opinions on this subject from time to time. On the 2nd of July, 1894, he is of the opinion that cannel is likely to be reduced in the future considerably under 1¼d. per candle per 1000 cubic feet (200 candles); and he is now surprised that I should arrive at a cost of 0·81d. I would further point out to him that, on the 28th of March, 1895, he informed the Committee that the cost was then 0·79d. But I will show, if the returns he himself is responsible for are used as evidence, that the cost of cannel enrichment must be very much lower than either his estimate of 0·79d. or mine of 0·81d. I find that the average illuminating power of the town gas at Bradford is 18·83 candles for the three years ending March, 1893. At Bradford, 25 per cent. of cannel is used to produce this quality. If we know the quality of the unenriched coal gas, then it is easy to arrive at the value of the cannel. The information we have on this subject is partly provided by Mr. Wood, partly by Mr. Newbigging, and partly by myself. I will give the results together with the enriching value of the cannel. They show, if the quality of the gas as supplied to the town is 18·83 candles, the following enriching values:—

	Value of Common Coal Gas.	Enriching Value of Cannel Gas.
Thirty-three days' test oil gas (Mr. Wood)	15·16 candles.	29·8 candles.
Report of March 28, 1895 (Mr. Wood)	15·67 ,,	28·3 ,,
,, ,, ,,	15·75 ,,	28·1 ,,

So that the enriching value of the cannel would be, according to Mr. Wood's reports, from 28·1 to 29·8 candles. Mr. Newbigging found the unenriched coal gas to be 15·7 candles; I found it to be 15·8 candles.

As regards the price, Mr. Wood asserts that, out of 500,000 tons offered, none came up to my estimate of 23 candles, at the price I take of 13s. per ton. The Committee has accepted tenders at prices of from 9s. 6d. to 15s., and that ostensibly for cannel that, by Mr. Wood's returns, must have, on an average, an enriching value of 28 to 30 candles. How is it that he can object to my taking 23 candles with cannel at 13s.?

With cannel of an enriching value of 28·7 candles, and costing but 13s. 3½d. per ton (the average price paid at Bradford), it will be necessary to show that the whole of the bye-products from the cannel coal are only worth 2s. per ton of cannel carbonized before a fraction can be added to my estimate of 0·81d.; and with the lowest yields and prices that it would not be ludicrous to take, it is impossible for Mr. Charles Wood, in the face of his figures, to prove that cannel enrichment is costing more than 0·70d., as it will be to show what circumstances have happened since March 28, 1895, to justify his opinion expressed to the Committee that the cost is now over 1d., owing to the difficulty of disposing of the cannel coke.

The reason I do not adopt the figures that are the natural outcome of the information provided by Mr. Wood—figures that lead him fatally to a contradiction of his now estimate of over 1d.—is because I do not think the average cannel Bradford obtains at 13s. 3½d. per ton will have an enriching value of 28 to 30 candles. Messrs. Wood and Newbigging are astonished when I take it at 23 candles. Mr. Charles Wood cannot change his estimates in this manner. He says that gas liquor is only worth 7s. per ton according to the market quotation. Why does he refer to the JOURNAL OF GAS LIGHTING for market quotations, when he has sulphate works, and knows that he has obtained the following figures?

Year ended.	Average per Gallon of 10-oz. Liquor.
March, 1891	0·94d.
,, 1892	0·85d.
,, 1893	0·84d.

He objects to my having taken 0·84d. per gallon. How can he say, in the face of his figures, that cannel enrichment will cost more than my estimate? How can he explain why his estimate of 0·79d. should now be over 1d., as he stated to the Committee? It cannot be because, as he says, of the low price of cannel coke. I have taken that into account, in deference to his assurance that the cannel coke that has averaged for three years 6s. per ton is now almost unsaleable.

Messrs. Newbigging, in their letter of the 7th of September,† follow in the same strain. Their letter is the confused echo of Mr. Wood's. They are astonished at cannel of 23-candle enrichment at 13s. I ask them what they suppose the Bradford Corporation obtains for the cannel at 13s. 3½d., which I have shown to be the average price. They can make an estimate. They know something of the unenriched gas. Perhaps they will explain how it is that Bradford obtains 18·83-candle gas with 25 per cent. of cannel of less than 23-candle enriching power. They have already committed themselves in their report of the 6th of August, 1895,‡ to the statement that: (1) The average cost of cannel enrichment is 1¼d.; (2) that the cost at Bradford is less than 1¼d. due to exceptional circumstances. What are these exceptional circumstances? Is it that the cannel bought at 13s. 3½d. per ton is equal to an enriching value of 28 to 30 candles? This will not very well explain their surprise at my estimate of cannel at 13s. with 23 candles enriching value. Otherwise I deny that the circumstances at Bradford are exceptional. There are many towns in quite as favourable a position, and some in a more favourable position, as regards

* See JOURNAL for Feb. 12, p. 329. † *Ibid.*, Sept. 10, p. 542.

* See JOURNAL, Oct. 1, p. 679.

† *Ibid.*, Sept. 17, p. 590; also correction Sept. 24, p. 636. ‡ *Ibid.*, Oct. 1, p. 682.

cannel. Messrs. Newbigging's estimate of the average cost at 1¼d. does not, however, apply to Bradford, is really irrelevant, and I will not say anything more about it.

They state that, as a matter of fact, it is well known that the coke from many high-class cannels is absolutely worthless. What, I have asked, have high-class cannels to do with the case under discussion? Do they suppose that Bradford can obtain high-class cannels at 13s. 3½d. per ton, or that high-class cannels have (according to them) less than 23 candles enriching power? I fail to see how the remark is relevant, for several reasons—viz., that high-class cannels cost more than twice the price Bradford pays, and give gas of considerably more than 23 candles enriching power, and because it is also well known that some high-class cannels do give excellent coke.

What is the object of these irrelevant remarks? Messrs. Newbigging cannot pull my estimate down by such references. The quantity of tar Messrs. Newbigging must take my word for, since it is based upon my own results. If they knew much about—not high-class cannels, for these are not under discussion, but the second-class Midland cannels, as used at Bradford, they would know that there are such cannels that give more tar than I find as the average of the particular cannel I estimate for.

I insist on the integrity of my estimate for the cannel I select as my basis—a cannel selected because I could not accept the figures I found at Bradford so far as to adopt them as my own. That disposes of the alteration that has been made of my figures. I claim to have proved Messrs. Newbigging and Wood's objections are untenable.

Messrs. Newbigging say they differ from me on two vital points: (1) The price of the oil; (2) the value of the bye-products. In their report of Aug. 6, they say that the price they take, of 3¼d. per gallon, is that on which the results of other enriching processes have been based. They now say, on the 7th of September: "We took the price at 3·25d. for the reason that the other oil actually used in the experiment was of inferior quality." Is it a coincidence that the price of inferior oil and that of oil used for obtaining results in other enriching processes is always 3¼d. per gallon; or were all the other oils of inferior quality, and is the only oil of good quality that used in the thirty-three days' test? These two different statements require some explanation. Why did they, in their report of Aug. 6, not say at once that they took the price at 3¼d. because the oil was of inferior quality? Why did they give another explanation then?

They, on Sept. 7, quote, in support of the new statement that they took the price at 3¼d. because the oil was of inferior quality, a letter from Messrs. Besseler, Waechter, and Co. to the Town Clerk. This letter is dated July 31, stating that they are not at all surprised to learn that the waggon of oil was not so good as that used in the thirty-three days' test. The letter to which this is a reply was, I suppose, dated before the 31st of July. Before the 31st of July, neither I nor Messrs. Newbigging could have known, with any degree of certainty, that the oil was inferior to the thirty-three days' test, even if we had had any personal knowledge of that test. We were the only persons who were in possession of the information on which an opinion could be formed as to what was the quality of the oil we used; and we had not finished our reports. Mine is dated the 1st of August; and Messrs. Newbigging date theirs the 6th of August. And yet, before we knew the results, and when no one else could have known, there is correspondence being carried on behind my back prejudging the result, and condemning the oil.

The matter was put into my hands by the Gas Committee. That body never interfered with my action. The officials were not present during the whole of the testing, and could not therefore have known. Mr. Newbigging, jun., and I are the only parties who could have formed an opinion founded upon knowledge; and yet the matter is taken out of my hands before I know and before I report, and the oil is condemned. And more, when the correspondence comes to light, it does so in a letter written by the representative of Mr. Smith to Mr. Smith; and that letter is circulated among the members of the Council when they are going to discuss the question, and before I have time to point out what I am going to do. My report of the 1st of August is in manuscript, on the table of the Committee meeting of the 9th; whilst Messrs. Newbigging's report of the 6th is printed, and in the hands of the members of the Committee!

Is there any foundation for saying that the oil was bad? I see none; and I will refute the statement by a reference to Mr. Wood's own figures. I will show that his report of the thirty-three days' test disproves what Messrs. Newbigging, Dvorkovitz, and Shaw are urging—viz., that the oil of the recent test was inferior to that of the thirty-three days; or, in other words, that the Kerosene Company's "Solar oil" was inferior to the Nobel's. On the contrary, I will show that these figures, that the Committee is called upon to accept in preference to my test, lead them inevitably to the opposite conclusion.

In the thirty-three days' test, 1513 candles per gallon of oil passed through the retorts were obtained; *but at the same time* 0·0713 *of a gallon of bye-products—oil-gas tar—were employed (vide Mr. Wood's report of March* 28, 1895*) in carburetting in the carburettor*, now disowned by Mr. Shaw, and thrown back upon the Corporation's Engineer. Mr. Charles Wood insists, and has always insisted, on the very high values for this oil-gas tar; and this insistence is the cause, I believe, of the wrangling (*vide* your speech in the Council on the 10th of September). I will not refer to the figures in the carburetting report book, but to Mr. Wood's report of the 23rd of January, 1895, where he puts one gallon of bye-products (oil-gas tar) as equal to 35,000 candles. Of course, but a portion of this oil-gas tar can be evaporated into the gas; and the results, calculated on the oil vaporized, have, if my memory serves me correctly, reached 350,000 candles per gallon of oil vaporized in some cases. His candles are five times higher than mine. I therefore reduce his 35,000 candles per gallon of oil-gas tar to 7000. From the total of 1513 candles per gallon of oil in the 33 days' test must be deducted, for the oil-gas tar used in carburetting, 0·0713 × 7000 = 499 candles. Thus reducing the candles due to the 68·15 cubic feet of oil gas from the retorts to—

1513 candles from oil gas and carburettor.
Deduct 499 candles from carburettor.

Leaving 1014 candles of oil gas per 68·15 cubic feet.

I will now summarize the results for the oil gas alone without carburetting—

	Cubic Feet per Gallon.	Oil Gas Tar.	Candles per Gallon.	Candles per 5 Cub. Feet of Oil Gas.
My test.	69·70	35·00	1,139	81·7
Thirty-three days' test	68·15	37·31	1,014	73·3
Dvorkovitz's promise, July 1894 . . .	105·00	37·50	1,210 (?)	57·5

I now put the gentlemen who insist upon the superior quality of the oil used in the thirty-three days' test upon the horns of the following dilemma: They must either admit that the oil (Kerosene Company's) in the recent test is *superior* to the other, or they must deny the 35,000 candles given by Mr. Wood as the value of the bye-products (oil-gas tar). Is the particular lot of the Kerosene Company's oil to be condemned upon such evidence? I do not discuss whether one merchant is justified in thinking his geese to be swans; but we cannot allow such evidence to make us believe that the Kerosene Company's swans are geese.

As regards the bye-products, Messrs. Newbigging say that they gave 4·695d. per gallon as the value; and that their figures are unrefuted. Whose business was it to refute Messrs. Newbigging's figures? I had no interest in refuting their figures, especially as in this case it appears to me that the figures refute themselves. The Gas Committee had nothing to do with Messrs. Newbigging's report. I certainly was asked about the figures. But I would never have gone out of my way to make an observation about their figures if I had not been asked; nor would I do so now unless forced to do so by the manner in which they have criticized mine.

I am glad to see that Messrs. Newbigging are prepared for a reduction in the 4·659d. per gallon. They are mistaken entirely in saying that any blunder of mine is the cause of the wrangling; and they should have verified that statement before having made it. Messrs. Newbigging will discover, on inquiry, that the illuminating power of coal gas in this country is stated in candles per 5 cubic feet; and that when people speak of 15-candle gas, for example, that is only a ready and handy way of saying that 5 cubic feet are equal to 15 candles, and consequently that one cubic foot is equal to 3 candles. I do not see how Dr. Dvorkovitz can be an authority on this matter, since he commenced, in July, 1894, with candles similar to mine, and on the 1st of April, 1895, sets them five times too high in number. I have shown how he passed through a transition stage; and he is still not clear on the subject. I am informed by you that the cause of all the wrangling was that yourself and certain members of the Committee could not understand the extraordinarily high results given by Mr. Charles Wood. He was asked to look into them. It was discovered that the candles employed in July, 1894, by Dr. Dvorkovitz had become increased by five. A little goodwill would have explained the affair, and have prevented you and others from seeking to learn the truth about such matters outside.

The question of the price of oil—and I have shown that Messrs. Newbigging have made two different statements on the subject of their price of 3¼d. per gallon that do not altogether coincide, especially when they are taken in conjunction with this correspondence about the inferior quality of the oil, that Mr. Wood's own figures disprove—is very simple. I wrote to the Town Clerk to ask the Committee to have prices obtained for the same or similar oil. The price furnished me by the Town Clerk was 3·8d. per gallon, including hire of tank-waggons. This price was slightly lower than one other quotation put before me, and the same, I understood, as a quotation previously made for a very large quantity. This disposes of the question of price, which was rumoured at first as being based on small quantities taken for experiment; later on as being that "on which the results of other enriching processes have been based;" and more recently as the price because it was of "inferior quality." I consider I have been able to dispose of all these contradictory statements.

It is complained that I did not take the best basis for the valuation of the bye-products (oil-gas tar). There were several open to discussion. Of those that were possible, I took that one most favourable to the oil gas. There were the following bases: (1) Its value as a fuel. This is less than ½d. per gallon at Bradford. (2) Its valuation for distillation. I do not see how the Corporation could be reasonably asked to enter into a gas-enrichment process that would entail the installation of a tar-distiller's business for the relatively small quantity of oil-gas tar to be distilled. (3) Its valuation on the basis of the conditional offer made by the Syndicate, reported in July to be 6d., and now 3½d. per gallon. I have already discussed this; and further say that, even had I been asked by the Committee to adopt this basis, I should have in my report declined all responsibility, and would have held out no hope that other persons not favoured with such an offer would be able, in the open market, to secure more than ¾d. per gallon.

I found for the portion of oil volatilized 1550 candles per gallon. Had we been enriching with pure benzol, instead of with crude tar, which there is every reason to suppose would exert a prejudicial effect, by absorbing some traces of hydrocarbons from the gas, we could not have obtained more than 1700 to 1800 candles.

Having thus replied in detail to all the criticisms that it has been thought convenient to launch at me, I now claim the right of asking for a clear answer to those I have advanced against my opponents' criticisms. How do Messrs. Newbigging explain their two statements respecting the price of oil—viz., 3¼d. per gallon? The importance of this question they will not fail to recognize. How do they know that the oil was inferior? How do the people who claim that Mr. Wood's results must be accepted as final, explain that his figures prove that the oil must have been superior? How do Messrs. Newbigging explain their assertion that my way of stating results in candles is a "darkening of counsel," with pages 50 and 51 of their "Handbook," fifth edition, enlarged? In a future, and I suppose to be further enlarged, edition of that work will, I ask, Messrs. Newbigging retain the "precious 5" (to employ their own elegant style), or will they enlarge the number of candles, even at the cost of reducing the new edition by leaving out the "precious 5"?

Dr. Dvorkovitz succumbed to the hypnotic influence of the Bradford enlarged candles. The first mention of this change of ideas on the subject of candles, I find in a report purporting to be signed by him,

and dated the 1st of April, 1895.* When, may I ask, did Messrs. Newbigging change *their* opinion? I also ask them to justify their statement that I ever advised the Committee that Mr. Wood's figure of cost per candle was altogether wrong, and should be multiplied by five.

I am somewhat acquainted with Mr. W. Wood's reports, as also with those of Messrs. Newbigging; but I do not remember that Mr. Wood ever calculated his costs at per candle. I find that he calculates indifferently in "thousand feet-candles" or in "candle-thousands," which are, according to him, equivalent terms. I call upon Messrs. Newbigging to justify their statement about what they say I advised the Committee—a statement that I do not recognize as mine. Can they explain why they go back upon their "Handbook"? Has it anything to do with their statement—a statement that I deny—that my "blunder" was the cause of all the wrangling? How do Messrs. Newbigging explain their reference to high-class cannel?

How do the parties concerned explain the correspondence about the alleged inferiority of the oil used in the last test, which, by Mr. Wood's test, is proved to be superior? How do they explain why they take 23-candle (enriching) cannel at 14s. 6d. per ton, when Bradford figures (Mr. Wood's) show that he obtains 28 to 30 candles for 13s. 3½d.? How do they explain that on the 20th of September, 1895, the inventor is claiming the carburettor as an integral part of his invention, and on the same day Mr. Shaw is declaring it to be no part of their oil plant, but the suggestion of the Corporation Engineer? How do they explain that Mr. Shaw writes on the same day claiming that the thirty-six hour test was unfavourable because of the inferiority of the oil, "as notified at the time to the Town Clerk by the firm who supplied it," when, by the letter of Messrs. Newbigging of the 7th of September, it appears that it was the Town Clerk who notified the alleged inferiority of the oil to the firm in question?

How is it to be explained that Mr. Shaw writes at the same time, and, as another reason, that the unfavourable result is because of "the omission of any allowance for the value of the bye-products," and yet I had valued them in my estimate at 1·7d. per gallon? How is it explained that Dr. Dvorkovitz allows himself to say that my tests are not satisfactory; and yet they were confirmed in every particular by the representatives of Mr. Smith (*vide* Mr. Newbigging's letter, already quoted)? How do they account for the statement in the *Bradford Observer* that I had estimated the saving at £3125 when it was estimated at £942?

All these different statements, which appear to me to be very much ajar, may be good enough for the untechnical public. It remains to be seen if they can be explained in a manner satisfactory to those who understand the subject they relate to.

The case has its comic sides; but I make a point of asking Messrs. Newbigging to explain their two statements about the price of the oil in conjunction with the letter they publish from the firm that obtained it, as I understand (but I am open to correction), from the Kerosene Company.

It has been stated (Messrs. Newbigging have not stated it) that I said I would make no use of carburetting trials. I can dispose of this story at once. It is not true. Mr. Newbigging, jun., must have very strangely misunderstood his position in the matter if he supposed that he was entitled to make conditions with me. I was conducting the inquiry for the Corporation; and he was allowed to be present to watch all the tests I applied (I had liberty, by my arrangement with the Corporation, to apply all I thought proper), and he had equal facility given to him by me to make the same tests for himself. I never attempted to get between his proper judgment and his principals. Much less would I have allowed him or his father to do so with me. I never treated it as a matter for a collaboration of reports; and I could not understand what they had to do with my report, when they telegraphed on the 31st of July asking if I was sending in my report for the 2nd of August, and why Mr. Newbigging, sen., should require a meeting to agree upon certain matters of fact. The test had been made in the presence of the representative of the process. If the tests agreed, as they did, so much the better—there was so much less ground for debate; though even in this case of the tests which do agree (for the difference is less than 1 per cent.), Dr. Dvorkovitz is not satisfied.

A certain matter that happened revealed to me before the commencement of the second trial that an attempt might be made to put "Mr. Newbigging" in as collaborating with me against the orders and the meaning of the Committee, which were that I was to conduct a trial with the assistance of the officials of the Corporation, and that Mr. Newbigging should be allowed to represent Mr. Smith. I observed that, in an article in the *Bradford Observer* of Sept. 10, he is now promoted to the position of the "senior expert." I never permitted Mr. Newbigging, jun. (who cannot complain of the courtesy with which he was treated by me), to collaborate with me. The results he publishes are his; those I publish are mine.

The inventor endeavours to throw upon the Gas Committee the onus of proving the value of these bye-products (oil-gas tar). Does anyone know what that means? It means that an article, about which there is no published information on which a trade distilling value can be based, is part of their process; and the Committee is called upon to prove its value for distillation in the only way possible—by distilling it in a practical manner, and selling the products in the market in order to get them classed. This is a cool piece of business. Did it never occur to them that it was their duty to do this? Why should any Gas Committee be railed at because they have not proved that laboratory figures can be justified in practice, when the owners of the process are not able to show that they have made any serious attempt to provide the required proof? I am tired of pointing out these contradictions; but there are many other matters that have not escaped my attention.

LEWIS T. WRIGHT.

[By a slip of the pen, it was stated, in the lines introducing the documents on this subject which appeared in the JOURNAL last week, that Dr. Dvorkovitz had asked us to publish Mr. Lewis T. Wright's first report. As mentioned in the foot-note to Dr. Dvorkovitz's letter in the previous issue, it was Mr. Wood's report on the 33 days' test that he asked us to reproduce, with his reply thereto. This we did; and, in order to make the story complete as far as possible, we also gave Mr. Wright's first report. In Mr. Wright's letter of the 21st ult. to the Chairman of the Gas Committee, the date of the conclusion of the last trial is given as the 27th of July. The writer informs us that it should have been the 26th.—ED. J.G.L.]

Messrs. T. Newbigging and Son send us for publication the following letter in reply to that of Mr. Lewis T. Wright of the 21st ult., which appeared in the JOURNAL last week (p. 683):—

Sir,—We have read Mr. Lewis T. Wright's letter dated the 21st ult. [*ante*, p. 683], a portion of which purports to be a reply to ours of the 7th ult.

In a controversy of this kind, the resort to personalities should have been avoided. We regret, therefore, that Mr. Wright has endeavoured to institute a comparison between himself and us, to our disadvantage, on the question of fitness to deal with the matters at issue. In this connection, he trumpets his "twenty-three years' experience" in the use of cannel. This is the kind of boasting usually indulged in by disputants when worsted in argument. We say, in reply to Mr. Wright on this head, that if he will add nineteen years to his twenty-three, the sum-total will represent the duration of the experience of one of us with the same material; but that is neither here nor there. Whatever words have been bandied by others in a discussion which has caused a great deal of virulent writing and speaking, we at least have not hitherto questioned Mr. Wright's fitness to deal with the points in dispute; and it would have been only professional courtesy had he observed the same behaviour in regard to our qualifications.

Mr. Wright professes to have ascertained that the present Bradford contracts for cannel range from 9s. 6d. to 15s. per ton, and that the average is 13s. 3½d. Assume for the moment that this is so, what justification has Mr. Wright to offer for taking the price at 13s. in his estimate of the cost of enrichment by cannel? Further, why does Mr. Wright now abandon the claim for 19½ gallons of tar, which he assumed in his estimate would be the yield per ton—dismissing it with the remark that "it is too trifling to discuss"? The difference between a yield of 14 gallons (our figure) and 19½ gallons (his figure) is 28 per cent.; and this calculated out into money makes 10 per cent. on a reduction in the total money-value of all the residual products taken together, and at the prices assumed by Mr. Wright. Then as regards the ammoniacal liquor, his figure of value is equally absurd, as it represents the whole profit from the Chemical Department of the Corporation, which, among other things, includes the manufacture of sulphuric acid. These corrections made will materially raise his figure of cannel enrichment cost; and yet he has the temerity to assert that it is impossible to "affect his estimate by the one-hundredth part of a penny." But it is a thankless task attempting to follow Mr. Wright in all his sinuosities.

It is important to remember, in speaking of the price of cannel, that at the time when the introduction of the oil process was first entertained—viz., in 1893-4—the average price paid by the Bradford Corporation for cannel per ton was 17s. 8¾d. and 14s. 10½d. in those years respectively.

We agree with Mr. Wright that the real question at issue is not the cost of cannel enrichment, but the value of the bye-products from the oil process. It would have spared much unnecessary trouble had this occurred to him sooner. How has Mr. Wright arrived at his estimate of their value? By a brief test made in a carburettor, which is not a part of the Dvorkovitz apparatus, and which at the time of making the experiments we jointly condemned. We said at the time, and Mr. Wright fully agreed with us, that any conclusions drawn from its use during a brief experiment would be absolutely untrustworthy. In spite of this, he has based his estimate of the value of the bye-products on a three hours' test made with the carburettor, against which experiments there was a unanimous protest. Mr. Wright when at Bradford agreed to ignore these tests in making his report; but, instead of doing so, he has made strenuous use of them, to the disparagement of the oil process. Our value of them was arrived at from an analysis made by a competent and independent chemist. We embodied his analysis in our report; and we would refer those interested in the subject to the contents of that report.

The remainder of Mr. Wright's letter is taken up by an endeavour to show that we prejudged the case by making a statement about the quality of the oil, and that such statement was made without his authority. Had it been necessary, or had we desired, to make a statement, we did not require the authority of Mr. Wright for doing so. But we deny that we made any statement whatsoever until our report appeared. It shows the poverty of Mr. Wright's arguments when he attempts to make capital out of this. It was well known to everyone in any way connected with the experiments, that the oil used was inferior in quality. It was the only oil obtainable at the time. The matter was no secret. The firm who supplied it wished it to be clearly understood that the oil was inferior, and so informed the Town Clerk in a letter. Mr. Wright should be the last person to speak of prejudging the case, seeing he had expressed an opinion on the cost of enrichment by this process, basing his statement on Mr. Wood's figures, before being called in to examine and report on the process itself.

Mr. Wood is quite in order in his calculations in expressing the terms in "candle-thousands." This is a form of expression applied, as is well known, in many other departments of scientific inquiry; and it is a matter of surprise to us that such an elementary fact should need to be stated. Mr. Wright's proposed form of expression—viz., "the cost per thousand per candle per 5 cubic feet"—is both clumsy and unscientific. The 5 cubic feet as consumed in the standard test has no bearing whatever on the general question under discussion. When once the illuminating power has been ascertained, the 5 cubic feet drops out of consideration, because it is not a factor in the statement of the enrichment cost. This is only Mr. Wright's endeavour to give a colouring of justification to what follows.

Mr. Wood, the Gas Engineer of the Corporation, has pointed out in his letter of the 3rd ult. that on his calculations of the cost of enrichment by the process—viz., 0·42d. per thousand cubic feet—being submitted to Mr. Wright, the latter pronounced them to be incorrect,

* See JOURNAL, Oct. 1, p. 680.

and asserted that the figure of 0·42d. should be multiplied by 5, bringing up the cost to 2·1d. per 1000! This was a serious statement for Mr. Wright to make, because it has been a proximate cause of all the subsequent bickerings. If it had been true, it would have effectually undermined the professional reputation of the Corporation Gas Engineer, and jeopardized his position. Being incorrect, it recoils on Mr. Wright himself; and as he has not had the manliness to apologize for his initial blunder, his action, both in this instance and subsequently, may be left to the judgment of unbiassed readers.—We are, &c.,

THOMAS NEWBIGGING AND SON.

5, *Norfolk Street, Manchester,*
Oct. 2, 1895.

ELECTRIC LIGHTING NOTES.

The ratepayers of Yeadon seem to be a little chary about adopting an electric lighting scheme which the District Council wish to undertake; their fear being that, in a scattered place like Yeadon, it will not pay. The question was placed before a public meeting last Friday week. The principal speaker was Mr. F. H. Medhurst, who had been called in by the Council to advise on the tenders submitted, and had recommended the acceptance of the tender and scheme of the Brush Company. The tender, he said, amounted to £5487; but it did not include buildings, foundations, connections with the consumers' premises, excavating and making the roads good again, sundry charges, contingencies, &c., which he estimated at £1795—thus bringing the total cost up to £7282. The plant was to be equal to supplying 1800 lamps, besides 146 street-lamps; and although the undertaking would not quite pay interest and sinking fund during the first and second years, he believed that in subsequent years there would be a surplus. The charge proposed to be made was 10s. per lamp per year. Among the speakers who condemned the proposal was the Chairman of the Council (Mr. Hudson). After a full discussion, it was decided to defer the question for three months; and, in the meantime, the Council are to ascertain the number of lamps that would be taken up.

An application of the St. Helens Corporation to the Local Government Board for sanction to borrow £10,000 for the purposes of electric lighting was the subject of inquiry by Mr. F. H. Tulloch last Tuesday. The case for the Corporation, as stated by the Town Clerk (Mr. W. J. Jeeves), was that the Corporation owned the gas undertaking, and had therefore a special interest in keeping control over the electric lighting. In former years, there had been applications by various companies for Provisional Orders to authorize them to supply electricity within the borough, which had been consistently opposed by the Corporation, as they felt that they ought to have control themselves, but believed the time had not then come for the installation of the light. In 1894, the Corporation considered they ought to have power to put down an installation; and they therefore applied for an Order, which was granted. It was proposed to put down an installation at the gas-works. The plant would be sufficient to meet any demands for electric lighting likely to be made within the immediate future, and would be capable of extension should the requirements warrant it. The fact that the new technical school and free library, now in course of erection, would be lighted by electricity, was the particular reason for the application, and formed the policy by which the Corporation were actuated. In reply to the Inspector, the Town Clerk stated that the contracts for the plant had been let, subject to the approval of the Local Government Board. The application was not opposed.

The Liverpool City Council last Wednesday passed a resolution to the effect that, in accordance with the agreement dated May 28, 1895, between the Liverpool Electric Supply Company, Limited, of the one part, and the Corporation of the other part, a further agreement be made by the Corporation with the Company to complete the purchase of their undertaking, works, and property within six weeks from the date of an Act of Parliament authorizing the sale to the Corporation, provided the Act is passed in the year 1896.

The Exeter City Council last Wednesday decided to affix the seal to a conditional agreement with the Electric Lighting Company for the sale and purchase of their undertaking. The agreement is for the Council to purchase the works, subject to the approval of the Board of Trade and the sanction of the Local Government Board, for the sum of £7500. It was also resolved to make application to the Local Government Board for permission to borrow £11,000 for the purposes of electric lighting. It was anticipated that £3000 would have to be expended, in addition to the purchase-money, in laying down new dynamos and other plant.

The Hull Corporation having applied to the Local Government Board for permission to borrow £8000 for the purposes of electric lighting, an inquiry into the matter was held by Mr. R. Walton last Wednesday. It appeared from the statement of the Town Clerk (Mr. R. H. Dawe) that £4324 had already been expended in payment of contracts which were in excess of previous estimates; and the balance was required for the purchase of plant to meet the increased demands for the light.

The electric lighting capital account presented to the Hampstead Vestry last Thursday evening showed a deficiency on the 25th ult. of £522. Mr. Johnson wished to know what was being done in the matter of this gradually increasing deficit, and whether any steps were being taken with reference to raising fresh loans. The Vestry Clerk (Mr. A. P. Johnson) pacified the inquisitive member by stating that the Committee would consider the whole matter at their next meeting.

The electric lighting question was discussed at a special meeting of the Swansea Town Council last Wednesday; and a scheme adopted by a majority of one—eleven members being absent. We can only briefly record the fact to-day; but we may at the same time express the belief that the decision will be challenged, and the matter dealt with afresh by a fuller assembly of councillors.

A fire broke out early last Sunday morning at 91, Onslow Gardens, South Kensington—a private residence in the occupation of Mr. A. Hughes. A man passing the house noticed flames issuing from a grating close to the pavement. On an examination being made of the vault under the roadway, it was discovered that an electric transformer had caught fire. The flames were speedily extinguished; but the electric apparatus was completely destroyed.

EAST LONDON WATER-WORKS COMPANY.

The Half-Yearly General Assembly of the proprietors was held last Thursday at the Company's Offices, St. Helen's Place, E.C.—Mr. GEORGE BANBURY presiding.

Mr. J. PURSER having read the notice calling the meeting, the report was taken as read.

The CHAIRMAN stated that the increase in revenue from water-rates during the last six months, when compared with the amount received in the corresponding period of the previous year, was £5458; showing that their anticipations as regarded the extension of building operations in that part of their area which was outside the Metropolitan district were being realized. The income derived from the houses newly supplied averaged only £1 1s. 0¾d. per tenement; and when one calculated that they gave their consumers 36 gallons per head per day (which was really more than anyone could fairly use), this cost only came to about ¾d. a week for each individual. Many of the shareholders might say that the business of supplying thousands of houses, as they now did, at rates considerably below this average, must be rather a philanthropic than a remunerative undertaking; but they must take the bad with the good. At their last meeting, he spoke about the long and severe frost of 1895—unparalleled, he believed, during the present century. He also alluded to the measures they had taken to mitigate the great inconveniences to their customers; and he further mentioned the heavy demand that would be made upon their exchequer through this memorable winter. This half year they had to meet that demand; and the increase in their working expenses—purely owing, he might say, to this severe winter frost—came to no less than £18,700, thus eating up the whole of their reserve fund, which they had been putting by from time to time with such care. This heavy charge included a sum of £3617 for the hire of water-carts from vestries and local boards, to convey water to frozen-out consumers. It was, indeed, a severe task afterwards to repair all the bursts in the mains and the broken service-pipes over so large an area as that which they had to deal with. It was, however, all completed in the London district by the 8th of April, and in the outside district by the 19th of that month; so that those very ingenious, but very ill-informed minds that attributed their subsequent excessive pumping to "shattered mains," were singularly in error. The expression "shattered mains" was somewhat catching; but it was most delusive and erroneous. Owing to their having had, as usual, to oppose Bills brought against them in Parliament by the London County Council, there was an increase of £1600 in law charges; and there was the customary unwelcome rise in rates and taxes to the parishes. The increase this year was £1600; and their annual payment to the parishes now was £30,000. From whom this amount was to be extracted when the Company no longer existed to pay it, was rather a curious problem. He did not know from whom they would get it then. As to the progress of works, although Mr. Bryan's time and attention had been greatly taken up by other important matters, excellent progress had been made with the works now in hand. Their two large covered reservoirs at Buckhurst Hill and Hagger Lane were very near completion. The reservoir at Hagger Lane would contain 8 million gallons; and both would supply householders by gravitation. At Ferry Lane, their new filter-beds and triple expansion engine were at work, doing very good service in the Essex district. Improvements and measures for increasing their power of supply were being carried out at Chingford, Walthamstow, and Lea Bridge; and the enlargement of the present Racecourse reservoir, so as to increase its capacity by nearly 200 million gallons, had made such excellent progress under Messrs. Kirk and Randall, that they hoped it might be completed at the end of the year. But the main, and most interesting operations were the construction of the two large reservoirs at Walthamstow, comprising a water area of 80 acres, and capable of holding about 400 million gallons. Messrs. John Aird and Sons obtained the contract by tender; and the rapid progress made, owing to this firm's abundant resources as regarded skilled superintendence, men, and plant, had been everywhere acknowledged, and duly appreciated. When he was there last, he found that 29 steam-engines were employed for various purposes, and that six locomotives were running over six miles of rail. When one watched the progress of these extensive works—which would be a blessing, not only to the present, but to future generations—it was strange to think that they would be completed in spite of the relentless opposition and unceasing obstruction of the Progressives of the London County Council, and in spite of the votes and would-be veto of the then Government. These were the works authorized by the Bill which they were enabled to get through the House of Commons by a majority of one vote. When that Bill was sent to the Committee after this severe struggle, the latter were so impressed with the necessity of the proposed works that they ordered them "to be prosecuted with all due diligence;" and this had been done faithfully and energetically. The Government Analyst (Dr. Frankland) gave their water a high character. He ranked them next to the New River in regard to purity; and stated "that after our storage and efficient filtration, the water was of excellent chemical and bacterial quality for dietetic purposes." Their whole financial position—and their very existence, indeed—depended on what was going to take place in Parliament; so it was best to tell them the exact state of their affairs. At the last meeting, he mentioned that the Bills for the acquisition of the Lambeth and the Southwark and Vauxhall Water-Works, promoted by the London County Council, had been referred to a Select Committee, eventually presided over by the Hon. David Plunket; and that the Bills of the other Companies were down for second reading on May 3. That was the position when he last addressed them. As regarded the latter Bills, postponements followed from time to time; so that the second reading of them did not take place before the somewhat sudden dissolution of Parliament. In the case of the two former Bills, the other Companies and the outside authorities were allowed to appear before the Committee, and show cause against those principles and provisions in the Bills which they deemed objectionable, and which were common to all the other Bills to be brought up thereafter. This naturally lengthened the inquiry,

which virtually resolved itself into a discussion as to the basis upon which all the Companies should be eventually purchased. The Committee began their sittings on May 14, and continued them until July 3, when the Chairman announced "that they had nothing to do but dissolve themselves, because of the early dissolution of Parliament." The inquiry was necessarily incomplete; and the Committee did not, in fact, decide whether, in face of the important evidence produced, and the decided objections of the outside authorities, the London County Council were the proper body to whom the Water Companies should be eventually sold. He might mention that before the Committee two members of the London County Council came forward, and deprecated the transfer to their body. They were two very prominent members of the Council; and their evidence might have carried some weight. He might briefly mention two important principles which the Committee laid down, subject to the main question of transfer being decided. First, as regarded the specific and one-sided instructions which the London County Council wanted to be given to the Arbitrators, and which would have compelled the latter to exclude from consideration points which enhanced, and to consider points which depreciated the value of the undertakings, the Committee recorded as follows: "They do not feel justified in endeavouring to influence in any way the impartial exercise of that (the Arbitrators') discretion; and they are unwilling, by special reference to particular circumstances, to seem to prejudge their consideration, or by implication to exclude or affect the consideration of any others which may be submitted to the Arbitrators"—thus leaving the Arbitrators free and unfettered in their powers, as such persons ever should be. The second important point was that the whole of the Companies should be taken over simultaneously; thereby preventing competition with, and unfair treatment towards, those which would have remained to be bought. The Committee conceded to the Companies these two very important points, upon which their Counsel laid great stress. There were other unjust and objectionable provisions in the Bills; and one of them was rather extraordinary, for by it they were to be given over at a date long before the County Council had paid the purchase price, or even before the Arbitrators had made their award. There was also the power to cancel previous engagements and contracts. The important contract for the two large reservoirs at Walthamstow might thus have been put an end to. Time, however, had not permitted discussion on these provisions; but from what they saw, there was every reason for believing that they would have been fairly dealt with throughout by that Committee. There seemed to be no doubt that the inquiry before Mr. Plunket was abortive as regarded practical result, and that the Committee itself was defunct—indeed, several of its members had not been returned to Parliament. As to the future, he learned that the London County Council could, if they so decided, move that the two Bills relating to the Lambeth and Southwark and Vauxhall Companies be referred to a fresh Committee; but they could not go on from where they left off, and the inquiry must be re-opened *ab initio*. The other Bills which were not read a second time could be introduced into the House at the stage at which they were left; but it was apprehended that no new matter involving any change of principle could be inserted into them. The expenditure of thousands of pounds in repeatedly defending these cases against the London County Council, was a very serious matter to their shareholders; but their adversaries could advance against them with a light heart, knowing, as they did, that the unrepining ratepayer had to settle their bills. He now came to a delicate point, upon which he could not say as much as he had at first intended; but they would naturally expect him to refer to the recent great drought, and its unfortunate effects upon their consumers and themselves. He had been prepared to explain to them all the details, and the complete answers which the Company had to the various charges which had been made against them; but, as they were aware, the Local Government Board had ordered an inquiry into all the circumstances. As that inquiry was now proceeding, it would be unbecoming on his part, and even disrespectful, to the Commissioners if he were to dilate upon the facts about to be placed before them. They would, however, have seen the letters and statements of the Company in the Press; and there was a singularly clear and comprehensive report in *The Times* of Aug. 6, from their special correspondent, which very impartially summed up the whole case. He might, however, just briefly say that there were two articles in *The Times*—one on July 29 and the other on Aug. 6—which put the case so clearly, that they were really well worth reading and considering. He had thought of having the two articles printed, so that they might take them away with them from that meeting; but other things had caused him to overlook the matter. He might just briefly remark that, had it not been for the action of the London County Council, there would have been no occasion to resort to an intermittent supply; and if people had only had cisterns in their houses, as prescribed by law, no practical inconveniences would have arisen when the intermittent supply was resorted to. He might add that they resumed the constant supply on Sept. 8. He must say one word upon the important question of waste. There was a well-known authority—a civil engineer—who lately wrote in *The Times*: "Unfortunately, London householders have not yet learned the lesson that waste of water is a grave offence against the community at large." This was, indeed, true; and their consumers, having grown accustomed to receiving an unlimited supply, had become thorough spendthrifts in its use. As the water belonged to a private company and not to a municipality, great extravagance, rather than reasonable economy, was the order of the day. If in days to come they were taken over by a municipality, he fancied that the means the latter would take to prevent waste would be more strict than those of the Company; and people would also consider that it was advisable to keep the consumption down in view of the rates. He had on several occasions mentioned their Engineer's wonderful power of overcoming difficulties, and of carrying out improvements and extensions; but this year his task had been unusually severe, owing to the drought and frost. In fact, he had been tried to the utmost; but he was happy to say that Mr. Bryan's health still continued, and he (the Chairman) trusted that when the existing difficulties were over, he would be able to go away for a time and rest in quietude. Mr. Crookenden, as usual, had afforded them great aid during the parliamentary inquiry; and of late his post had been one of great difficulty, for he had been very much harassed. Both these gentlemen were at that moment attending the inquiry before the Commissioners. In conclusion, he might say that the proprietors doubtless clearly understood that the memorable and, to the Company, disastrous frost of last winter, had not only caused them infinite trouble and anxiety in alleviating the inconvenience to their consumers, but had also hit them very hard financially. It had compelled them to reduce their dividend, and had swallowed up all their reserve fund. They had thought it the wisest course to settle these heavy frost bills as they came in, and not allow them to remain as troublesome demands upon future income. Although they had thus received a temporary financial blow, there was little cause for anxiety. Their constitution was sound, and they possessed plenty of recuperative power. Their area of supply was increasing in population, their new works would ere long be aiding them most materially, and their whole system—in the shape of engines, mains, reservoirs, and plant—was in excellent order; so that, with seasons even of the most ordinary character, and with trade maintaining its present aspect, they might reasonably hope to regain their former position. They, as Directors, certainly welcomed the Local Government Board inquiry now being held regarding the temporary cessation of the constant supply, as there appeared to be no ground for apprehension. In fact, they rather courted the investigation; for, as the proprietors were all by this time aware, whenever their case came before a just and competent tribunal, they invariably benefited thereby. He then proposed—"That the Directors' report and accounts submitted to the meeting be received and adopted, and that, as recommended by the Directors, a dividend of 3½ per cent. (less income-tax) on the ordinary stock of the Company for the half year ending Midsummer, 1895, be declared."

Mr. H. Dalton seconded the motion.

Mr. F. B. Brown said that their money had been wasted in the frequent attacks made on their property. First, there was a Royal Commission; and the result was that they were exonerated. But not satisfied with that, another complaint was urged against them—this time about the frost of last year. He did not, however, suppose that they were the only Company that suffered from deficiency of water. He was at Brighton last summer, and could not get any water for three weeks. Because they were private individuals, they were attacked. The Chairman had said that the Directors welcomed the present inquiry; but as a shareholder, he did not. As it was, their dividends had been reduced by ½ per cent.; and he thought it was time that the inquiries into their affairs were put a stop to. Although they had spent £20,000 extra through the frost, yet some portions of the Press had said that the Company had done nothing to relieve the inconvenience and suffering caused by the frost. He hoped the Directors would not get frightened by the attacks on them, and spend the shareholders' money too freely. He was sure that the shareholders as a body would support them in meeting the unjust and lying charges which had been made against the Company.

Mr. Ilsley said he thought that the pending inquiry was a good thing for them, as it would enable the Directors to answer so perfectly the charges brought against them. There was a mania on the part of some people against Water Companies. Anything said to their detriment, was accepted by these people as fact; and they could not listen to what was urged on the other side. It was absurd to talk of a "water famine" where people were offered, as by their Company, 25 to 30 gallons per head per day; but it was not the Company's duty, and they had not the power, to place proper vessels in people's houses for the reception of the water.

Dr. Chesshire referred to the latest scheme of the London County Council for obtaining a water supply as the most ludicrous he had ever heard of. He had a paper in his hand, which informed him that in Glamorganshire and Cardiganshire people were crying out for water. It was therefore absurd to go to a place for water where none existed.

Mr. Goodwin said he had heard with satisfaction that the Directors courted the inquiry now being made by the Local Government Board; and he trusted they would come out of it triumphantly. What, however, had struck him, as an outsider, was that it was most unfortunate that the East London Company should have been the only Company to stop the constant supply, and against which allegations had been made with reference to the supply to poor people. All the Water Companies were, as it were, on their trial; and it was most unfortunate that at such a juncture their Company's property should be depreciated.

The Chairman suggested that these matters should not be discussed at that moment, in view of what he had already said as to the Commission that was now sitting, but for which, as he had pointed out in his opening remarks, he had been prepared to explain everything, and give complete answers to the allegations made against the Company.

Mr. Goodwin said he was quite in the Chairman's hands; but he hoped that the shareholders, after the inquiry, would have an opportunity of hearing more on the subject, and that it would not be left simply for the public Press to discuss.

The Chairman, in reply to questions, said that they were bound to give the constant supply in the Metropolitan area; but outside it was not compulsory. It could hardly be said that the shareholders' money had been thrown away in connection with the inquiries which had been made into their affairs, for the decisions which had been given had been greatly to their benefit; and the misstatements which were sometimes made against them in certain organs of the Press were thus answered. Mr. Ilsley had said it was absurd to call what had occurred a famine; but he had noticed that that word was always put in inverted commas in those papers which knew anything about the matter. The scheme proposed by Mr. Binnie and the London County Council for a water supply, would be subjected to a great deal of criticism; but he did not think it would be advisable for him to say anything further about it. He then put the resolution; and it was carried unanimously.

Mr. Ilsley proposed a cordial vote of thanks to the Chairman and Directors.

Dr. Chesshire, in seconding the motion, stated that in Birmingham, where the water undertaking had been sold to the County Council, the rates had recently been put up by 33 per cent.; which was "only a very small instalment" of what was coming on the ratepayers.

The motion was carried; and a similar vote was afterwards passed to the Engineer and the Secretary.

THE RECENT SCARCITY OF WATER AT THE EAST-END.

Proceedings to be Taken against the East London Water Company.

At the Meeting of the London County Council last Tuesday, the Public Control and Water Joint Committee reported that, after due consideration of the matter of the deficient water supply in the East-end of London, they had come to the conclusion, upon the advice of Counsel, that they should prosecute the East London Water Company for penalties under the Metropolis Water Act, 1871. They therefore recommended that the Solicitor be instructed to take proceedings against the Company for failure to maintain a constant supply, as required by the provisions of the Act. Mr. Beachcroft pointed out that a Local Government Board inquiry upon this very matter was in progress; and surely, he said, it would be in their interests to wait and know the result before they put themselves in such an antagonistic attitude towards the Company as to prosecute them for penalties. They owed a little mercy even to the Water Companies. He could not believe that any of the Companies were wilfully at fault, or that the Directors were anxious to diminish the quantity of water in their pipes, or to favour one set of consumers as against another. He moved the following amendment: "That it is inexpedient for the Council to commence proceedings against the East London Water Company without further information as to the advantage to be secured to the ratepayers by a conviction, pending the Local Government Board inquiry; and that accordingly the Committee be instructed to bring up a further report at the conclusion of that inquiry." Sir J. Dimsdale seconded the amendment; but, on a division, it was lost by 16 votes to 64.

Local Government Board Inquiry.

The inquiry instituted by the Local Government Board into the alleged deficiency of water supplied by the East London Water Company was opened at the Hackney Town Hall last Tuesday, before Colonel Ducat, R.E., and Dr. F. W. Barry, two of the Board's Inspectors.

The investigation was held at the instance of the East London Vestries, who were represented by Mr. Balfour Browne, Q.C., Mr. T. H. Bevan, and Mr. W. H. Eldridge; Mr. W. A. Blaxland (Solicitor) and Mr. Freeman appeared for the London County Council; Mr. G. P. Goldney (City Remembrancer) for the Corporation of London; and Mr. Pember, Q.C., and Mr. Cripps, Q.C., M.P., for the East London Company.

Mr. Balfour Browne, in opening the case, said this was an inquiry instituted by the Local Government Board, on the application of the Hackney Vestry and other Local Authorities, into the causes and effects of a scarcity of water which prevailed in the East-end of London during June, July, and August last. A letter dated Sept. 3, 1895, received from the Local Government Board ran as follows: "I am instructed by the President of the Local Government Board to state that, having considered the representations that were submitted by the deputation which attended here on the 30th ult., he has given directions for the holding of an inquiry as to the circumstances which occasioned the deficiency of water supply in the Metropolitan area comprised in the district of the East London Water-Works Company, the effects of the widespread deficient water supply having regard to the public health, and the means which should be adopted with the view of preventing the recurrence of such difficulty." First, with regard to the scarcity of water, there could be no doubt whatever; but as to the "widespread" scarcity, that would have to be proved. The effects of a deficient water supply would be given by various witnesses. Possibly his friend Mr. Cripps would admit that, if the supply was not sufficient, the effects would be deleterious on a teeming population like that in the East-end of London. As to the means which should be adopted with the view of preventing a recurrence of any such deficiency, the suggestions of the promoters of the inquiry could only be tentative. They awaited with some impatience what the East London Water Company proposed in order to avoid this deficiency in the future. The inference from the facts was that the primary cause of it in the past was the Company's negligence. They supplied an area estimated to contain a population of 1,202,557 persons; and the quantity of water required to serve it was between 40 to 50 million gallons per day. The Company's sources of supply were mainly from the Rivers Lea and Thames. They had power to draw from the Thames about 10 million gallons a day; and there were a very large number of important works, some of which were merely for the collection, and others for the pumping, of water. These works were situated at Walthamstow, Lea Bridge, Chingford, Sunbury, Hornsey Wood, High Beach, Woodford, and Waltham Abbey; but the most important were at Lea Bridge. The Company were incorporated in 1807; but in 1852, after the cholera epidemic in London, the Act of 1807 and another of the Company's Acts were repealed. Their district was afterwards extended; and various provisions were made, one of which bore upon the question of constant supply. In 1852 and 1863, further Water Acts were passed; but the Metropolis Water Act of 1871 was the principal statute on this subject. Under section 7 of the Act, the provisions that had formerly been made with regard to constant supply were somewhat modified. The section provided for a supply of pure and wholesome water sufficient for the domestic purposes of the inhabitants constantly laid on at such pressure as would make the water reach the top storey of the highest house in the Company's district. There were various other provisions in the Act as to when the constant supply was to be demanded. Section 15 specified that, "notwithstanding anything in this Act, a company shall not be subject to any liability for not giving a constant supply if the want of such supply arises from frost, unusual drought, or other unavoidable cause or accident." This exempted the Company from the duty, and also, of course, from the penalty for not performing that duty, under such conditions. They would see whether or not these conditions exempted the Company in this case, or whether the cause of this scarcity was outside this section altogether. Then, by section 16, a company who violated, refused, or neglected to comply with any of the provisions of the Act were to be liable to a penalty of £200, with a further penalty not exceeding £100. With regard to the last section, his clients were not asking for a penalty, because the Local Government Board, which had taken the place of the Board of Trade, had no power to award penalties, which they must go for elsewhere. He (Mr. Balfour Browne) understood the Inspectors' functions were under the Metropolis Water Act, 1852, section 9 of which specified that, "if at any time complaint as to the quantity or quality of the water supplied by any company for domestic use be made to the Board of Trade by memorial in writing signed by not less than twenty inhabitant householders," the Board of Trade could appoint a competent person to inquire and report upon the matter. The Inspectors' functions were, however, not confined to the memorial of the twenty householders; for there was a conference of the Local Authorities in the district, and the inquiry would therefore also proceed under the Public Health (London) Act, 1891. Section 293 of this Act gave the Local Government Board Inspectors power to inquire, at the instance of the Vestries, into matters concerning the public health in the district supplied by the Water Company.

Mr. Cripps, on behalf of the Company, said it would shorten the case if he stated that they would not take any technical objection to the inquiry.

Mr. Balfour Browne said it became the duty of the Company, by virtue of the Act of 1871, under certain conditions, to furnish a constant supply of water. He believed the Company claimed to be the pioneers in giving a constant supply; and if this were so, it was greatly to their credit. But the Act of Parliament said that, when once a constant supply had been given, it was the duty of the Company to continue it, for very obvious reasons. Many of them remembered when in other districts in London an intermittent supply was given; the water being stored in cisterns. That system had been condemned by the Act of 1852, and also, by implication, by the Act of 1871; and it was condemned by the East London Company, who, in conjunction with various local authorities, took steps to have the cisterns done away with in their own district, and therefore made his clients absolutely dependent upon a constant supply, which they had now failed to give. This question of the scarcity of water was complicated in this particular year. Before the severe frost, the Company came to the conclusion that it was necessary to put persons upon a short supply; and the night supply to a great number of houses in the district was cut off. When the frost came, owing to the position in which the pipes were laid, there was a stoppage of water in a large number of districts; and many houses were without it for six weeks. Consequent also upon the frost, serious damage had been done to the mains and service-pipes. This was owing to the neglect of the Company to repair their pipes; and an enormous amount of water escaped through the leakages caused by fractures during the frost. This accounted for the scarcity of water in June, July, and August. On the 12th of July, the Company issued a circular stating that, in consequence of the unprecedented and continued drought, the hours of supply must be materially curtailed. Consumers were requested to store a reserve while the water was on, and to abstain from using it for any purposes whatever other than domestic necessities. The watering of gardens by sprinklers and hose was strictly prohibited for the time being. The recommendation that their consumers should store water, they not having the necessary means of doing so to any extent, was really adding insult to injury. On the 15th of July, a large public meeting was held on this question; and a protest was unanimously carried in consequence of the shortness of supply, and a similar resolution was passed on the 1st of August, when there was another meeting. The points raised were, first, as to scarcity; secondly, as to the effects of that scarcity; and, thirdly, as to its cause. It would hardly be denied that the pubic health suffered through this deficient supply. The people had to get their water at the stand-pipes; and they boarded the water-carts, provided for watering the streets, and dipped in their jugs to get water for their domestic necessities. It would be proved over and over again that, in every district included in the Company's limits, the Company did not use all the means in their power to maintain a constant supply. Then, again, he should establish the fact that the Company unduly favoured one class of consumers to the detriment of another class, to the pecuniary profit of the Company. Those consumers who paid the Company in proportion to the quantity of water they received had water; and those who paid whether they got water or not, had none. The fourth complaint against the Company was that the scarcity of water was mainly to be attributed to the leakage from their defective mains and service-pipes. As to the first charge—that the Company did not use every means in their power to give a constant supply—they had the right to draw 10 million gallons a day from the Thames at Sunbury. During June, when the drought was excessive, though not so bad as it was afterwards, they drew less than 7½ millions a day from that source. He was told that the Company's main for conveying this water was not sufficient for the whole 10 million gallons; for in July they only drew, on an average, 9 million gallons daily. Besides this, there was a power among the London Water Companies for the intersale of water. He did not find that this Company purchased water from any of the Companies, except a very small quantity upon one occasion, and this late in the drought, from the New River Company. Then, again, owing to some curious carelessness at the time that, or just before, the drought commenced, their principal storage reservoir was emptied for the purpose of being deepened. It was culpable carelessness not to have exercised sufficient forethought to have avoided such a thing. Then, again, the Company were unfair in their distribution of water; for some manufacturers who had theirs by meter were supplied, while it was refused to those who wanted it for domestic use. During the whole time that the people of East London were getting no water, the Tottenham Local Board had a supply, which was paid for by meter and not by rates. Next there was a charge of delay in the construction of the reservoir. The Company admitted that their storage was defective; but they blamed the London County Council for having opposed a Bill by which they sought to secure a larger amount of storage. The fact was that the Bill was opposed for other things than the storage of water; and, indeed, the Company's own Engineer stated that, if the population of the East-end went on increasing for the next thirty years as it had done in the past thirty years, they would be well able to cope with the supply under

existing conditions; and, further, that the Company possessed storage for 17 days, which was not equalled by any other of the London Companies—some of them running down to only two or three days.

Mr. CRIPPS remarked that that evidence was not given before the Parliamentary Committee, but before the Royal Commission on the Metropolitan Water Supply.

Mr. BALFOUR BROWNE said at any rate the evidence was given before the Company went to Parliament; and therefore the Committee might well have refused further powers of storage when their Engineer had said they were provided for thirty years. But there was no reason why the Company should have waited for parliamentary powers to increase their storage works; it was only necessary that they should forego some of their large profits, and make these works. Another thing the Company might have done was to have laid their mains deeper, which would have prevented an enormous waste of water when they were fractured by the frost. However, they preferred remedying defects at the expense of the ratepayers rather than of their own shareholders. The case for the Water Company would be that the season had been a very dry one; but there had been droughts just as serious before, though not coming after fractured mains from frost. The Company said that, if the people would only have cisterns in their houses, this calamity would not have occurred. But it was to do away with cisterns that the constant supply had to be laid on; and they wanted to go back to an obsolete and improper system, in order to remedy the evils which they could obviate without this assistance. The Company might say that leakage did take place from the mains, but that it was from the service-pipes, which belonged to the consumers. This plea, however, would not do; for if a water company in the first instance laid a main too near the surface, the service-pipe must necessarily also be too near the surface. Again, it would not do for a company to say all the water was running to waste through the service-pipes being fractured; for they had powers to compel anyone in the district to repair those pipes. This was a short sketch of the case. He would show that the scarcity of water had existed over the whole of the Company's district, and that it had been due to their negligence.

Mr. CRIPPS said the chief question here was rather the cause of the scarcity, and the means to prevent it in the future, than the fact of the scarcity.

Mr. BALFOUR BROWNE said he proposed to show, in the first instance, how widespread was the scarcity.

Mr. CRIPPS: This is not a widespread scarcity; but we admit that the constant supply for a time had to be replaced by an intermittent supply; and then the question would be what caused that. Our view is that it was owing to the unusual drought and the obstructive action of the London County Council. I suppose we shall have to discuss the effect of the scarcity on the public health.

Mr. BALFOUR BROWNE: Yes.

Evidence was then called by the complainants.

Dr. *H. J. Buck*, a medical man in practice at Clapton, was the first witness. He prefaced his evidence by stating that, had it not been for the discourtesy of the Company in not answering his letters, he would not have been a witness. He had to go without his bath, which was a most distressing circumstance to him. In cross-examination, he admitted that no infectious or other disease was caused by the want of water; only the excessive inconvenience of the lack of water for sanitary purposes.

Mrs. *Clayton*, a midwife, spoke of the inconvenience she had experienced from want of water; Mr. *Ward*, a coffee-shop keeper, testified to his trade suffering; and Mrs. *Dunscombe* and Mrs. *Staunton*, laundresses, brought forward complaints.

The next batch of witnesses were officials of local authorities. The first of these was Dr. *J. King Warry*, the Medical Officer of Health for Hackney. He said that during June, July, and August, there was a great scarcity of water; and the period of the lowest supply was from the 15th of July till the 18th of August. The water was on from two to three hours a day. Where a district was dependent upon a constant supply, it did not lend itself to an intermittent supply; for it did away with storage in low-class houses. Asked what would be the first indication of the sanitary mischief of cutting off the supply, he said there would be a general lowering of the health, from the people being exposed to foul smells from water-closets. He found the death-rate of the Hackney district during five weeks from the 15th of July to the 18th of August was 23·3 per 1000, and for the remainder of London, 21·7 per 1000. The people suffered from summer diarrhœa during those five weeks; and it was aggravated through the scarcity of water. The deaths from diarrhœa and enteritis were 7·5 per 1000; whereas in the rest of London the rate was 4·8 per 1000. Those figures referred to a population of 144,131.

Cross-examined by Mr. CRIPPS: The death-rate from diarrhœa was 4·8 for the part of the district supplied by the Company; and for the rest of London, 3·1. He had no statistics for the same period in 1893 and 1894. Asked if he had supplied figures to show that in one district of Hackney the death-rate went in a week to 71·5 per 1000 above the normal death-rate of London, witness replied that he had not; but in one week it went up to 59 per 1000.

In re-examination by Mr. BALFOUR BROWNE, witness said he considered that the comparison between Hackney and the rest of London was a fair one.

Dr. BARRY remarked that the 59 per 1000 in the district cited, with 7500 inhabitants, was derived from very small figures.

Mr. *J. Gough*, one of the Inspectors of Nuisances for Hackney, said complaints were made of insufficient water for ordinary domestic purposes; but the majority were to the effect that the parties had not sufficient water for flushing closets. The water was only on an hour or two each day from the middle of July to the end of August.

Dr. *F. W. Alexander*, the Medical Officer of Health for Poplar and Bromley, spoke to the possible relation between the scarcity of water and zymotic diseases, and compared the deaths from the latter in Poplar and Bromley with the rest of London—the former always being higher during the scarcity of water. The deaths from diarrhœa had gone up, as compared with 1893 and 1894. There had not been an exceptionally small quantity of rain in 1895—in fact, the year agreed with 1894; but was a little more than in 1893. The rain helped to flush the drains. He considered that cisterns in a poor and crowded district, where the people would not cover or clean them, would result in a very bad state of affairs indeed. Almost immediately after the first circular issued by the Water Company, there was ½ inch of rain in one week; and in the next week, more than 1½ inches. If there had not been this rain, he thought the soil would have stopped in the sewers, and putrefaction would have been set up.

Dr. *G. A. Rogers*, the Medical Officer of Health for Limehouse, said the deaths from diarrhœa and gastro-enteritis showed an increase at the same time that the constant supply of water was cut off. The death-rate was 8·1 per 1000, as against 4·5 in the rest of the Metropolis; and 6·2 in the period of drought of 1893 in his district. Considering that the drains must have been very full of soil, they might take it that this caused the increase of diarrhœa and gastro-enteritis.

Mr. *Mansell*, the Sanitary Inspector for the Homerton District, said they had general complaints of the closets being stopped and choked through an insufficient flush of water, caused by the supply of water being discontinued

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On the following day, evidence for the Vestries was continued.

Dr. *G. P. Bate*, the Medical Officer of Health for Bethnal Green, said that his district had a population of 127,000; and there were between 17,000 and 18,000 houses. Four-fifths of the houses had small yards attached; and generally each had its own closet. Twenty years ago, the supply of water was intermittent, which was not conducive to health; but for this a continuous supply was substituted, and a great improvement took place. In June, July, and August last, there was much scarcity of water, and a corresponding increase in the rate of mortality. The fire-mains were kept charged; and anyone who had his water from these had his supply continued. Most of the consumers, however, were served from the mains, whence there was only a supply for two hours a day. He had taken out the figures with reference to diarrhœa, and made a comparison between eight weeks in 1894 and 1895, with the result that there were 29 deaths for 1894 as against 101 for 1895. He attributed this great increase to the shortness of water. It had been stated officially that upwards of 30 gallons per head per day were pumped into the district during the period of water famine; and he thought 12 gallons per head were sufficient from a medical point of view, without allowing for water for trade purposes. In his opinion, there was an enormous waste somewhere. Consumers were as careless as they could be, and were too lazy to turn off the taps. The fittings were often tied up with string.

Mr. FREEMAN said he attended for the London County Council, who considered it only respectful to the Commission that they should be represented by Counsel. Should they be attacked, he would, of course, have an opportunity of defending them.

Mr. PEMBER said the Inspectors would judge as to whether there should be any rebutting evidence called; but he must insist upon his right, as defendant in the case, to speak the last word.

Mr. BALFOUR BROWNE said they would leave the Company to explain the cause of the scarcity; and it might be necessary to rebut this defence. Though it was for his clients to make out a *primâ facie* case, the main burden of the inquiry must fall upon the Company. He had no means of going to their mains and finding out where they were leaking, or what quantity of water was being wasted.

Mr. PEMBER said he admitted that the complainants were enabled to give rebutting evidence; but he should claim to answer it.

Colonel DUCAT: I think that is perfectly fair.

Mr. FREEMAN: I am here in a different capacity from Mr. Balfour Browne, who is bringing certain allegations before you. I am here more to assist the Commissioners by anything that may arise in the case. For instance, Mr. Cripps stated yesterday that the cause of the shortness of water was—partly, at any rate—owing to the fault of the London County Council; and if evidence is tendered to this effect, I shall claim to answer it, and to lay my facts before the Commission. My learned friend agrees with me.

Mr. PEMBER: Certainly not. Mr. Freeman has known for a long time that the County Council are blamed for this scarcity, partly owing to their opposition to the Company's Bill in 1893; and it is for him to put someone in the box to tell us the truth about the rejection of that Bill. If he does this, then I shall tell my story. Of course, if we should say anything which would entitle my friend to call rebutting evidence, we shall not object.

Dr. *Bate* was then cross-examined by Mr. PEMBER. He said the Company took the initiative in supplying water continuously. He knew that he could only get water two hours a day at his surgery. He could not tell whether there was an increase in the deaths from diarrhœa in other parts of London during the water famine in the East-end; nor could he tell whether there was an unusual increase in the death-rate from that disease in other large towns of England during the months of June, July, and August.

In re-examination by Mr. BALFOUR BROWNE, witness said that the drought would have been mitigated if there had been cisterns in the houses of the consumers; but if cisterns had to be maintained in order to meet such a contingency, it would be a very costly and unsatisfactory procedure.

In reply to Dr. BARRY, witness said his district was a crowded one; and the comparison of the death-rate was with his district and the whole of London. There was an increase in the death-rate all over London in the month of July.

Dr. BARRY: Would the increase in your district be normally higher than in the rest of London?

Witness: Not higher than in similarly crowded districts.

Take it in another Water Company's district. Would the increase be greater proportionally during June, July, and August than in the three previous months?—I have not gone into that, and should not like to say.

Mr. *F. W. Barratt*, the Surveyor to the Vestry of Bethnal Green, a district with a population of about 123,000, said that in ordinary times they employed 18 water-vans. These vans were in full work until the Company said they were short of water, and asked the Vestry not to use them; and the vans were reduced to six, at which they had continued up to the present. Another duty they had was the flushing of sewers and courts; and this the Company stopped on the 13th of July. A letter was written to the Company. They replied that they had

not given orders to stop the flushing of the sewers; and they would do all that they could to aid them—in fact, "they were pumping 30 gallons per head per day for all purposes." However, the water was shut off in all the branch mains for the greater part of the day; and the Vestry gave up trying to draw from them. There was a great deal of waste going on in the consumers' pipes; and the Vestry wrote several letters to the Engineer of the Company, giving lists of places, and calling his attention to the waste. Asked what he suggested was the remedy for this state of things, witness said it was more efficient inspection. In many cases, the fittings were out of order—they had evidently been broken for some time; and considerable portions of the consumers' pipes in the small houses were exposed, and consequently would be the first things to freeze. Then they were not repaired for a very long time. He did not think the Company were quick enough after them. He did not believe there were any broken mains that could have caused the waste, because in the case of a fracture the water always, or nearly always, showed on the surface.

In cross-examination by Mr. PEMBER, witness said the Company should have a moderate control over fittings, as this was the only means of checking waste. The Company erected 80 special stand-pipes in Bethnal Green to meet the emergency; and there was a constant supply all day from them.

In re-examination by Mr. BALFOUR BROWNE, who referred witness to the Water-Works Clauses Act, 1863, and asked him whether ample powers to prevent waste were not given by that Act, witness replied that there were inspectors, who prosecuted in some cases; but they did not do enough in this direction.

Mr. *J. Foot*, one of the sanitary inspectors for the Bethnal Green Vestry, spoke to complaints of the failure of the water supply, which the local authorities were, he said, powerless to remedy.

Mr. *J. Lovegrove*, the Chief Surveyor to the Hackney Vestry, said there was great inconvenience during the period of frost in this district, from the freezing of the mains and service-pipes; and the Vestry had 36 of their own vans with syphons, so that they could run water into pails and vessels. The effect of the frost on the water-pipes involved the opening of the roads in a great many cases. There was as many as 1536 openings made between the 1st of January and the 30th of April; and 93 of these referred to the mains. The depths of the mains varied from 1 ft. 6 in. to 3 feet; and by far the larger number would be about 2 feet or 2 ft. 6 in. When the dry weather came, they could not water the roads as before, because the water-vans could not get water from the hydrants. But when the water did come on, the hydrants and water-vans were literally besieged by the inhabitants. The carmen were unable to proceed with their vans, owing to the people dipping their utensils into the vans. They said it was shameful that the water should be used on the roads when they had not sufficient for their use in the houses. It was in consequence of this that the General Purposes Committee ordered the road-watering to be stopped.

In cross-examination by Mr. CRIPPS, witness said that of the 1536 openings made during the frost, 93 referred to mains, and the rest would be consumers' pipes.

Mr. CRIPPS: Whatever leakage there had been during the frost would be gone when the drought came?

Witness: It would depend upon the absorbent character of the subsoil. Where we have a gravelly subsoil, leakage may continue for a considerable time, until supersaturation takes place, if the crust is hard; but if the crust of the road is somewhat soft, it shows at once.

Dr. *T. Taylor*, the Medical Officer of Health for Mile End, said that if there had been cisterns, the inconvenience would have been very much mitigated. Still it was not so good for a poor district as the constant supply—in fact, he objected to the cistern system *in toto*.

Mr. *J. W. Johnson*, the Sanitary Inspector of the Board of Works for Limehouse, said he represented a thickly-populated district of poor people. During the months of July and August, the soil-pipes were foul and offensive, and in many cases choked, owing to an insufficient quantity of water for flushing purposes. The supply was only given for two hours in the day.

Mr. PEMBER: Why did they not take the trouble to flush the pipes when the water was on?

Witness: They did do so; they have 2-gallon flushing-cisterns.

Dr. *Vaughan Ryegate*, the Medical Officer of Health for St. George's-in-the-East, and Mr. *W. Firth*, the Sanitary Inspector to St. Leonard's, Shoreditch, also gave evidence; and some other witnesses (non-official) related their experiences.

Mr. BALFOUR BROWNE said this closed his case. He thought he had proved scarcity; and he had tried to show the effect on health. He had also endeavoured to show the unfairness of manufacturers being put on the fire-mains, and getting their water, while other people were not. He had suggested the cause of the scarcity—viz., the enormous waste of water.

Mr. A. C. MORTON (for the West Ham Corporation) said he should like to have the opportunity of hearing the case of the Water Company; and, if necessary, he would then give evidence as to the cause of the scarcity.

Colonel DUCAT: Mr. Balfour Browne has put down what he says is the cause of the scarcity—the leakage, which he has proved. Have you any other grounds to suggest?

Mr. MORTON: No; but I want to have the power of giving rebutting evidence.

Mr. PEMBER: The limitations of the inquiry are to fact, cause, and effect.

Mr. BALFOUR BROWNE: And possibly remedy.

Mr. PEMBER: They must prove them all; I am not going to help them. As to remedy, when my own case comes on, I shall show that there is no remedy wanted.

The inquiry was resumed on Thursday; and the case for the London County Council was proceeded with.

Mr. *A. R. Binnie*, M.Inst.C.E., the Chief Engineer to the Council, was called, and examined by Mr. FREEMAN. He said he reported to the Council on the matter under consideration at the end of July last. He had endeavoured to discover the cause of the shortness of water at the East-end; and he had prepared tables, founded on the Official Water Examiner's reports, showing the total quantities supplied by the East London Company during the years 1892, 1893, 1894, and the first five months of 1895. During 1892, the average daily supply was 43,561,270 gallons; in 1893, it was 41,901,868 gallons; in 1894, it was 41,396,448 gallons; and in 1895, for the first five months it averaged 53,010,513 gallons. From 45,000,000 gallons a day in January, 1895, it rose to 59,000,000 gallons in February, 1895. Since that time the supply averaged 54,000,000 gallons during March; in April, 55,000,000 gallons; and in May, 51,162,000 gallons. In February, 1895, the supply was 59,155,000 gallons a day; and in February, 1892, it was 44,900,000 gallons. In March, 1895, it was 54,384,000 gallons; and in March, 1892, it was 44,892,000 gallons. In April, 1895, it was 55,326,000 gallons; and in April, 1892, it was 44,033,000 gallons. In May, 1895, it was 51,163,000 gallons; and in May, 1892, it was 42,913,000 gallons. In June, 1895, it was 51,335,000 gallons; and in June, 1892, it was 44,235,000 gallons. For the five months of 1895, the total excess from February to June over the preceding year was 1,501,232 gallons. The flow of the Lea was not in any way below the average; and the river yielded ample supplies of water. The witness then produced tables giving the excess supply to the district of the East London Company in the months from February to June, 1895, as compared with the maximum quantities in similar months in previous years. They showed that during this period a total quantity of more than 1501 million gallons of water was sent into the district, which, at the average rate of the maximum supply during similar months in previous years (which might be taken at a little over 44 million gallons a day), represented a supply for 34 days in excess of any previous quantities pumped into the district by the Company. Witness was next examined on a table supplied by the Conservators of the River Lea, showing the gaugings at Feilde's Weir during 1892-3-4, and the first five months of 1895, divided under the heads of "Maximum Flow," "Minimum Flow," and "Mean Flow" for each whole month. The minimum flow of any one day in January was 43·6 million gallons; in February, 51·3 million gallons; in March, 60·9 million gallons; in April, 44 million gallons; and in May, 27·8 million gallons. The "mean flows" per month were: January, 160·8 million gallons; February, 84·5 million gallons; March, 105 million gallons; April, 62·7 million gallons; and May, 43·5 million gallons. The mean average flow of the River Lea for January, February, and March, 1895, was 116·6 million gallons; and the average flow for March, April, and May was 70·4 million gallons. These figures he contrasted with the gaugings of the minimum flow of the River Lea at Feilde's Weir during the years 1874, 1884, 1887, and 1891, which were dry years. The mean of these three months in 1874 was 20,709,000 gallons; for the same three months in 1884, it was 33,657,000 gallons; for 1887, it was 23,927,000 gallons; and for 1891, it was 23,226,000 gallons. The year 1892 was a very dry one. The three consecutive driest months were July, August, and September, during which the mean daily discharges of the Lea were 43·9, 33·5, and 37·6 million gallons respectively, or an average of 38·3 million gallons; so that it could not be said the months of March, April, and May last, which averaged 70·4 million gallons, were an exceptionally dry period. He found that there was a much larger quantity of water being sent by the Company into their district in 1895 than in the corresponding period of previous years; and he had come to the conclusion that the cause of the shortness of supply was clearly not an insufficiency of water, as a larger amount was being pumped into the district than on any previous occasion. In January, there was nothing exceptional in the service of the Company; in February, the average daily supply was 14,255,000 gallons a day in excess of any previous record; and this excess supply continued down to June. Therefore the only conclusion he could arrive at was that in February something occurred which prevented the people getting that supply. They did not become more careless in their habits in 1895 than in any previous year. What happened was that there was a great frost; pipes became burst and broken; and he presumed they had not been repaired down to the end of June. This would amply account for the difference between the quantity of water sent into the district and that received by the consumers.

Mr. FREEMAN: Did the Company ever avail themselves to the full extent of their power to draw the water which they stated they had when before the Royal Commission?

Witness: Well, they have exceeded their power of drawing from the Lea during those months. They have not, however, availed themselves of their power to draw daily from the Thames 10 million gallons; from the gravel springs at Hanworth, 2 million gallons; and from the Company's existing wells in the Lea Valley, 11 million gallons. The large quantity in excess, of which I have been speaking, was taken from the Lea; and in June there was abstracted from that river, 58,894,000 gallons, and in July 49,639,000 gallons.

Mr. PEMBER: But that is for two Companies?

Witness: Yes.

Mr. FREEMAN: Have you any comment to make upon that?

Witness: I view with the gravest apprehension this continued large abstraction of water from the Lea. The Lea Valley has a population of over 180,000 persons; and, minimize it how we may, the people of London have to drink more or less the clarified sewage of those people.

Mr. PEMBER objected to going into the quality of the water.

Mr. FREEMAN then asked the witness to keep to the inquiry more closely.

Witness (continuing): The Duke of Richmond's Commission said that not more than 50 million gallons could be expected from the Lea Valley; but now they were taking a quantity largely in excess of that. Lord Balfour's Commission, in their report, said: "This abstraction of the water from the Lea by the Water Companies is, in our opinion, too great with the storage now in existence."

Mr. PEMBER said this was not a question of whether the Water Companies were justified in taking the water from the Thames or the Lea. The Inspectors had no more to do with that than if the present inquiry related to gas.

Witness: I was merely saying that, in exceeding the quantities cited by previous Royal Commissions, a great danger was being run.

Mr. FREEMAN: Can you see any other reason for the deficiency in the supply to the consumers than the leakage from the Company's pipes, and so wasting it?

Witness: I have no other means of accounting for it, especially taken in conjunction with the sudden increase in the supply in February.

The County Council have been blamed for opposing the Company's Bill of 1893; and thus preventing the carrying out of works which would have obviated this scarcity of water. What is your view?—That could not have affected this question, seeing that the works could not have been completed for a year or two. I have shown that the shortness of water was not caused from a drought at all; the Company have had an excess of water in those three months.

In cross-examination by Mr. PEMBER, witness said that during a frost it was a general thing to leave taps running; but this would not account for the excessive waste of water. He believed more water was lost by an intermittent than by a constant supply. A large excess of water was used during a frost. In other towns there was also a very serious waste of water during the frost. In East London, it amounted to about 20 per cent. The experience of the East London Company was no exception to that of water companies generally during the frost. He presumed that the leakages were going on to a large extent now. When the supply was cut off, as happened for the greater part of the day, water was saved, and therefore stored; and as it was not allowed to run through the mains, there was no waste. The fact that the reservoirs were full by the end of July, and the supply fell to the normal quantity, did not do away with his waste theory. The Company had a Bill for storage powers before the House of Commons. It was to give authority to construct a reservoir covering 90 acres, and to store the full quantities of water which the Company had a right to take day by day from the Lea. But the powers asked for were not granted. The proposal was to acquire fresh storage for 1200 million gallons of water. No further storage capacity was necessary in the Lea Valley, because, with the existing reservoirs, the whole of the supply furnished by the valley was practically exhausted. What the Company now possessed was sufficient to tide them over any season of drought, and keep up a daily supply of 30 million gallons of water. The London County Council opposed the Bill referred to. He recommended this course to be adopted, because he regarded the valley of the Lea as a constant source of danger to the Metropolis as a source of water supply. This conclusion was formed by him after the Royal Commission had reported as to the quantities that might be taken from that river, and after they had borne testimony to the very high standard of purity of the water. The sources of pollution of the Lea had not been removed; and sewage was still flowing into the river. When these sources of pollution were removed, they might reasonably discuss how much more good water could be drawn from the river.

Mr. FREEMAN then summed up the case on behalf of the London County Council. He said it was for the Company to show that the drought or the frost was the unavoidable cause of the failure in the water supply, and not concomitant circumstances attending thereon. That the failure was due to any drought, had been disposed of by the fact that the River Lea was in full volume at the time, and the Company pumped more water than was usual during the period referred to. The real cause of the dearth was the waste caused by the burst pipes; and it was well known that it was cheaper to pump water into the mains than to stop waste. Then it must not be forgotten that those who paid for water by meter had a constant supply; while those who did not were so negligently treated as not to receive any water at all. It was absurd to attribute the water famine to the action of the London County Council, because the Bill was rejected on important public principles—viz., the possible combination of all the Water Companies in one body. The fact was that the waste took place either in the mains of the Company or in the communication-pipes, for the fractures in either of which the Company were responsible.

The case for the County Council then closed, and that of the Company was opened. The further proceedings in the inquiry, which closed on Saturday, will be reported next week.

BIRMINGHAM CORPORATION WATER SUPPLY.

The Elan Valley Works—Further Parliamentary Powers—Conditions of Labour at the Pumping-Stations.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Alderman Fallows) presiding—the Water Committee presented a report which stated that the thorough renovation of the Aston filter-beds had been undertaken, at an estimated cost of £2250. The filtered water-pools at Aston had also been emptied and cleansed, at an outlay of £290. During the summer months, the resources of the department had been strained to the utmost to keep pace with the demand in the various districts; and considerable inconvenience to consumers had been caused at times. With their existing works, the Committee could not distribute larger quantities of water; and, in periods of pressure, it was absolutely necessary that strict economy should be practised. The Committee had had under consideration the hours of labour worked by the engine-drivers and stokers at the pumping-stations, and had resolved to adopt the system of eight-hour shifts from the beginning of October. The rate of pay had been, per day of twelve hours, for drivers 5s., and for stokers 4s. 2d.; and it would be lowered to 4s. 6d. for drivers and 4s. for stokers per day of eight hours. Existing drivers, however, would receive a special allowance of 2d. per day. Time-and-a-half rate for Sundays had been paid, and would be maintained. The holidays would be reduced to six days per annum, assimilating them to the level of other departments of the Corporation. It was estimated that the cost of the alteration would be about £1700 per annum. Under the head of Elan Valley works, the Committee reported that considerable progress had been made with the excavation in the base of the Caban dam and channels. The railway in the upper part of the valley had been completed as far as the site of the Pen-y-gareg dam, and was being continued to the Craig Goch dam. A commencement had been made with the excavation of the foundation of the Pen-y-gareg dam and the necessary river diversion. A start had also been made with the excavation at the submerged dam near Careg Edu. The number of men employed in September on the works in the Elan Valley was 1003. By the Act of 1892, the provisions of the Railway Clauses Consolidation Act of 1845, with respect to the temporary occupation of lands during the construction of works (including the use of land for the deposit of spoil), were applied only to the railways and reservoirs authorized. The Bill, as originally drafted, extended the application of the Railway Clauses Act to the aqueduct; but this provision was struck out at the instance of the Lord Chairman of Committees, in accordance with a practice recently introduced by his Lordship. It had consequently been necessary to endeavour to acquire, by agreement, the sites required for the deposit of spoil from the aqueduct works. For the whole of the length already let, and for other sections, spoil sites had been acquired on terms more or less reasonable; but with regard to an important section now under negotiation, the prices asked by the owners of all the suitable sites were, in the opinion of the Committee, so excessive that they are unable to authorize their agents to acquire the lands on the terms named. The Committee were advised that little difficulty was likely to be experienced in obtaining parliamentary powers for the compulsory acquisition of definite sites, to be scheduled and indicated on plans to be deposited. They therefore recommended that application be made to Parliament, in the ensuing session, for an Act giving compulsory powers for the purchase or use of the necessary lands. For the construction of the reservoir, filter-beds, and other works at Frankley, a large quantity of stone, cement, and other materials would have to be conveyed from Rubery station. Under existing circumstances, these would have to be carted over hilly country roads at heavy expense. In the application to Parliament, it was proposed to ask for powers to construct a short railway from Rubery station to the property of the Corporation at Frankley, as the cost of conveyance by rail, even taking into consideration the expense of making the railway, would effect a saving as compared with cartage. The railway would be about a mile in length, and would pass wholly over the property of one landowner, with whom negotiations had been opened.

Alderman LAWLEY PARKER first proposed a resolution authorizing the Committee to take the necessary steps for the promotion of a Bill during the next session of Parliament, empowering the Corporation to acquire sites for the deposit of spoil from the aqueduct works authorized under the Birmingham Corporation Water Act, 1892, to construct a line of railway from Rubery Station to the site of the authorized reservoir at Frankley, and for other purposes. He said that, roughly speaking, the Committee required one or two acres of land upon which to deposit the spoil for every mile of aqueduct; and they had endeavoured to acquire sites by agreement with the owners, but some excessive prices were required. In purchasing the land for the aqueduct, they were asked £12,000 for a piece which they ultimately obtained under their compulsory powers for £2500. It was important, therefore, that they should obtain compulsory powers to acquire the land they needed for spoil banks. As to the short railway from Rubery Station to Frankley reservoir, when the reservoir was first projected, Mr. Gray was of opinion that a sufficient quantity of clay would be found on the site to make the lining, even if the soil was not of such an impervious character as not to require lining. But when Mr. Mansergh sank a number of trial holes, it was found that the quantity of clay there was comparatively small; and the quality was not of such a character as to encourage him to use it. It had therefore been decided to line the reservoir with concrete, with a surface of asphalte. For this some 200,000 tons of stone would be required; and it would have to be brought from two quarries in the neighbourhood of Rubery Station. The Committee were of opinion that, if the owner of the land (Lord Cobham) was prepared to deal on reasonable terms, and not to oppose the Bill, it would be economical to construct the railway in question.

Mr. LANE seconded the motion, which was unanimously carried.

Alderman PARKER moved the adoption of the Committee's report. Referring to the alterations in the hours of labour at the pumping-stations, he said the whole of the men were now fairly satisfied; and he believed the shorter hours would be a benefit to them and to their families, while more efficient service would be rendered to the department. With regard to the water supply, ever since he had been Chairman of the Water Committee, he had been called upon to preach to consumers the need for economy. He told them in June last that their resources were strained to the utmost. There was some relief in July and August; but he was sorry to say the position was as acute now as it ever had been. On the high levels, they found it impossible with their present resources to secure a continuous supply throughout the whole of the twenty-four hours; and he was afraid this difficulty would be a recurring one until they obtained the Welsh water.

Mr. BARBER seconded the resolution, which was passed.

The Uncovered Reservoirs at Southampton.—The Southampton Town Council have adopted the recommendation of the Works Committee and the Water Engineer (Mr. W. Matthews) that the two reservoirs on the Common be covered, at an estimated cost of £6000 (*ante*, p. 645); and application is to be made to the Local Government Board for sanction to borrow the amount for thirty years.

Brisbane Gas Company.—The financial statement of this Company for the half year ending June 30 last shows a net amount, with the balance brought forward, of £8033 to the credit of the profit and loss account. The Directors recommend a dividend of 4½ per cent., amounting to £6295. The payment of the dividend-tax of £315 would make this up to £6610—leaving £1423 to be carried forward.

Trial of Incandescent Gas Lighting at Sutton (Surrey).—The incandescent system of gas lighting has been tried in six of the public lamps at Sutton, previously fitted with 4-feet burners, each giving a light of 10 candles. The result was an increase to 80 candles when glass chimneys were employed, and to 60 candles with the mica chimneys which it was necessary to use. This is so satisfactory that the Surveyor to the District Council has advised a further trial of the system. By substituting 4-feet incandescent burners for the existing 7-feet ordinary jets, he reckons that a saving of 27s. 4d. per annum will be effected; and by using the same type of burner instead of a 5-feet jet, 7s. 1d. per annum would be saved. It has been decided to spend £40 in fitting thirty more lamps with incandescent burners.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held a meeting of some consequence on Monday. First on the list of business was the report of the Engineers, which showed an increase of 7,677,000 cubic feet of gas during August, as compared with the output in August of last year, and an increased output, since the 15th of May, of 14,038,000 cubic feet over the output in the same period of last year. The Commissioners next introduced a recommendation by the Works Committee as to the price of gas for a year from the survey which begins this month. This was to the effect that the gas should be of from 24 to 26 candle power; and that the price should be 3s. per 1000 cubic feet, subject to the usual rates of discount, and for public lighting 2s. 1½d. net per 1000 cubic feet. Last year's prices were 3s. 2d. and 2s. 3d. respectively.

In moving the adoption of the recommendation, Bailie Kinloch Anderson, the Convener of the Committee, said they were quite warranted in making the reduction, for they would recollect that last year there was a net profit of some £13,000; and out of this sum they had to give a very considerable contribution to taxation—not less than £2000. Therefore, he thought, they should be very careful in fixing the price of gas, so as not to have too large a surplus. The result of last year's working was that the Commissioners had an increase over the previous year of £16,531, which represented much more than 2d. on the quantity of gas consumed. But this year they were fixing the rate a little bit wide, in view of some very heavy expenditure they had going on. As they all knew, they were providing stoking machinery; and they had the expensive item of a new chimney at the Edinburgh works. These and several other items they proposed to pay out of revenue; their capital account would not be increased. Otherwise they might have been able to reduce the price of gas at any rate 2d. more. They had taken no account whatever, in their calculation, of the extra profit that would result from the working of the stoking machinery, which they were advised would save something like 1s. 3d. per ton of coal used. They wanted to prove the plant before they took that into account. Therefore they might have again a fair surplus at the end of the year; but it was exceedingly desirable to have a reserve fund, to save over-drafts from the bank. He therefore thought they were safe in fixing the price of gas as recommended. Mr. John Jamieson, in seconding the motion, said that while it was right to avoid having too large a surplus, all the dictates of prudence pointed to the advisability of their laying aside a substantial reserve fund. Last year, they had the largest increase they ever had in any year—about 104 million cubic feet. On a former occasion when they reduced the price of gas, they had an increase of 39 million cubic feet; and when they advanced the price to 4s. 6d., there was a diminution in the consumption which, he thought, showed that their great safety lay in a low price of gas. Lord Provost M'Donald thought they had great occasion to congratulate the Works Committee, and especially their Convener, who had a thorough grip of the gas business, which was an important thing for them. The recommendations of the Committee were then adopted.

Mr. J. Walcot, referring to a previous resolution of the Commissioners to make a display with incandescent gas lighting in front of the offices of the Commission, said he had always thought they did not do all they should do in this direction. They ought to make a good display, and show people what could be done with gas. The Lord Provost said he hoped that the remark would be taken into account.

Then followed a somewhat peculiar item. A letter from the Clerk to the Perth Gas Commissioners was read, in which it was stated that their Manager, on account of advancing years, had resigned office, which he had held for over 44 years, and that they were anxious to secure the best man possible; that they were willing to give him a proper salary; and they asked the experience of the Edinburgh and Leith Commissioners on several matters in connection with the appointment of a Gas Manager—including training, the duties required, and particularly whether he had any duties other than connected with the manufacture of gas, and the emoluments. The Lord Provost said the Works Committee would look at the letter, and would give them all the assistance they could. Bailie Kinloch Anderson said they would be glad to do it.

After this, the Commissioners took up the question which was raised by Mr. Mackenzie in the Town Council recently, regarding the clandestine testing of Edinburgh gas by a deputation from Liverpool. The Lord Provost said he promised in the Town Council to have the matter looked into; and this was their first meeting since. The great point upon which the question seemed to hinge was that the man who tested the gas had to give notice. That immediately suggested, to the uninitiated mind, that it was a hint that for the time being the manufacture of gas should be a little superior. He scarcely could take this view of it. He had been making a little inquiry; and, shortly stated, the result was that a place was needed for the purpose of making the test, and notice was required to be given in order that it should be ready for the official. If they could so modify the arrangement that the examiner could go at any time he liked, and even if he could take one or two districts in the town and test the gas there, he believed it would give confidence to the public. He did not for a moment believe that anyone in connection with the gas-works wanted to do anything unfair. That a man could bring an instrument in his portmanteau, or in his pocket, and test the gas, he was told was impossible. But if they were to take up the question, it must be taken up in all honesty of purpose; so as to give a fair return to the public. Bailie Kinloch Anderson said he had since learned that two tests were alleged to have been made—one on the Sunday night, when they were sitting in the Balmoral Hotel, and the other on the Monday. The Commissioners had no test on the Sunday—they gave their Analyst a rest on Sundays; but in respect of the Monday, he made it his business to see the book at the works, and the average of three tests that day gave 26-candle power. It was only fair to say—he wished to be candid in the matter—that their Analyst also tested the gas in the premises in which they were met, as well as at the works. He left on his holidays on that Monday, and an assistant did the work for him; and the tests that he made in the office showed just under 23 candles. They might put down the discrepancy to want of experience on the part of the apprentice; but both results were far above that stated by Mr. Mackenzie, and he had no doubt whatever that the tests they made were correct. They must be looked upon as really honest in their service. They bought the material to produce a gas of from 24 to 26 candle power. They had their analyses for the year, showing 24·91 candles for the twelve months, and 25·73 candles for the previous year, in Edinburgh; and 24·84 candles in the past year, and 25·55 candles in the previous year, in Leith. Could it be supposed that they would strike averages like this for the whole year if even at any time they had gas of the low candle power spoken to by Mr. Mackenzie? He agreed that suitable apparatus could not have been employed. He was told by experts in these matters that they could not get a correct result by this "snap-shot" method of testing the gas. The testing lay with the Corporation. Mr. Falconer King was not their official; he was the official of the Corporation. The Corporation might send him to half-a-dozen places in the city to test the gas. The notice which was given was in terms of the statutes. These provided that the tests should be made at the time when the gas was being supplied to the public. He did not know that the illuminating power of the gas varied during the day; but he believed that the gas varied in pressure. The Commissioners had notice, certainly, of the time when the examiner was to attend; but they did not get 24 hours' notice. Sometimes the notice came in the evening of the day before, and sometimes on the morning of the day of the test. But he was told by Mr. Mitchell that the gas made and sent to the holders could not have returned to the testing-place within 24 hours; so that it might be taken that there was no special distillation of coal for the purposes of testing. The examiner was not required to give 24 hours' notice; and he might say that if they received notice at nine o'clock in the morning that would be quite sufficient, as they could have everything ready for him in two hours' time. Mr. Cameron suggested that, when the gas was tested, the examiner should take two samples and seal them up, and that one should be sent to the Commissioners. The subject was then allowed to drop.

On Thursday, the Dean of Guild Court of Edinburgh granted warrant to the Edinburgh and Leith Gas Commissioners to erect their new chimney. The Commissioners, through Bailie Kinloch Anderson, adhered to their proposal to erect a chimney 250 feet high, instead of giving way to the suggestion of the Court and making it only 200 feet high. The site is about 40 feet to the south, and a few feet to the east of the present chimney; and the design shows one of the most handsome chimneys which it is possible to build, both as to configuration and the ornamentation in the shape of bands and fluted work. Not until it is completed will the old one be removed. It is not before its time that it should be taken down, as, I understand, it is still giving manifestations of the unsoundness of its foundation.

Mr. G. A. Alexander, son of Mr. Duncan Alexander, Superintendent in the Edinburgh Corporation Gas-Works, has been appointed as Assistant-Manager in the works of the Portobello Gas Company. Hitherto he has been employed in the office of Mr. Mitchell, Engineer and Manager of the Edinburgh works. On the occasion of his leaving that situation to enter upon his new duties, he was entertained to a smoking concert, which was held in the Canongate Institute on Wednesday night. Mr. Alexander's popularity in the works was shown by the fact that Mr. Mitchell took the chair at the meeting, and that about 200 of the workmen attended the entertainment in his honour. Besides this mark of esteem, he was made the recipient of valuable tangible gifts, in the shape of a silver-mounted inkstand and a case of drawing instruments from Mr. Mitchell; and of a gold albert and appendages and a writing-desk, from the workmen. He enters the Portobello works with one of the heartiest God-speeds any young man could receive.

The Corporation of Glasgow recently entered the market soliciting contracts for a supply of coal for the gas-works for the next six months. In the present state of the coal trade, with the miners producing more than they were ever before known to do, offers of all descriptions were specially abundant. The Gas Committee have consequently been able to conclude contracts for the full quantity they desired, at prices ranging from 6s. 6d. to 6s. 9d. per ton. The rates show little variation from what they did in January last, when contracts for the first half of the present year were entered into, or in June last, when further coal was bought. But, of course, they are greatly down from what they were a year ago. The fact that the Corporation have entered into contracts for six months, is a pretty certain forecast of the condition of the coal trade; the Gas Committee being as well advised in the matter as it is possible for any body to be. Had there been a prospect of prices rising next spring, it is unlikely that the period contracted for would have been limited to six months. If, on the other hand, there had been any likelihood of prices falling soon, the probability is that a shorter period than six months would have been fixed. The outlook would therefore appear, so far as the best judges are to be relied upon, to warrant the expectation of a steady market for some time to come.

The Dundee Town Council, on Thursday, discussed the proposal to go to Parliament to obtain an increase to their borrowing powers. In a flock, there is always one sheep behind the others. On this occasion, the position was filled in the Council by Mr. Speed, who opposed the proposal, and asserted that he had never heard that the borrowing powers of the Gas Department had been exceeded by £22,000. The fact was stated at the annual meeting in June, by Treasurer Ritchie, when presenting the accounts for the previous year; and the need for increased borrowing powers had been mentioned before. Mr. Brownlee, the Convener of the Gas Committee, on being called upon by the Lord Provost to explain how the matter stood, stated that they had a sum of about £45,000 at the credit of the sinking fund, which they were unable to apply to the purpose for which it was intended, on account of the want of borrowing powers, because they would see if they paid off their mortgage debt, they reduced their borrowing powers to that extent. They could not at the present time afford to do this. The consequence was that they were not only beaking the law, but taxing the gas consumers very considerably, in respect that the interest of the sinking fund was a charge against revenue, because it went to sinking fund itself; and they were therefore called upon to pay a larger sum—last year it was £1200 or £1300—

than they otherwise would require to have charged against revenue. He did not think that this was altogether a great evil, because it no doubt increased their capital to all the greater extent. At the same time, there was no question that the Gas Commission had been for a year or two practically water-logged for the want of borrowing powers. Whether they might stave it off this year or not—which, in his opinion, they should not do—it must be fairly met; and he thought it would be desirable, before any expense was incurred in this matter, that the Board should meet and have all the facts laid before them, and give their opinion as to whether they should go to Parliament this year or not. Certain it was they had exceeded their borrowing powers; and he did not think public men were called upon to take upon themselves these responsibilities. Notwithstanding this very sensible statement by Mr. Brownlee, Mr. Speed still objected; and after a good deal of discussion, consideration of the subject was adjourned.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 5.

Sulphate of Ammonia.—There has been a fair demand. But orders are still largely in the hands of dealers; and there is more sulphate offering, so that prices have been barely maintained. It may be noticed that values at the different ports continue to show considerable variation; quotations ranging from £8 15s. to £8 18s. 9d. per ton f.o.b. For forward delivery quotations, very little above spot prices are being assiduously circulated on the Continent by speculators, with what object is pretty obvious; since, beyond damaging spot market, they seem to gain nothing—buyers, in face of continuously falling prices, not responding very readily to overtures made to them.

Nitrate of Soda remains quiet. Fine quality on spot may be had at 7s. 10½d. per cwt.; and this is the full value of autumn shipment cargoes, ordinary quality.

LONDON, *Oct.* 5.

Tar Products.—The improvement mentioned in benzols last week has been maintained; and business has been done at slightly advanced figures, especially for 90's. Inquiries for benzols generally are also more numerous; and the bottom appears to have been touched. Pitch continues steady, and has no signs of weakness—rather the reverse. Creosote is more difficult of sale, and at easier prices; and, with the increasing output in front of the market, there does not seem much hopefulness of improvement. Values are now so low that, in many cases, it could be more profitably used as fuel, than sold as creosote. This is especially so in the Scotch district, where it is surprising that so little of the oil is used in this direction. Carbolic is quiet and lifeless, at about 1s. 6d. a gallon for 60's; and crystals are steady at their old figure. Anthracene keeps firm at last week's prices; and considerable business is being done. Prices are as follows: Tar, 18s. 6d. to 22s. Pitch, west coast, 35s. 6d.; east coast, 38s. Benzols, 90's, 1s. 0½d.; 50's, 1s. Solvent naphtha, 1s. 1d. Toluol, 1s. 1½d. Crude, 30 per cent., naphtha, 4¾d. Liquid creosote, 1⅛d. Naphthalene salts, 25s. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d.; 75's, 1s. 9d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia has slightly improved, but not to any remarkable extent. Buyers, however, are anxious to cover for forward delivery; and this in itself is a good sign. Prices realized during the week have ranged between £8 12s. 6d. and £8 17s. 6d., less 3½ per cent. Gas liquor is quoted at 6s. to 7s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The change in the weather will necessarily help to brisken up the demand for house-fire coal, and deliveries from collieries on account of contracts for gas coal will become heavier now; but so far the general position remains without appreciable improvement. In one or two instances, slight advances have this month been made upon the commoner classes of house-fire coals; but with these exceptions, October has opened with no upward move whatever upon the excessively low prices that have been ruling all through the summer. Pits also continue on short time, very few collieries as yet working more than four days per week, and heavy stocks are in most cases held. At the pit mouth, best Wigan Arley remains at about 10s. to 10s. 6d. per ton, Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; and common house coal, 7s. to 7s. 6d. There is a fair business doing in the lower qualities of round coal, for iron making, steam, and general manufacturing purposes; but the demand is far below the plentiful supplies offering. As a result, prices continue to be cut extremely low; and 6s. to 6s. 6d. per ton are about the full average figures obtainable for ordinary steam and forge coals. Only a limited inquiry comes forward for engine classes of fuel, with supplies plentiful, notwithstanding the slackness in the round coal trade; and very low quotations are made for contracts. The average selling prices remain at from 3s. and 3s. 6d. for common, to 4s. 6d. and 5s. per ton for best slack, at the pit. A depressed tone still prevails in the shipping trade, with only a very limited demand; and low prices are ruling. Ordinary steam coal averages 7s. 3d. to 7s. 6d. per ton, with some of the better qualities fetching 8s., delivered at the Garston Docks or the High Level, Liverpool.

Northern Coal Trade.—The coal trade of the north has been rather differently affected during the last few days; there being a falling off in the demand for steam coal, while that for gas coals has shown a satisfactory enlargement. The cessation of shipments to some of the northern ports, is the chief cause of dulness in the request for steam coals; and the highest price for best Northumbrian kinds is now 8s. 9d. per ton f.o.b., while sales at lower prices are noted. For second class steam coals, from 8s. to 8s. 6d. per ton is now the current quotation; and steam smalls are rather scarce at 3s. 6d. to 3s. 9d. There is very little alteration in manufacturing coals; but negotiation has been commenced for next year's supplies, and shows so far a more than ordinary difference of opinion between producer and consumer as to the prices that are likely to rule. In regard to gas coals, the settlement of the contracts for the Newcastle Gas Company at 6s. 6d. per ton delivered, shows that the prices are 6d. per ton less than a year ago; and yet they are higher than they were some six months since. The Stockton gas coal seems to have been similarly bought. Deliveries of gas coal are now being steadily maintained, and give to some of the collieries fuller work than since the spring. The price for odd cargoes is rather steadier. In coke, there is a better demand for both distant and local gas furnaces; and the price may be put as at 13s. to 13s. 3d. per ton delivered at Middlesbrough, while export coke is quoted 14s. to 14s. 6d. per ton f.o.b. There is no alteration this week in gas coke; but the production is being enlarged, and in some of the inland centres there are still heavy stocks, though the demand is increasing.

Scotch Coal Trade.—There is not much variation to note since last week. A great quantity of coal is produced, and is perhaps moving off more freely then coalowners admit; but stocks are accumulating notwithstanding, and market prices remain low. The colder weather is expected, by increasing the demand at home for domestic purposes, to lessen the amount offered for export; and a slight increase in shipping rates might be looked for, were it not for the extra keenness of the competition by English coalowners, which has been experienced since the Scotch coal strike of last year. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 165,860 tons—a decrease of 2805 tons upon the quantity in the preceding week, but an increase as compared with the corresponding week of last year of 152,834 tons. For the year to date, the total shipments have amounted to 6,453,100 tons—an increase upon the same period of last year of 1,664,310 tons, but a decrease as compared with 1893 of 147,224 tons.

Reduction in Price of Gas.—The Directors of the Wellington Gas Company announce a reduction of 3d. per 1000 cubic feet in the price of gas to all consumers, as from the 29th ult. The present price will be 4s. 4d. per 1000 cubic feet, with a discount of 5d. if the account is paid by the last day of the month following each quarter-day. The net price will thus be 3s. 11d.

Sales of Stock and Shares.—Messrs. Richardson Bros., of Stamford, sold by auction, a few days ago, £980 of stock in the *Stamford Gas Company*. The stock was put up in £75 lots (including a dividend from Jan. 1 last); and the prices made ranged from £125 to £126 10s.——At Spalding on Monday last week, some £10 shares in the *Spalding Water Company* were sold at par, and a number of others were withdrawn at £9 17s. 6d. The shares, which are fully paid, are paying 6 per cent.; but the fall in prices is stated to be due to the last report being unfavourable. ——Last Tuesday there was sold £50 of *Dundee Corporation* 3½ per cent. gas debentures, at a price equal to 125¼ per cent.——The following sales were recorded last Saturday: Three £10 shares in the *Ashford Gas Company*, at £20 each; 70 ordinary £5 shares in the *High Wycombe Gas Company*, at an average of £12 per share; 70 ordinary £2 shares in the same Company, at £4 15s. per share; 30 ordinary £2 shares in the *High Wycombe Water Company*, at an average of £4 18s. per share.

The Water Revenue of Darlington.—The Chairman of the Water Committee (Mr. G. Marshall) informed the Darlington Town Council last Thursday that the profit on the water-works during the past half year only amounted to £221, after paying interest and redemption on capital. This was a decrease of £975 compared with the corresponding half of last year; and, assuming that the diminution continued, they would have to reduce very considerably the amount they had been accustomed to hand over in relief of the rates, which amounted to about 3d. in the pound. There had been a diminution of 36 million gallons in the water consumed for manufacturing purposes (which represented £654), as compared with the corresponding period of last year. Then there had been a considerable outlay on special repairs, due to the long and severe winter, and they had had to pump an additional 36 million gallons of water, for which they would obtain nothing. The additional expenditure had made great inroads into the £1200 they had in hand at this time last year. The consumption per head had been 22 gallons, as against 17½ gallons in the corresponding half year—no doubt due to people letting water run to waste during the frost.

The Public Lighting of Sydney (N.S.W.).—Whenever dissatisfaction is expressed with public lighting by gas, the complainers generally suggest the adoption of electricity; and should this medium be selected in substitution of the older method, the parties not unfrequently find that it would have been better not to have made the change. In Sydney (N.S.W.) there is a feeling adverse to gas, notwithstanding that the Australian Gas Company have proposed to reduce the charge for each street-lamp by 2s. 6d. per annum; and a conference of the Mayors of the suburban boroughs and municipal districts has been held to consider the proposal, and to "devise some more efficient and less costly means of lighting the public thoroughfares." After some talk, it was decided that a deputation of five Mayors should wait upon the Directors of the Company to discuss the subject. There is, of course, nothing unusual in this. But after the resolution had been passed, the Chairman (Alderman W. T. Poole, of Redfern) gave, at the request of the meeting, some information respecting the lighting of his town by electricity. He said his advice briefly was to make the best terms they could with the Gas Company. He would not advise them at present to go in for electric lighting, because electricity as a lighting power was only in its infancy; and he doubted if an installation in any of the boroughs could be made to pay. It certainly could not prove remunerative if devoted entirely to street lighting. The installation at Redfern had cost £19,000. The working expenses were roughly about £1500; the interest on the capital represented about £1000; and there was a sinking fund of from 2½ to 3 per cent. He could tell them plainly that had the Redfern Council illuminated the streets by means of gas, the cost per annum would have been £1820, whereas the ratepayers were now paying £2200 (being £1 per lamp per annum extra). He was by no means sure the penetrating power of the 25-candle electric lamps now in use at Redfern was as great as that of the old 16-candle gas lights. The matter stands over pending the report of the deputation.

The Ashford District Council and the Gas-Works.—At the meeting of the Ashford (East Kent) Urban District Council last Friday, the Finance Committee recommended that the Council should communicate with the Gas Company with "a reasonable view to purchasing the works." The recommendation was adopted without comment.

Extensions at the Tamworth Gas-Works.—Last Friday, the Chairman and Directors of the Tamworth Gas Company entertained to a banquet at the Castle Hotel, a number of shareholders, consumers, and managers of local gas-works in celebration of the completion of an extension of the gas storage and purifying plant, the contractors for which were Messrs. R. & J. Dempster, of Manchester.. About 30 gentlemen were present.

Torquay Gas Company.—Speaking at the meeting of this Company last week, Mr. W. H. Kitson, J.P., stated that the half-year's profits amounted to £4061, and that the dividends required £3186; leaving a surplus of £875. There had been an increase of £1252 in the sale of gas, and of £42 for public lighting; the number of public lamps having increased from 855 in 1894 to 880 in 1895. In residuals there had been a considerable falling off. Dividends were declared for the half year at the rates of 10 and 7 per cent. per annum.

The Price of Gas for Public Lighting at Barnsley.—Communications recently passed between the Town Clerk of Barnsley and the Secretary and Manager of the local Gas Company (Mr. W. W. Hutchinson) regarding the price of gas consumed for public lighting. The Town Clerk was instructed to apply for a reduction—a request which was regarded by the Council as reasonable in view of the "low price of coal." On behalf of his Directors, Mr. Hutchinson replied that they were aware that the cost of coal was now more moderate; but they reminded the Council that the extra expense (£2000) during the last coal dispute, which came entirely out of the pockets of the shareholders, had not yet been recouped them. The Directors hoped the result of the current year's working would enable them to make a reduction. The matter was mentioned at the meeting of the Town Council last Tuesday, when Alderman Wray informed his colleagues that the public lighting cost £2200 a year, which was a very serious item. It was also stated by Mr. Harvey that at Rotherham the Corporation had reduced the price of gas to 2s. 3d. per 1000 cubic feet. From the report to hand, it does not appear that the Council contemplate any further action in the matter at present.

Bexhill Water and Gas Company.—At the half-yearly meeting of this Company, the Directors reported that the net profit for the six months was £1311, as compared with £1006 in the corresponding period of 1894. It was recommended that a dividend at the rate of 4 per cent. should be paid, and £400 be carried to the contingent fund. The Manager (Mr. F. Russell), in his report, said there was a satisfactory increase of new water and gas services, and that the spring at Buckholt had not been affected by the continued dry weather. The balance-sheet showed that the total revenue from the sale of water was £1244, and from gas £1838. The principal items on the debtor side were £825 for coal, fuel, purifying materials, &c., and £440 for wages, repairs, maintenance, machinery, &c. The Chairman (Mr. R. Kersey) moved the adoption of the report. Referring to the proposal to carry £400 to the contingent fund, he said this was to provide for works which they anticipated shortly commencing. This was a course which was absolutely imperative, as their water supply was becoming very insufficient for their services. Their capital was now nearly all exhausted; and they had no other means of appropriating funds for such a purpose. The motion was carried unanimously.

The Price of Coke at Rotherham.—A long discussion was raised at last Wednesday's meeting of the Rotherham Town Council by a recommendation of the Gas Committee that authority be given for the sale of 800 tons of coke at a minimum price of 7s. per ton net between the present time and Dec. 31. The Chairman of the Committee (Mr. G. Gummer) made a statement on the subject, from which it appeared that he was absent when the recommendation was adopted; but, had he been present, he would have opposed a reduction to the extent suggested. He called attention to the fact that in August one of the largest consumers of coke in the borough made an application to enter into a contract for six or twelve months, to which the Committee replied that, "considering the better outlook of trade generally at the present time," they had decided to offer to supply the whole of the coke required by the applicant during the next six months at 9s. 3d. per ton, or for twelve months at 9s. 6d. per ton at the works, less the usual discount of 2½ per cent. monthly. He (Mr. Gummer) therefore now asked how it came about that, in a month's time, the Committee had resolved on a reduction to the absurd sum of 7s. per ton. He failed to see anything in the state of trade or in the increase of the stocks of coke that would warrant a Committee with any business ability at all in making such a reduction. Taking the estimated price of residuals as that now received, he found the total revenue for residuals for the year 1895-6 would be something more than £2000 less than last year. In the face of this, he thought they would make a mistake in reducing the price from 9s. 6d. to 7s. per ton. He considered a medium might have been taken, which would have given satisfaction to large and small consumers; and he moved, as an amendment, that the price be 8s. per ton. This was seconded by Alderman Neil. Mr. Hickmott, who was in the chair at the meeting of the Committee when the resolution was passed, stated that the general opinion of his colleagues—and it had been his own opinion for many years—was that the holding on to stocks of coke to the extent they had, and the cost in stacking the coke for more than one or two years, had been an unwise policy. A number of speakers followed on both sides. Mr. Jenkinson gave the information that at Sheffield the price of coke was 10s. 10d. per ton; and Mr. Hirst called attention to this wide difference in the proposals of the Committee: That while they were open to sell coke to manufacturers at 7s. per ton, they were suggesting that the working man should be charged 13s. 4d., which was an increase of nearly 4s. on the present price of 9s. 6d. He expressed his disapproval of the management of both the gas and water works, and said the sooner the Council went into the question the better. It was pointed out by Alderman Marsh that the price of 13s. 4d. was for bags of ½ cwt. delivered. The amendment was carried by nine votes to six

Gas-Meter Rents at Halifax.—Alderman Tattersall moved, at last Wednesday's meeting of the Halifax Town Council, an instruction to the Gas Committee to consider the advisability of dispensing with meter-rents. He thought that the amount of profit on the gas undertaking during recent years warranted this; and the reason he brought forward the resolution was because the bulk of the meters were rented by the poorer section of the community. The resolution was seconded by Alderman Brook, and passed.

Tavistock Gas Company.—The annual meeting of this Company was held yesterday week; the Chairman (Mr. H. T. Doble) presiding. The accounts showed that the rental from private lighting for the year ending June 30 was £1801; the receipts for the public lamps, £457; for coke, sulphate of ammonia, &c., £660; from meter-rents, stove hire, &c., £57; and an item of £180 for interest, made a total of £3158. The payments, including a dividend of £640, amounted to £2777; leaving a credit balance of £381. An interim dividend of 8s. per share was declared.

Water-Works for Worthing.—The Worthing Town Council have resolved to borrow £54,504 and £23,000 to defray the cost of the sewerage scheme and the water-works; a site for the latter undertaking having been selected on the advice of Mr. J. Mansergh, M.Inst.C.E. The money will be obtained from the Bank of England, in conjunction with Parr's Banking Company, and will be repayable in sixty half-yearly instalments (principal and interest combined) of £1406 7s. 7d. and £539 9s. 6d.; the borrowers to have the power to pay off the whole debt then due on Aug. 26, 1910.

The Public Lighting Contracts for Weybridge.—Referring to the report which appeared in the JOURNAL for the 17th ult. on this matter, the opinion of Counsel (Mr. Glenn) has since been obtained upon the proceedings of the District Council. It upholds the action of the Council on all points, excepting with reference to the gas-lighting contract; and, with regard to this, it is declared that it has no binding effect on either side, as it contains no clause as to penalties. At last Wednesday's meeting of the Council, it was agreed that a new contract with the Gas Company should be prepared, and submitted at an adjourned meeting.

The Finances of the Keighley Corporation Gas Department.—At last Tuesday's meeting of the Keighley Town Council, the Gas Committee reported that the gross profits upon the working of the gas undertaking for the year ending June 30 last (after lighting the public lamps free of charge) was £8931, from which had been paid interest on loans, £2798; provision for sinking fund, £1480; cost of fire brigade, £564; and cost of specifications for patents library, £16—making a total of £4859. This left a surplus of £4072; and the Committee recommended that £2000 of this should be appropriated in aid of rates, and £2072 in reduction of the debt on capital account. This was agreed to.

West's Retort-House Plant for Copenhagen.—The municipal authorities of Copenhagen have decided, upon the recommendation of their Engineer (Herr Irminger), to adopt stoking machinery at their gas-works. Herr Irminger recently visited several towns in England with the object of inspecting different systems of mechanical stoking; and the one decided upon is West's manual drawing and charging machinery, with engine and coal breaker, elevator, conveyor, and storage hoppers complete. The contract has accordingly been placed with West's Gas Improvement Company, Limited, who are also erecting at the same works some of West's improved regenerator retort-settings under a separate contract.

The Action of Thirlmere Water on Lead.—At a meeting of the Committee of the Manchester and Salford Sanitary Association last Wednesday week, it was stated that, at the instance of the Manchester Council for the Registration of Plumbers, the Association had undertaken to inquire into and report upon the action of Thirlmere water on lead, as it had been suggested that, owing to the soft character of the water, there might be a danger from its action on the service-pipes. The following report by Mr. William Thomson, F.C.S., was submitted: "I now send you my report on the Thirlmere water, which I was requested to test for its action upon lead pipes, and which I obtained from the Prestwich reservoir. I have ascertained that the water does not dissolve any metallic lead, and is, therefore, quite as safe as the former Manchester water."

East Stonehouse Water Supply.—The East Stonehouse District Council, who derive their water supply from the Plymouth Water-Works, have applied to the Corporation for the terms upon which an additional quantity over and above that stipulated in the local Act of Parliament can be supplied to their district. The Corporation Water Committee have decided to inform the District Council that they are prepared to afford a further supply when it can be furnished without detriment to the supply to existing consumers. They stipulate, however, that a specified weekly quantity, and not a variable amount, be taken. The water will be delivered through the existing North Road main until a new main for which provision was made in the East Stonehouse Water Act of 1893 is constructed. While it is delivered through the North Road main, the charge will be at the rate of 3d. per 1000 gallons, to be reduced to 2½d. when it is delivered through the proposed new main.

Water-Works Improvements at St. Helens.—Mr. F. H. Tulloch, one of the Inspectors of the Local Government Board, was engaged at St. Helens last Tuesday in considering applications by the Corporation for loans for various purposes. One of them was for £3000 for a new engine and alterations to the pumping-station at Eccleston Hill. The Town Clerk (Mr. W. J. Jeeves) explained that the Corporation were the owners of the water undertaking; and they required this money for improvements at the Eccleston Hill pumping-station. There were two engines, one of which was erected in 1852, and the other in 1862. The whole of the capital debt on the engines and buildings had been paid off. The engine erected in 1852 required repairs, which could be done out of revenue in the ordinary course; but the engine erected in 1862 was in such a condition that it was considered best to replace it with a new one on modern lines, which would effect a considerable saving in fuel, and enable considerably more water to be pumped. There was no opposition.

Lancaster Water Supply.—The Corporation of Lancaster have obtained power to borrow about £62,000 for the construction of a new reservoir at Bleatarn, which has been necessitated by the development of the town, and more especially of Morecambe. The work is to be commenced forthwith.

The Public Lighting of Bromsgrove.—Owing to the Bromsgrove Gas Company having declined to reduce their charge of £2 15s. per lamp a year for the public lighting, a Committee of the District Council recommended, at last Wednesday's meeting of the latter body, that the offer should not be accepted, and that a trial should be made of two or three oil-lamps. The Vice-Chairman (Mr. H. W. Lewis) thought the Council should be prepared to adopt temporary measures for lighting the town until they could devise some better plan either by means of electricity or otherwise. Mr. Fitch urged that the Company should be requested to reconsider their tender, and that a meter should be attached to a few of the lamps to ascertain the amount of gas consumed. The report was adopted by six votes to four. The Vice-Chairman said he should prefer to come to terms with the Company if possible; and he proposed that a deputation should be appointed to wait upon the Directors to endeavour to arrange for the supply of gas by meter. Mr. Bower seconded this proposal; and it was carried.

Heavy Consumption of Water at Manchester.—The ratepayers of Manchester have good cause for congratulation in having become possessed of the Thirlmere water before the recent long spell of hot and dry weather. The average daily supply has recently been greatly in excess of the corresponding period of last year; but so plentiful is the supply under command, that the Committee have not experienced the slightest difficulty in meeting the exceptional demand. The average consumption for the eight months ending Aug. 31, was at the rate of 29 million gallons per day. For the whole of last year, the average was 25 million gallons per day; so that, without taking the circumstances of last month into consideration, there has been an increase of 4 millions daily in the average consumption. The average daily output in the last week of September rose to above 31 million gallons; and yesterday week it still further increased to 33 millions. Had it not been for the Thirlmere supply, it would have been quite impossible to have distributed such a vast quantity of water; and it would have been necessary to impose restrictions upon consumers.

West Gloucestershire Water Company.—According to the report submitted at the half-yearly meeting of this Company last Saturday week, there were laid, during the six months ending Aug. 31, 228 additional services; making the number of houses and other properties supplied 5541, which, together with some meter and miscellaneous supplies, are estimated to produce a water-rental of £4360 per annum. In common with almost all water-works in the kingdom, the Company's mains suffered greatly from the unprecedented frost in the early part of the year; and their repair cost £315. The profit of the half year was £754, which made, with the balance brought forward, £1022. From this, the Directors recommended the declaration of a dividend (less income-tax) at the rate of 2 per cent. per annum. After the payment of this, there would remain £322, against which the entire cost of repairing the damage done by the frost has been debited. The Chairman (Mr. Enoch Horton), in moving the adoption of the report, said that several new streets and roads were being opened up in the Company's district; and building operations were being carried on vigorously. Owing chiefly to this, it was of the greatest importance that the Company should spend a further £3000 or £4000. The motion was carried.

The Purchase of the Odessa Water-Works by the Municipality.—An extraordinary general meeting of the Odessa Water-Works Company was held on Monday last week, at the Cannon Street Hotel, for the purpose of confirming the following resolutions, which had been previously passed at an extraordinary meeting held on the 12th ult. (see *ante*, p. 600): (1) "That the concession of the Company for the supply of water to Odessa, with such of the property of the Company as the Directors may determine, be sold to the Odessa Administrative Council, or other body representing the Municipality of Odessa, on the basis of a capitalization of the net annual receipts, taken for the purpose at 200,000 roubles for the residue unexpired, at the date of sale, of the term of the said concession, and otherwise upon such terms as to time for payment and upon such conditions as the Directors and Municipality may agree; and that the Directors be, and they are hereby, authorized to enter into a contract for, and carry out such sale;" (2) "That, in order to permit of the distribution of the proceeds of sale of the Company's concession and other property, the Odessa Water-Works Company, Limited, be wound up voluntarily; and that the present Directors be appointed Liquidators for that purpose." The chair was occupied by Sir Peter Spokes, who briefly moved the resolutions. A long and exceedingly acrimonious discussion followed, in the course of which some strong language was indulged in at the expense of the original promoters of the concern; but eventually the resolutions were adopted by a majority of those present. The Chairman intimated that he held a very considerable number of proxies in favour of the resolutions, for which, however, in view of the vote of the meeting, there was no use.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 718.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	24—25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	10	16—17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼—7¾	..	4 3 10
40,000	5	,,	6½	Do. New	4	5¼—5¾	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	207—212	+4½	4 4 11
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	222—227*	..	4 16 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	27 Sept.	11¼	British	20	54—55*	..	4 1 10
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8—8½	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	305—310	..	4 7 1
165,000	,,	,,	10½	Do. New do.	100	225—230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	275—285	+5	4 11 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	207—212	..	4 14 4
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100†	293—297	..	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	282—287	..	3 9 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	+2	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145—150	..	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	249—254	..	4 14 5
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¼—6¼	..	4 16 0
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113-116*	+1	4 6 2
541,920	20	12 June	5	Monte Video, Limited	20	18—19	..	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
420,000	100	2 May	6	People's Gas of Chicago— 1st Mtg. Bds.	100	108—112	+2½	5 7 1
500,000	100	4 June	6	2nd Do.	100	102—107	+2	5 12 1
150,000	10	26 Apl.	7	San Paulo, Limited	10	11—12	+½	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	310—315	+3	3 16 2
308,685	,,	,,	13	Do. C do.	100	325—330	+5	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	..	2 16 6
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	292—297	..	3 7 4
1,719,514	Stck.	10 Apl.	7†	East London, Ordinary	100	223—227	−½	3 1 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118—122	+½	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	303—308	..	3 17 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—265	+1	2 16 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143 148*	..	2 13 4
500,000	100	14 Aug.	12¾	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147—152	..	2 12 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	293—298 *Ex div	+3	3 7 1

† Next dividend will be at this rate.

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EDITORIAL NOTES.

Questions Concerning Prepayment Meters.

THE useful, though brief, discussion upon Mr. Holliday's paper read at the North of England Association meeting, turned in a great degree upon the important question of how the occasional differences between the contents of the money-box of prepayment meters and the registration of the meter index should be treated in the best interests of both supplier and consumer. Mr. Holliday stated in his paper that, at one recent monthly collection, there were 51 cases where money had to be returned to the consumer, and 100 cases where it was necessary to request the consumer to pay sums varying from 1d. to 3s. 8d., by reason of the cash in the box being deficient. This upon 350 or 360 meters must be regarded as an excessive proportion of errors. Mr. Holliday did not give a balance-sheet of these irregularities; so that it is impossible to say whether the whole difference, if any, inclined to one side or the other. Seeing, however, that he has adopted the plan of leaving the correction of the differences to be done only every three months, and then does not insist upon deficiencies being made good, there is probably not much for either party to complain about in the long run. Mr. E. H. Millard, of Durham, inclines to the principle of treating the prepayment attachment exactly like the ordinary meter registration. The figures may be too high or too low; but the Company simply take the money, and say nothing about the matter. We are disposed to agree with this policy. It is manifestly unwise to trouble the consumer about the erroneous working of his meter. It is no affair of his; and it is too much to expect him to accept without question the arbitrary rule that where there is discrepancy between the prepayment attachment and the ordinary index, the latter is always to be taken as correct. The consumer may quite reasonably think it is for the gas company to satisfy themselves as to the reliability of their appliances before offering them to the public, and that supplying meters involves trusting them as between the company and the consumer. We certainly are inclined to hold that where the company have not this confidence in a prepayment attachment—as much, that is to say, as they have in the rest of the meter—it would be better not to fix it.

The incidental subject of leakage cropped up in the course of the discussion; but it was quashed for the occasion by the President—doubtless, with reason. All the same, the question whether the proportion of unaccounted-for gas is increased by the adoption of prepayment meters is one that is well worth considering in a proper time and place. The discrepancy between the working of the automatic cut-off arrangement and the meter index may affect this proportion; and each addition of a new service to the distributing network also means increased risk of leakage. This consideration, however, is not confined to the case of services connected with prepayment meters.

Another important point that calls for settlement in regard to the management of the automatic prepayment meter system is that of the property in the contents of the cash-box. To whom does the money put into this receptacle belong? Nine ordinary men out of ten would say, without thinking twice, that it is the property of the suppliers of gas. The automatic appliance for turning on the gas upon the inducement of a penny dropped into the box, they would say, is as much the agent of the supplying authority as if, instead of being a set of levers, it were a living man in the service of the undertaking. The whole system hangs upon the fact of the gas being paid for before delivery. It is a prepayment device first, whatever else it may be besides. When the penny is put into the slot of the prepayment attachment, it effects a commercial operation, and then reposes in the place appointed for it until collected in due course. Nobody but an officer of the company can touch it; and it is as fully in the possession of the company as if it were to roll straight from the slot through a pipe into the cash-box at the rental office.

It is partly with reference to this idea of the money that has been dropped into the meter cash-box being paid to the company for gas delivered, and as such representing so many completed purchases of gas as there are coins in the box, that we adopt the principle expounded in the first paragraph of this article. It appears, however, from an incident that has lately transpired in Norwich, that the

common-law-inspired Magistrates of the Bench of that city do not so regard the question. They declined to allow the British Gaslight Company to prosecute a thief who had robbed a meter cash-box, on the ground that the money was the property of the householder in whose name the meter stood. The point was not adequately argued upon this occasion; the Company's advocate not being prepared to show that the money had been, so to speak, paid over the counter for goods actually delivered. The point is doubtless a nice one, as so often happens when the good old common law of England needs to be squared to some new modern instance. But we cannot concede the correctness of the Norwich Magistrates' reading in this regard. On the last two occasions when prosecutions of this nature were instituted—reports of which appear in another column—the presiding Magistrates did not raise any objection to the *locus standi* of the Companies. These instances, therefore, settle the procedure in such cases, so far as the Metropolitan area is concerned.

Good Advice for Gas Consumers.

For once in a way, there has appeared during the past week in a leading London daily newspaper a really intelligently conceived and, on the whole, fairly written article on the subject of how consumers may keep down their gas bills. The journal which has thus distinguished itself is the *Daily News;* and the article appeared in last Thursday's issue, in which it occupies a prominent place. The writer is evidently not a technically trained person; and the amount of new information he is able to give his readers is so small that, if his performance were to be judged by this standard, it would come out very badly. Happily for him, however, it is not so much technical knowledge that the average gas consumer needs for keeping his gas bills within bounds, as a little common sense and care for his own interest; and the application of these is the strong point of the article. It is, we suppose, inevitable that a popular writer on the subject of domestic gas consumption should have his little joke about the "tricky and mendacious meter." Gas officials know that there is another side to this picture, and also that mendacity and intention to deceive are not more conspicuous in the much-maligned meter, than they are in some of those members of his household to whom the consumer is in the habit of referring for information as to how much gas is used in the house when his back is turned, and in regions to which the head of the household rarely penetrates. The *Daily News* article lays due stress upon considerations of the latter order, and wisely reminds the householder that now and henceforward is the proper time to look after gas-burners unnecessarily or improperly used, and that it will be too late to do so when the bill for the Christmas quarter comes in. A wasteful habit of lighting the gas in bedrooms and in little-used passages at nightfall, and leaving the flames burning at the full until the house is shut up for the night, is easily acquired by young people and servants about this season of the year, when long evenings are yet a novelty. Unless this extravagance is checked betimes by some person in authority, an enormous quantity of gas will be passed through the meter without anybody suspecting the fact; and then, when the bill comes in, there is an explosion—though not of coal gas; and, of course, nobody knows how or why so much gas has been consumed.

The *Daily News* writer mentions with favour the growing employment of gas-burners with flash-lights, which enable the flame to be turned on or off at will; thus imparting to gas one of the most admired advantages of incandescent electric lighting. He also observes with truth that "next "to the supervision of servants and the wants of out-of-"the-way burners, the matter of pressure is probably the "most important consideration, and the one that is most "generally overlooked." He proceeds to give some perfectly correct directions as to the proper way to burn gas by means of open flames, so as to get the full lighting advantage from it, and points out the wastefulness of consuming gas at too great or too little pressure. Curiously enough, he just stops short of giving the full practical value to his advice by recommending the use of governor burners. It is true, he declares that "unfortunately the "photometer does not form any part of the appliances of "an ordinary household, or gas consumers would soon "realize pretty clearly that some form of regulator is "indispensable if they wish to get full value for the gas "they pay for." But he omits to mention that, for a few pence each, there are regulator burners to be had, any pattern of which will save its cost many times over in the course of a winter's quarter, as compared with the waste of an unregulated burner. Still, the article is a good one, so far as it goes.

While upon the subject of gas pressures, it may be suggested that distributing engineers occasionally, from want of thought, bring their employers into disrepute by failing to notify consumers when considerable alterations are effected in the ruling pressures of a particular district. Every year, in the ordinary way, districts discovered to be getting an insufficient supply are provided with larger mains; and trunk mains are run to distant points with the praiseworthy object of equalizing pressures. This is all very right and proper. But it sometimes happens that consumers who have become habituated to low-pressure conditions suddenly get the offer of a largely increased supply, as the result of main-laying operations of which they have been kept in profound ignorance. In such cases, they may or may not notice that their "gas is better" than it used to be. But when the next quarter's bill comes to hand, they are sure to be startled at its unprecedented magnitude. The gas manager rubs his hands at the increased consumption that has rewarded his improvements in distribution. But the consumer rages, and is not to be pacified by any retaliatory measures short of ordering out all the gas-stoves and gas-fires in his place, and perhaps investing in oil-lamps as well. Much of this might be obviated by notifying the consumer betimes of what to be prepared for. At any rate, if, after having been "forewarned," he is not "forearmed," the fault is his own.

The Gas Supply of Leeds.

The Leeds Corporation Gas Committee have recommended, and the City Council have agreed, that the price of gas supplied within the city limits shall be reduced from 2s. 4d. to 2s. 2d. per 1000 cubic feet as from the beginning of the new year. A further recommendation by the Committee, to make the same reduction of 2d. per 1000 cubic feet to the consumers outside the city boundary, was rejected; so that the price to these outsiders will remain at 3s. per 1000 cubic feet. There was an interesting debate in the Council upon the motion; and it appeared that, in offering this reduction, the Gas Committee think they are going quite as far in the direction of cheapness as the circumstances of the undertaking permit. It must be regarded as a regrettable piece of selfishness, however, that the boon which the Committee felt justified in granting to the outside consumers was withheld by the Council. The most noteworthy point of the speech of the Chairman of the Committee, Mr. J. Tweedale, in moving the resolution to reduce the price, was its reaffirmation of the principle "that those who made the gas profits should share in the "benefit of such profits." This policy Mr. Tweedale pronounced to be "sound finance, while other methods might "be unsound, unfair, or unjust." The only questions that agitated the members of the Council in regard to the proposition were, first, whether the reduction might not be greater; and, secondly, whether something more should not be done to reduce the Committee's bank overdraft, which was stated to average £112,000 over the year. In the end, it appeared to satisfy the majority of the Council that the course recommended by the Committee was a safe middle line between the claims of consumers and financial prudence, inasmuch as, while the reduction would absorb £18,000 of the gas profits, there would remain £8000 for reducing the overdraft. In all probability, unless something unforeseen happens to the gas undertaking during the coming year, the Council will find the effects of their present policy more beneficial to the undertaking than they expect. It is at least certain that the cheaper gas is sold in Leeds, the more it will be in demand, and the greater will be the variety of the applications found for it by an ingenious industrial community. The citizens are not likely to forget, however, that they once had gas as low as 1s. 10d. per 1000 cubic feet; and though it was stated in the Council meeting that it had never paid at this price, the undertaking ought to have so improved during the period that has elapsed since the charge was raised above this figure as to be within sight of the possibility of at least returning to it. Leeds gas once upon a time ranked with the cheapest in the kingdom, and that it no longer does so is not a matter upon which the Gas Committee can be congratulated. If they have had their vicissitudes, so have

other places; and the fact of the latter having recovered more quickly might be construed into an indication that Leeds is not so fully up to date in gas matters as they are. Fortunately, a proposal to raise the nominal illuminating power of Leeds gas fell flat at the meeting; and it can hardly be too strongly insisted upon that indulgence in any such obsolete ideas would be fatal to the revival of the days of cheap gas.

The Cost of Street Lighting at Bradford and Elsewhere.

The accounts of the Bradford Corporation for the last half year have just been submitted to the Town Council by Mr. W. C. Dixon, the Chairman of the Gas and Electricity Supply Committee, who was able to make out a very fair statement on behalf of the important undertakings under the care of the Committee. There is nothing very exceptional about the gas accounts, unless it be the cost of the public lighting, which is borne by the department for the benefit of the ratepayers. The amount is £21,111 for the year, which, as a local newspaper observes with evident surprise, is equal to 5d. in the pound on the rates—"that "is, it is nearly equal to the whole cost of the poor of the "town, so far as that falls on the rates; and is equal to "half the education rate." It is further remarked that it is just as well that the Gas Committee, who have to resist constant pressure for cheaper gas and more lighting, should protect themselves by periodically publishing what it costs "for illuminating the path of the wayfarer in busy "streets and lonely alike." So far as we are aware, this point of the relation between the amount spent on the public lighting and the rateable value of a town is not often brought into discussions of the former subject. There is consequently no rule in regard to the matter. But we should scarcely have pointed to Bradford as a particularly bright and shining example of liberality in street lighting; yet it must be admitted that the bill for it is a tolerably heavy one. The local newspaper already referred to remarks that "probably if the cost of lighting "had always been charged in the form of a rate, instead "of being taken out of the gas receipts, the Bradford "streets would not have been so well lighted as they are "now." But are they so remarkably well treated in this respect in comparison with other centres of population of equal importance? English towns deal with this matter of the cost of street lighting in different ways, as is indicated by the gaps in comparative and analytical statistics of gas supply where this information should come. It is an expenditure that should evidently be collated with rating as well as with gas revenue.

The Congress of the National Free Labour Association.

The Third Annual Congress of the National Free Labour Association was held last week at Newcastle-on-Tyne, when a good deal of information respecting the many shortcomings of Trade Unionism was put into circulation through the medium of the newspapers which reported the proceedings of the Congress, greatly to the disgust of the Trade Union leaders. It is not the fault of the prominent men in this Association that they are constantly seen to be on their defence against the charge of animosity to the principle of mutual co-operation which is assumed to be the basis of Trade Unionism. The truth is that the Free Labour Association is as truly a Trade Union, in the natural or original meaning of the term, as any of the organizations against which it is its mission to protest. But whereas the Association claims to uphold the principle of freedom for workers to work wherever they please, the recognized Trade Unions stand committed to a policy of tyranny over the individual workman and the employer, in the name of Socialism. Mr. John Chandler, the President of the Congress, described in his address the origin of the Association, which was called into existence by the dictatorial action of the "false and upstart leaders of the "new socialistic Trade Unions" that came into existence about the time of the dock strike in 1889. Some trenchant things about the conduct and results of this and other strikes were said at the Congress. One member observed that the frequent preponderance of votes in favour of striking, when the question is submitted to ballot, is due to the suffrage being given to boys, who have no responsibility, and to whom a holiday is always desirable. "Difficulty, too, would be experienced in the way of con-"ciliation so long as Trade Unionism was used for the "manufacture of bogus M.P.'s and broadcloth idlers." These were cutting remarks; but they were capped by others equally pungent. One resolution carried by the Congress drew attention to the fact that the funds of Trade Unions are in urgent need of protection, as indicated by the startling record that during the past three years 3852 Trade Union officials in various societies throughout the country have been sent to prison for fraud, forgery, and embezzlement of the funds. Altogether, if the proceedings of the Congress were not so lively as those of the Trade Unionists at Cardiff, the character of the resolutions passed at Newcastle-on-Tyne was far more practical and businesslike than the trashy transactions of the earlier gathering.

WATER AND SANITARY AFFAIRS.

The London Water Question comes before the County Council to-day in a peculiar form, by no means in harmony with the policy hitherto adopted by that body. A report will be brought up from the Parliamentary Committee, recommending that Her Majesty's Government be asked either to deal themselves with the question of water supply, or to appoint a Royal Commission for the purpose, with a view to placing the entire supply of London and the outlying districts in the hands of a public authority. But the Progressives, although, in their wilfulness, they upset the project of a new street from Holborn to the Strand, are not likely to abandon their own scheme for supplanting the Water Companies. As for the intervention of the Government, past experience on the Conservative side rather forbids any movement of that kind. A Royal Commission might advise; but could hardly do more. If the Government would take heart, and bring in a Bill proposing a well-contrived scheme for a Water Trust, some good might come of it. But it is "a thorny subject;" and there is little doubt that the Government would rather not attempt to grapple with it. In the meantime, the people of London are getting better enlightened as to the facts and bearings of the case. Last week, Lord Farrer made a bold attempt to overthrow the authority of the report of the Royal Commission of 1893, by means of a long and trenchant letter to *The Times*. His Lordship is virtually quarrelling with the Commissioners for keeping strictly within the limits of their instructions; his great complaint being that these authorities, instead of wandering over the kingdom in search of a new source of supply, contented themselves with quietly showing that there was water enough to be had in the valley of the Thames. A very admirable reply to his Lordship's fallacies appeared on the following day in the editorial columns of the paper, in which the report of the Commission presided over by Lord Balfour of Burleigh was described as "peculiarly distasteful to the enthusiasts "of the County Council, because its sober common sense "is a standing rebuke to schemes in which political "animosities count for as much as disinterested solicitude "for the future water supply of London." The final criticism in *The Times* leader is still more pungent. The report of the Royal Commission is therein commended, because "it interposes an obstacle to the plans of a party "all whose views are coloured by its paramount desire to "discredit the existing Water Companies and acquire their "undertakings." It is as an ally to this party that Lord Farrer appears in the columns of the leading journal. Nevertheless, the Water Companies—and no less the ratepayers—may rightly feel indebted to his Lordship for eliciting the editorial deliverance which so very effectually disposes of his vehement appeal put forward in support of the Progressive policy on the Water Question.

On Saturday *The Times* contained another long letter on the subject of the London Water Supply. Although the writer simply signs himself as "X," we may presume that the real name would have carried weight; the letter being favoured with large type, as in the case of the communication from Lord Farrer. The writer enters into a defence of the Staines scheme, and does so with much success, though it does not follow that this particular plan is essential to the perfect utilization of the Thames for the purpose of the water supply. But "X" legitimately makes use of the scheme to show that the Thames is really capable of supplying all that will be needed from that source for the next forty or fifty years. Mr. Binnie's strictures on the project are met by the remark that the Chief Engineer to the County Council has a rival scheme of his own, and is therefore not an impartial witness as against any other plan. He is also

said to have appeared before the Royal Commission "as "the mouthpiece of the Water Committee" of the Council —"a Committee of which Lord Farrer is ex-Chairman." Lord Farrer having objected to the forty years' limit which the Commissioners fixed as the period for which an adequate supply should be forthcoming, "X" has shown that fifty years might have been taken, as proposed by the County Council, without any material change in the conclusions arrived at. Simultaneously with the letter from "X," one appeared from the pen of Mr. George Livesey, suggesting that Lord Farrer's "very able and "interesting letter" is hardly complete without some effort to show that London will ever require more water than the Royal Commissioners contemplated as probably necessary within forty years from 1893. The question is asked whether London can continue to grow indefinitely. "Already, I believe," says Mr. Livesey, "the rate of "increase is appreciably diminishing." This belief is fully justified. The yearly reports of the Registrar-General show that the average annual rate of increase in the population of London was less in 1881-91 than in 1871-81. It is reasonable to expect a further decline in the rate during the present decenniad, though the rapid growth of the population "over the border" may slightly affect the result as it concerns one or two of the Water Companies.

It is evident that the Metropolitan Water Question is fast ripening; and there are indications that the fruit is not likely to be to the taste of the County Council. Colonel Ducat and Dr. Barry have paid a visit to the works which are being carried out by the East London Company, and are said to have expressed themselves pleased and satisfied with what they saw. What they looked at is described at considerable length in a graphic and comprehensive article which appeared in the *Daily News* last Tuesday. The description both of the old and the new works is very striking, and calculated to enlighten the Metropolitan readers of that newspaper on a subject concerning which very few have anything like an adequate conception. We observe that the *Daily Chronicle* uses somewhat cautious language with respect to the Welsh scheme. Our contemporary says, "if the project ever takes definite form," and "should the scheme ever come to fruition," then certain considerations will have to be debated. The tide is clearly turning; and should the East London inquiry result in a report showing the extent to which the County Council are responsible for the recent deficiency in the supply, and also specifying the completeness with which the Company are providing against future failure, the effect on the public mind will contribute in no small degree to a right settlement of the entire question. Another letter from Lord Farrer was published yesterday, asking what steps the Water Companies are taking to carry out the Staines scheme. His Lordship appears to have no knowledge of the extensive works—to cost three-quarters of a million—which the Southwark and Vauxhall Company have in progress between Hampton and Sunbury, and which affect the Thames in the same way as the East London works affect the Lea.

Death of Alderman J. U. Bugler, J.P., of Ashford.—We regret to record the death, on Wednesday last, of Alderman John Udal Bugler, J.P., at the age of 66. Deceased was elected Chairman of the Ashford Gas Company in 1878, and held that position up to the time of his death. He was for many years actively associated with the administrative work of the County of Kent; and in 1892 he unsuccessfully contested the Ashford Division as an aspirant for parliamentary honours.

The Proposed Competitive Gas Supply for Liverpool.—The Finance Committee of the Liverpool Corporation had a special meeting a few days ago to consider what was to be done to give effect to the resolution passed by the Council on the 2nd inst., as recorded in the JOURNAL last week, in regard to the proposed competing gas supply for the city. They were informed by the Town Clerk that the Council could not proceed with such a project under existing circumstances. However, they gave him instructions to retain the services of an eminent gas engineer in London, who is to report as to the possibility of establishing a system of gas supply in the city apart from that controlled by the Gas Company. A correspondent of a Liverpool paper advises the Corporation to acquire the Company's undertaking, guarantee the shareholders their statutory dividends, and bring down the illuminating power of the gas to 18 candles. By the last-named proceeding, a considerable reduction could, he says, be effected in the cost of producing the gas, which, with economical management, might, he thinks, be supplied at 2s. 3d. per 1000 cubic feet, or perhaps less, after paying dividends.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 797.)

It was inevitable that the past week, with the settlement coming at the end of it, should be full of agitation for the Stock Exchange. Although it opened fairly, cheered by good trade returns and a calmer atmosphere in the Foreign Market, yet the disagreeable but wholesome process of weeding out the "weak bulls" in mines, could not be staved off. By mid-week, these gentry were cornered, and had to realize as best they could. The "bears" readily seized their opportunity; and, between the two, something very near a scare was brought about. However, the overloaded ship, lightened by the jettison of its rubbish, is now riding more easily through the settlement, and will sail in smoother waters now. Of course, other departments suffered to some extent through the turmoil; and nearly all prices are lower. But there is some reason to think they will be gradually taking their own line, and going on their own merits. The Money Market remains in the same lifeless condition; and the lessened requirements of the Stock Exchange reduce the temporary fillip it usually looks for in account week. Business in the Gas Market has been a great deal quieter. The general position is, on the whole, very firm. Several moderate advances in value have been effected; while only one retrogression has taken place. Transactions in Gaslights were much more limited. The "A," though quieter, was stronger. It changed hands several times at 297; the quotation rising a point. In the secured issues, a solitary deal in the "H" 7 per cent. was all that was marked. South Metropolitan also were extremely quiet; but the few operations recorded showed capital figures, especially for the "A" stock, which fetched top price. Nothing was done in Commercials, except a small parcel of debenture stock. About half-a-dozen transactions—mostly in Brightons—were effected in the Suburban and Provincial companies; and Alliance and Dublin had another rise. The Continental group moved irregularly. Imperial was weaker, and fell away a point; but Union was in great favour, and scored a smart advance. Of the rest, only South Americans were conspicuous; Buenos Ayres and San Paulo improving. In Water, there was a capital demand for the debenture and preference issues. Prices, as a general rule, were good; and the stocks of the Kent and Chelsea improved their position.

The daily operations were: Business in Gas was decidedly limited on Monday; and prices were unchanged. Buenos Ayres rose ¼. On Tuesday, transactions remained much restricted; but the prices marked were very good indeed. Continental Union advanced 2½; ditto preference, 5; and San Paulo, ½. There was more activity in Gas on Wednesday; and prices again were capital. Continental Union preference rose 3; and both Alliance and Dublin, ½. But Imperial Continental fell 1. Chelsea Water rose 1. Business was on about the same level on Thursday; prices being well maintained, but not advanced. Friday was fully as active as any day of the week. Gaslight "A" improved 1; and Buenos Ayres, ¼. In Water, Kent had a nice rise of 4. Saturday relapsed into absolute quietude; and the various quotations closed without noteworthy alteration.

ELECTRIC LIGHTING MEMORANDA.

The St. Pancras Vestry have a Lucid Interval—The Condition of Electric Manufacturing Industry in England—Electrical and Mechanical Competition—A Story from the States.

Though the matter is now two or three weeks old, having been reported in our "Electric Lighting Notes" a fortnight ago, previous reference to the subject in these columns renders it necessary that we should make some mention here of the rescinding by the St. Pancras Vestry of their resolution of July 31 last, prohibiting the London Hydraulic Power Company from supplying power to certain premises within the parish boundary. The whole story is an instructive disclosure of the fashion in which the parish business is done. The circumstance that an important resolution adopted at the end of July should be wiped out again by the middle of September, is in itself evidence that swift repentance may sometimes ensue upon parochial wrong-doing. But it would have been far more creditable to the Vestry if the bulk of the members had had the good sense to nip in the bud the folly of their colleagues of the Electric Lighting Committee. It came out in the course of the discussion on the motion to rescind the resolution, that the Electric Lighting Committee were themselves using the very convenience—a hydraulic power lift—which they had induced the Vestry to deny to the ratepayers of the parish. After this, of course, there was nothing more to be said; and the Vestry, after having, metaphorically speaking, jumped upon the Chairman of the Electric Lighting Committee, proceeded to purge

their records of the resolution in question. So far, the adoption of electric lighting by the Vestry does not appear to be reliable evidence of the existence of what may be called a high standard of political enlightenment among the administrators of the undertaking.

An article, decidedly pessimistic in tone, recently appeared in the *Electrician* on the subject of electric manufacturing industries in the United Kingdom. Passing in review the published statements of accounts relating to the last year's working of the three electric manufacturing companies whose capital is held to any considerable extent by the English public, our contemporary finds the outlook for this industry far from rosy. The Brush Company, on a capital of £697,888, earned 2·2 per cent.; Crompton and Co. earned on £291,174 only 2·38 per cent.; the Electric Construction Company, on £551,366, earned 4·6 per cent. Of course, the Chairman of every Company explained to the general meeting how it came about that matters were no better. These explanations, however, related to nothing more extraordinary than contingencies of business, which ought always to be allowed for in judging of working results. Our contemporary credits these concerns with having acquitted themselves well in difficult circumstances. They really had to make the business in which they are engaged; and such pioneering work cannot pay. Pioneering is now over, however; and those electric engineering companies that have lived through this stage of the industry ought to make better profits than they do, if the trade is to be esteemed worthy of being carried on. It is argued that "what is wanted to make all these concerns pay is more work; and, in spite of the fact that the last year or so has seen the closing of some manufacturing concerns, there are still too many in the trade for the existing amount of business." The remedy favoured by our contemporary is that the electric manufacturing companies should go in for collateral work such as the production of high-class steam-engines, as the Brush Company have already done.

The point seems to be quite lost sight of here, that there is another side to this question, and that, while manufacturing concerns which started with being electrical may find their profit in qualifying their speciality with general engineering work, mechanical engineers can and will take them in the rear by setting up electrical departments. This is indeed the course that the trade has been taking for some years; and it will grow increasingly difficult for electric construction companies with enormous capitals largely representing shares in electric lighting companies which do not pay, and goodwills and patents which have no actual value, to keep their footing against mechanical engineers who are not hampered in the same way. The *Electrician* wisely warns the electric construction firms that they must not look to raising prices to recover their vanished or dwindling prosperity. "The fact is that if motors and electrical appliances are to become part of our daily life, prices must go down. The countershaft holds it own over the distributing motor because of its cheapness; and this reason also in numberless cases determines the scales in favour of gas-pipes instead of an electric installation. The public and engineers have been educated to understand the advantages of electric systems, *but price bars the way*." [The italics are ours.] We can compliment our contemporary upon its frankness in confessing the truth of the situation. As we have always urged, it must be far better for electricians in the long run to recommend electric appliances for what they are, instead of trying to impose them upon the public for what they are not.

The article which we have been discussing winds up with a story which is too good to escape repetition. "'What are you busy with now?' was the inquiry addressed by an English engineer to the President of one of the largest American manufacturing concerns, a year or so ago. 'I am busy trying to keep the receiver off the doorstep,' was the reply." And the comment is made that this has been very nearly the truth with some of our English electrical businesses. It would be possible to go farther, and say that the effort has failed in several prominent cases. Our contemporary hopes that things will be better, and that the demand for electrical appliances will be increased "either by overcoming the terrible prejudice in this country against the electric tramway, or by so cheapening manufacture that markets at present barred will be available." But what then ails the American electric trade—for is not the United States the happy home of the electric tramway, and are not all kinds of electrical appliances more necessary to the people than meat or drink or the air they breathe? If this is not so, then the slow-going people on this side have been grossly misinformed on the subject. Before sacrificing our highways in order to keep the electrical industry alive, it will obviously be incumbent upon us to make sure that the proper effect will be duly achieved.

Personal.—Mr. J. P. Laws has relinquished his position as Gas Examiner for the London County Council at the Hornsey Road testing-station; and Mr. Meredith Blyth has been assigned to the vacant place. Mr. Herbert Bramley, an ex-Alderman of Sheffield, has been appointed Town Clerk, in succession to the late Mr. J. W. Pye-Smith. Mr. Bramley, who is 53 years of age, is a solicitor, and was articled to his father, the first Town Clerk of Sheffield.

ANNUAL ASSOCIATION CONGRESSES—POINTS OF LAW AND PRACTICE.

In the course of his address to the Mechanical Science Section of the British Association at Ipswich, Mr. L. F. Vernon-Harcourt testified to the utility of these gatherings of professional men, bound in ties of fellowship by a common interest or vocation, of which there is every year so large and heavy a crop in the United Kingdom. There never was such a time for association meetings and congresses as the present age. From early spring to late autumn, bands and coteries of all sorts and conditions of people are meeting in conference somewhere, talking over their common concerns, hearing addresses and lectures from leaders and instructors of their own selection, and not infrequently receiving a by no means stinted hospitality from residents of the localities which they deign to honour with their presence. There can be no doubt that in the vast majority of instances the causes with which these gatherings are identified are advanced thereby; and the bulk of those who attend them, often at considerable expense to themselves, are repaid for their trouble and expenditure of time and money by the instruction, help, and comfort they derive from periodical association with their fellows. Moreover, it is not the least of the benefits flowing from these public congresses of men of the same order, taste, or calling, that by means of the addresses, papers, and discussions for which they afford occasion, the community at large are enlightened, as could never be so well done by any other means, in the nature and actual condition of the causes which the meetings are designed to further.

This is certainly an age of publicity; and therefore whatever "craft" there may be in the multitudinous professions and industries that exist by virtue of the necessities of the public, there is little "mystery" as to the methods and aims of their followers and exemplars. There is no room nowadays for the pageantry and affectation of occultism which were so marked a feature of the mediæval guilds. The professional writers in newspapers—who seem often to glory in giving expression to lingering popular superstitions concerning the charlatanism of members of the medical profession, the rapacity and unscrupulousness of lawyers, the tendency of men of science to childish trifling with useless experiments, and so forth—have less excuse for their conduct in this regard, inasmuch as it is only necessary to look up the published reports of the annual congresses to learn what scientific and professional men really do think and talk about. We may not all take an absorbing interest in the topics that arouse lively controversies among the members of some orders of the community; but we can at least do these our fellow-citizens the justice of hearing what they have to say for themselves, and refrain from the unfairness of judging them upon some imaginary indictment of our own framing. Unfortunately, our smart newspaper paragraphists and facile leader writers too often prefer to evolve a typical physician, attorney, or engineer out of their own inner consciousness, as did the legendary German his camel, rather than take pains to study him as he is.

There are enough technical and scientific associations whose proceedings must needs be reported more or less fully in the Journal to render it unnecessary for us to go far afield in search of examples of good work done by these agencies for collecting and disseminating information likely to be useful to the specialists who form the bulk of our readers. At the same time, so closely interwoven are the threads of interest properly followed up by members of different professions in this modern England of ours, that it is difficult for any cultured man of affairs and of the world to say offhand that he has no need to know what the members of any particular congress are talking about and aiming at. Thus it is worth while for the employer of labour to read what was said at the Church Congress upon labour questions; and it would not do to pass over the Medical Congress without making a mental note of what the doctors think about the question of smoke abatement and aërial sanitation. To take another illustration—which we will make the principal subject of this essay—from the meeting last week in Liverpool of the members of the Incorporated Law Society. Few among us—to our regret it may be—are without special views, and experiences to support them, respecting the law of the land and its administrators. Apart from their general concern with the law, as citizens and individuals, engineers and secretaries of public companies and leading officers of municipal corporations need to be pretty good lawyers if they and their employers are to keep out of trouble. It must therefore be of some interest to others than members of the "lower branch" of the legal profession, to hear what the President of the Incorporated Law Society has to say respecting the state of the law and the prospects of its improvement. The holder of this eminent position this year is Mr. J. W. Budd, of London; and his address was as candid as it was learned. After treating of the thorny matters of land transfer and the law of trusts, the President went on to express his views of the Companies' Acts, and the report of the Board of Trade Committee thereanent, already noticed and discussed in these pages. On the whole, the presidential opinion was favourable to the report of the Committee and their draft Bill. It is regretted, however, that the Committee almost entirely devoted their attention to clauses

for the prevention of fraud, and did so little to facilitate the administration of companies. Mr. Budd is rightly solicitous that everything that is possible should be done to facilitate the establishment and administration here of companies carrying on foreign business, the control of the capital for which would otherwise go abroad. He thinks that many important alterations of the Companies' Acts are urgently called for, which the draft Bill will not touch; and he regrets that we are not at once to have a Consolidation Act, and that the new model form of Articles of Association is to be settled by the Board of Trade. Mr. Budd is almost rabidly opposed to the extension of official interference in law business in any shape or form.

Everyone who has been a litigant, either on his own behalf or on that of others, will appreciate the President's observations upon legal procedure. He freely admits the existence among the public of a strong and widely-spread feeling of dissatisfaction with the procedure of the Superior Courts in civil proceedings; and he confesses that the feeling is justified. "Our legal procedure is far too complex, too dilatory, and uncertain as to time, and too expensive for the requirements of business men in ordinary transactions." It cannot be otherwise while the present system remains in force. Procedure is regulated in the first place by rules made under the Judicature Acts. These rules are upwards of 1000 in number; and it is further necessary to refer to 7000 reported cases in order to ascertain what they mean. This alone is enough to frighten most litigants; and then they have to face the prospect of having their case, which perhaps hangs upon a perfectly clear issue, dragged through all the possible stages of an action, because "there is no summary process by which, in an ordinary action, a defendant having no defence, or a plaintiff having no case, can be prevented at any early period from putting his opponent to the expense and delay" of the regular full course. Well might Mr. Budd declare that this procedure "is a terrible weapon in the hands of an unscrupulous litigant." And, after all, when the right has triumphed over every obstacle and won a verdict in spite of all the machinations of the perjurers on the other side, the victorious party finds himself saddled with a good deal of the costs of the action, because the taxing master will only allow him to recover at most two-thirds of what he has been compelled to spend. Mr. Budd confesses that this is scandalous; and he deplores it as the principal deterrent cause that keeps the public away from the Courts. He trusts that "the strong views held by Lord Justice Smith on the subject, and his influence, will have the effect of regulations being laid down for the taxing masters, so that a successful litigant may on taxation be allowed all his costs and expenses reasonably and properly incurred." Let us trust so, indeed; but the aspiration is not accompanied by any hope of realization. The way to reform in disposing of ordinary judicature business is pointed out, in Mr. Budd's view, by the new experimental Court for the trial of commercial cases. "If such a tribunal had been established twenty years ago, we should have heard less, if anything, of the commercial classes refusing to resort to our Courts for the settlement of their disputes, and inserting in their sale and purchase contracts clauses for compulsory reference to lay arbitrators." In ninety-nine cases out of a hundred, the formal pleadings and particulars which hamper the procedure of the Courts could be dispensed with; and Mr. Budd would bring the parties to an action before the Judge at a very early stage, for a sort of provisional judgment on the merits of the case as stated. Lastly, on the delicate subject of solicitors' charges, Mr. Budd expresses the hope that when the judicial house is put in order, some alteration of the system of legal charges will be effected, by which solicitors will "be adequately rewarded for all necessary work, and in which there shall be no temptation to any practitioner to increase his client's disbursements as a means of adding to his fees." Again, let us hope so.

It is possible that we may have to skim in the same way the transactions of other annual congresses besides that of the lawyers; but, before quitting the subject of the popularity of these multifarious gatherings, which are always well received in the towns visited, some consideration is due to the townspeople's aspect of these peripatetic associations. The question has not, to our knowledge, been raised in public; but it must have occurred to many people that these visitations may sometimes put a tax upon the municipal authorities and the prominent residents of a few favoured localities which they would rather be spared. It certainly behoves the guiding spirits of movable institutions to make quite sure, before selecting a place for the temporary sojourn of their often numerous following, that they will be welcomed there. Municipal hospitality—which generally means the liberality and public spirit of the Mayor and a few leading citizens—is very free and undiscriminating. But when it comes to entertaining in rapid succession, incorporated dentists, journalists, solicitors, municipal auditors, engineers of various descriptions, organists, and so forth *ad libitum*, a provincial Mayor may well begin to regard the fun as one-sided. At any rate, the ruling authorities of wandering societies should see to it that they do not inflict a superfluity of "camp-followers" of their own upon their entertainers. It is one thing to extend municipal or other hospitality to the *bonâ fide* members and legitimate associates of a society, and another to throw open the doors to every hanger-on of such organizations. *Verb. sap.* Instances of this evil might, but need not here, be named. We must repeat, however, in the interest of the societies which hold provincial meetings annually or biennially, that the custom requires to be carefully practised, lest the abuse of hospitality by a few should bring discredit upon what is, on the whole, a satisfactory trait of the age.

PRESERVATIVE PAINTS.

According to the authority of Mr. M. P. Wood, as given in his paper read before the American Society of Mechanical Engineers (see last week's Journal), a good paint prepared for spreading in ordinary temperatures upon wooden or composite structures has the ratio of about one-third pigment and two-thirds oil or fluid medium. The practice of one of the principal United States railways, where the yearly expenditure upon painting materials amounts to over £60,000, is to allow 75 per cent. of pigment and 25 per cent. of oil for the paints applied to cars and wooden structures. Experiments show that the most durable paints are those that contain a large amount of pigment per unit of surface; and that pigment is the best which is strong enough of itself, or with a proper addition of inert material, to allow enough liquid to be mixed with it to flow and work well with the brush. These propositions appear to have the merit of being self-evident.

The destruction of paint, Mr. Wood goes on to state, may be brought about by eight causes, operating singly or together. First, mechanical injury; second, the action of deleterious gases; third, chemical action between the pigment and the vehicle, or fluid; fourth, chemical action between the substance covered and the paint; fifth, action of light; sixth, peeling; seventh, destruction by cleaning; eighth, water. The two last causes of injury apply more particularly to painted wooden or composite structures; but most of them apply more or less also to structures of iron and steel. In the first category, of mechanically destructive influences, Mr. Wood places the sand blast to which seaside structures are exposed; and the expansion and contraction of painted parts from changes of temperature. Gas engineers know well what these changes mean; for there is no structure that suffers more from them than gasholders, as is abundantly proved by the crackled appearance of old painted crowns. Mr. Wood remarks upon this head that it is impossible to proportion a paint compound so that its coefficient of elasticity will at all temperatures be the same as that of the metal underneath it. The trouble arising from this cause is increased by the effect of the strains due to the wind pressure, the passage of railway trains, vibrations set up by any cause, and the effect of snow, hail, and water driven against the surface at high velocity.

Second, the action of deleterious gases is only too familiar to engineers who have experience of paints and protective compounds. Sulphuretted hydrogen, due mainly to the quenching of coke in gas-works, seems to be an inevitable component of the atmosphere in and around these establishments. We do not know if this is fated to be always the case; but there can be no doubt that gasholders situated away from the works devoted to the manufacture of gas both look and stand better than similar structures placed under the lee of the retort-houses. Sulphurous acid fumes, as well as the waste gases of chemical industries are, however, not to be so easily avoided. White lead, as Mr. Wood observes, is the pigment most affected by these fumes; the effect of the sulphur upon it being to change the carbonate into a sulphide of lead, which is soluble in rain water and condensed moisture. Third, comes the question of chemical action between the pigment and its vehicle or medium. This is an exceedingly important field of inquiry, in which little research has been carried out. The siccative and other oils commonly used in paint are all capable of saponification. (The perishability of linseed oil has recently been established by a special investigation). It is well known that soda and potash are not the only substances which combine with fats to produce soap, and that almost any of the bases will combine with the fatty acid of nearly every oil to make soap. Hence we have iron soap, lead soap, zinc soap, and so forth. Many pigments are simply oxides or hydrates; and it is strongly suspected that they combine with the oil to form soaps, in which case it is evident that, after the paint has been left on a metallic surface for a sufficiently long period, it is no longer a pigment held to the surface by a medium which has undergone certain changes called drying, but is in reality a new chemical body consisting of the constituents of the liquid combined with the pigment, or, in other words, it may be a soap. (It may be remarked, upon this head, that one never sees an analyses of the softened remains of a coat of paint that has in the ordinary way to be removed from an iron structure before it is repainted; but it might afford some useful information). This consideration leads up to the third category of injuries—those due to chemical action between the body covered and the paint, whether pigment or vehicle. Oxide of iron paints oxidize their oil, and gradually destroy it. Other pigments also possess the same property; but some of them are credited with the additional power of forming on iron or steel surfaces a coating of the black or magnetic oxide, which effectually preserves the metal even after the paint itself has been removed. Mr. Wood admits that this action is obscure, and not thoroughly understood; but he accepts the fact.

The fifth cause of damage to paint—the action of light—is still somewhat of a mystery. The bleaching effect of light is familiar enough; but the chemical changes that attend the phenomenon in the case of paint, complicated as these are by the effects of sea air or acid fumes, are not determined. The fact remains, however, that the bleaching of a paint detracts from its durability. Sixth—peeling. Paints vary greatly in their adhesiveness to either metallic, wooden, or other surfaces. Mr. Wood gives the bad pre-eminence in this respect to zinc white; and he suggests that the formation of a zinc soap may really be at the bottom of the mischief. Some strength is lent to this hypothesis by the fact of galvanized iron being so bad a surface to cover with paint satisfactorily. A fruitful cause of the peeling of paint is too great haste in applying successive coats. Unless the foundation coat has thoroughly dried, the liquid in the new coat softens the pigment underlying it. The resulting mass, containing a notable proportion of the more volatile elements of the vehicle, begins to dry from the outside, where it puts on a thin but hard or vitreous surface, that retards the further evaporation of the vehicle, and prevents the access of the oxygen of the air which is essential to all proper drying. If the surface thus maltreated has been painted while at a low temperature, or during a damp or foggy atmospheric condition, and the temperature should soon afterwards rise, or the hygroscopic conditions undergo a marked change, then the paint is likely to speedily peel. This effect is favoured where the coating is a heavy one, or one hard to spread by reason of the earthy or inert character of the pigment; or if benzene is employed as a dryer. As a general rule, the more numerous the substances entering into the composition of a paint, whether pigment or vehicle, the more liable it is to peel. A small addition of fish or animal or non-drying vegetable oil, although oxidized by the addition of metallic salts, and used in combination with linseed or other siccatives, also induces peeling. The chemical *rationale* of peeling is difficult to make out; and Mr. Wood hints that, when this effect happens, it is usually almost impossible to trace it to the character of the paint. Destruction of paint by cleaning or washing hardly enters into the question of the preservation of structures. The effect of water upon paint, however, ranks next to that of detergent soap and the scrubbing brush. Direct experiment shows that dried linseed and other siccative oils, when applied to a surface alone, without the addition of pigment, are not water-repelling. When such oil has well dried, the application of water always gives it a shrivelled appearance, showing that it has absorbed moisture and has expanded, and that disintegration has commenced. Rain water, containing ammonia, increases this destructive action on the dried oil; and the slow wasting away of good paints containing pigments known for their resisting quality is attributable to this action. The ordinary test for the ability of paint to resist moisture is to paint a piece of glass with it, and after it has well dried to immerse it in water for some hours, noting the changes of colour and integrity thus produced. The more thoroughly a paint has dried, through efflux of time alone, before it is wetted, the more repellent it becomes.

(*To be continued.*)

Books Received.—"Rural Water Supply: A Practical Handbook on the Supply of Water and Construction of Water-Works for Small Country Districts." By Allan Greenwell, Assoc.M. Inst.C.E., and W. T. Curry, Assoc.M.Inst.C.E., F.G.S. (London: Crosby Lockwood and Son.)——"Potts's Mining Register and Directory for the Coal and Ironstone Trades of Great Britain and Ireland." Seventh edition. (North Shields: W. J. Potts.)

Presentation to Mr. A. Stradling.—On Thursday, the 3rd inst., a meeting of the men employed at the East Greenwich Station of the South Metropolitan Gas Company was held in the carpenters' shop, for the purpose of presenting a handsome gold watch, subscribed for by men in all the departments, to Mr. Albert Stradling, who, after 25 years' service, has been compelled by ill-health to resign his position as foreman, and is retiring on a superannuation allowance. Mr. J. Tysoe (the Engineer of the works), in making the presentation, remarked that they had met to bid farewell to one who had been a familiar figure among them for many years, who was well known to them all, and who was leaving owing to the state of his health. He had their sincerest sympathies; and their good wishes would go with him in his retirement. Mr. Stradling had been devoted to the Company, and had served them to the best of his ability; and if at any time, in the performance of his duty, he had given offence to anyone, he (Mr. Tysoe) was sure all was forgiven and forgotten. If Mr. Stradling would allow him, he would hold him up as the type of man the South Metropolitan Gas Company wanted in their employ. He had always had great pride in his work, had taken a reasonable amount of enjoyment out of life, and had been thrifty, whereby he was able to retire and spend the rest of his life in ease and comfort. He hoped that they were all in a position to do likewise. He then made the presentation; expressing the wish of all present that Mr. Stradling would live long enough to wear it out. He also asked him to convey to Mrs. Stradling their best wishes. Mr. Stradling thanked Mr. Tysoe and his fellow-workmen for the kind remarks which had been made about him. He said they alone would have been sufficient; but the beautiful watch by which they were accompanied gave him extreme pleasure.

NOTES.

The Limit of Span for Bridges.

In this age of "big things" in all kinds of construction, engineers generally cannot but feel interested in the issue of a reference made by the United States Secretary of State for War to a committee of engineers to "investigate and report their conclusions as to the maximum length of span practicable for suspension bridges, and consistent with an amount of traffic probably sufficient to warrant the expense of construction." Determinations such as this, of the permissible maximum dimension allowable to engineering structures—"the determination of the theoretical and practical limits which forbid the further application of any particular method of construction, chemical process, mechanical appliance, steam power, or other agent pressed into our service, has always possessed peculiar interest for the scientific and practical man." What gas-engineer would not be curious to know the economical and structural limit for gasholders, for example? In regard to suspension bridges for railway traffic, the American experts have put the limit of span due solely to engineering considerations at 4335 feet; but for local reasons they propose a bridge of 3200 feet span, or twice the span of the Forth cantilevers, for the Hudson River. In arriving at this result, the question of wind pressure was considered; and everything at present known upon the subject was passed in review.

Donkin on Steam-Boilers.

From time to time mention has been made in these columns of the steam-boiler experiments carried out since 1890 by Professor Kennedy and Mr. Bryan Donkin. The full details of twenty-one of these experiments have been published by our contemporary, *Engineering*. The peculiar value of these tests—apart from the careful way in which they were conducted—consists in the facts that the same coal was used throughout, and that all the trials were made on a uniform basis, which enables the results obtained to be employed for the purpose of comparing the performance of different kinds of boilers. In *Engineering* for the 20th ult., Mr. Donkin publishes a summary of these experiments, which should be of considerable value to steam-power users. A delusion that might have become mischievous was exploded by these experiments, in the great majority of which no free carbon monoxide was found in the furnace gases. The average coal combustion of Lancashire and Cornish boilers was found to be about 16 to 18 lbs. of coal per square foot of grate surface per hour. The weight of water evaporated per pound of coal varied from 8½ to 12½ lbs. from and at 212° Fahr. The highest thermal efficiency of any boiler was realized by three Cornish boilers at the East London Water-Works, where the combustion was very slow and with natural draught. The economizers tested effected a saving of from 9 to 13 per cent. The heat lost by the furnace gases varied from 6 to 30 per cent.; and that lost by radiation, from 3 to 9 per cent. This superiority of the old-fashioned Cornish boiler, with the draught setting through centre, split at back, past sides to the front, under bottom to chimney—the boiler having three cross tubes in each flue—is consoling to engineers who have always had faith in this pattern.

Bacterial Life in River Water.

A paper on the above subject was read by Dr. E. Frankland at the recent meeting of the British Association, and illustrated by means of diagrams on lantern slides. The author remarked that bacteria are much more numerous in winter time than in summer; and he showed that there are three conditions which affect these organisms, which all obtain in winter. They are temperature, sunshine, and the volume of the water flowing. In January, 1895, there were no less than 56,630 microbes in a cubic centimetre of Thames water; whereas in the previous month there were only 6000. Sunlight is a very powerful germicide; and it might be concluded, therefore, that the number of microbes in river water would be a good deal influenced by the amount of sunshine falling upon it. With regard to the third factor—the flow of a river—it is found that a smaller number of microbes usually accompanies increased flow. A very powerful agent for the diminution of the number of microbes in river water is storage in a reservoir for even a short time. In July, 1894, storage for six days reduced the number of microbes per cubic centimetre in Thames water from 2860 to 680; and by storage for over 14 days the number was reduced to 520. At the same time, the number of microbes per cubic centimetre in the New River Cut was reduced, by merely passing through two reservoirs, from 1560 to 260; and the microbes in the River Lea at Angel Road were reduced from 4320 to 1120 by 15 days' storage. Dr. Frankland said he could quote many more instances of great bacterial amelioration effected by the storage of river water; but those he had cited would suffice to show how rapid was the reduction of microbial life by even so short and imperfect a storage as that given to the waters of the New River Cut. The fact had obviously an important bearing upon the storage of flood water in the Thames Valley, as it left no doubt that the storage for a month or two of the flood water would effect such a bacterial improvement as would render the water of good quality for domestic purposes. By the construction of such

storage works, the capacity of the Thames for the supply of potable water to London would be enormously increased.

Low-Temperature Lights.

Professor Witz has communicated to the *Comptes Rendus* some observations upon the economical aspect of lighting by phosphorescence—or, as he terms it, luminescence. He observes that luminous foci are constituted by an incandescent solid or fluid, the temperature of which, according to Draper, must exceed 1100° C., in order that the light may be white and the spectrum complete. The visible radiation is bounded between the wave-lengths 0·38 and 0·76 μ. But the infra-red extends, so to speak, indefinitely towards the less refrangible radiations, giving out heat sensible by the bolometer as far as to wave lengths of 30 μ, and consequently including more than five octaves of luminous radiations. If the curve of energy of the spectrum is traced, it will be found to present a single maximum, situated generally at the begining of the infra-red; and the greater part of the energy will be found on the side of the dark or heat spectrum. It is therefore regarded as waste, so far as the production of light is concerned. The heat values attached to the foci of light are very small; and to improve the lighting effect of the energy that goes to the whole spectrum, would be an important gain. It has appeared to some that the solution of the problem might be furnished by luminescent foci, in which the temperature of the rarefied gas that yields the effect of light is only, according to Warburg, between 21° and 132° C. These foci, it must be admitted, yield but little light. But, on the other hand, their thermic emission is still more feeble. The luminescence of the tubes is effected either by high-tension currents, or by a frictional machine. Professor Witz has experimented with several tubes, and especially with a lamp intended for miners. The latter is illuminated without difficulty by the induction current of a small Ruhmkorff coil. It yields enough light to read a table of logarithms at a distance of 40 centimetres from the source of light. Mr. Langley has been content with this very rudimentary photometric measurement, as the greyish-blue tint of the light does not lend itself to ordinary photometric methods. The energy consumed is large in proportion to the light produced. The lamp was found to absorb more energy, and give less light, than an ordinary incandescent electric light. Still, the quantity of heat radiated is slight. Another form of lamp, intended for medical use, gave in heat only one-fifth part of the energy expended. From this point of view, no other light gives so favourable a result. It is hoped that improvements in this method of lighting will be possible; but the practical results up to the present are mediocre.

The Church and Old-Age Pensions.—The subject of old-age pensions was discussed at the Church Congress at Norwich last week in a paper read by Mr. A. F. Vulliamy. After an elaborate analysis of the schemes which have been proposed, the author came to the conclusion that, as the working classes could, and, to a great extent, did, provide against old age, without assistance from the State, and as it was doubtful whether there was any way by which the State could grant such pensions which was not unjust to the weakest portion of the community, there seemed to be grave objections to any present legislation on the subject, or any addition to the taxation of the country for the purpose of providing pensions. Mr. G. Abbott also expressed himself hostile to any scheme of State pensions, as being likely to impair the individuality, and diminish the sense of responsibility, of those whom such schemes were likely to affect.

The Value of Water-Meters in Controlling Supply.—Reference has been already made in the JOURNAL (*ante*, p. 31) to the opinions held by Mr. C. E. Bolling, the Superintendent of the Richmond (Va.) Water-Works, in favour of the use of water-meters in controlling supply. His views have been supported by a Committee of the Richmond City Council (of which he was a member), who a short time ago had the following matters submitted to them: (1) To inquire if the present pumping capacity is sufficient to supply the city with water. If not, to say what is necessary to be done to get a sufficient supply, and give the approximate cost. (2) To inquire into the respective merits of the water-meter system in place of increased pumping capacity and additional mains. The Committee had these questions under consideration for a period extending from April 23 to Aug. 10; the result being that they agreed upon the following answers: (1) The present pumping capacity is sufficient, under proper control, to supply the city with water for several years. (2) The water-meter affords the proper control. The cost of metering, including the meters already fixed, and the probable increase in the number of taps after the entire system had been metered might, they said, amount to as much as $202,000, upon the hypothesis that the city supplied one meter to every service, but that the consumer paid for additional meters when his service required more than one. The estimated revenue, based upon the existing population, general metering, a price of 15c. per 1000 gallons for domestic purposes, and 80 per cent. of this price for manufactories, and putting the daily sale of water at these prices at 4 million gallons, is about $213,000 as a maximum, or $148,000 as a minimum. The present revenue is about $139,000.

TECHNICAL RECORD.

COMPARATIVE STUDIES OF ACETYLENE GAS LIGHT AND THE ELECTRIC ARC.*

By W. Wedding.

Owing to the vast development of electrical engineering during the last ten or twenty years, the whole subject of illumination has undergone a great and progressive change. Not only is the use of electric arc and glow lamps extending, and their working improving every day, but on the other side also great efforts have been made towards the further development and greater utilization of sources of light. In practice, we are still far from a really rational utilization of energy for the purposes of illumination; but such progress has been recently made in this direction, that it is not only to the general interest to consider the present state of the question, but it is important that every electrician should make himself familiar with this progress. On the basis of the more recent investigations, for which ample numerical material is given in the *Journal für Gasbeleuchtung und Wasserversorgung* (Bunte), we will consider and compare the progress in illumination by gas incandescence, spirit incandescence, petroleum, acetylene, and electric light.

About eight years ago, the success of incandescent gas lighting was very doubtful; but gradually a development has set in which has now led to a considerable expansion of this system. During the last few months, this expansion has been accelerated by the competition between a large number of rival companies. The types of burners are very similar. Each burner uses a certain quantity of gas, according to the apertures and the pressure. The glowing mantle radiates a certain quantity of light, different in different directions in space. For each unit of light (the Hefner light—shortly called one candle), the burner consumes a certain amount of gas. The quantity of gas necessary to sustain one candle power for one hour we will call the effective consumption. For the Auer incandescent gas-light (German Incandescent Gas Company), an hourly consumption of 1·38 cubic feet of gas is reckoned for a candle power of 60 in a horizontal direction. Hence the effective consumption is $1{\cdot}38 \div 60 = 0{\cdot}023$ cubic foot per hour for 1-candle power.

Now, since the products of various factories do not use the same quantity of gas at normal regulation, the testing of the various burners was arranged so that each one was investigated for the different gas consumptions occurring in practice. The most favourable—*i.e.*, the lowest effective consumption—was taken as characteristic for the burner; and the test of efficiency was only applied at this rate of consumption and at this pressure. The value above given for the Auer gas-burner was verified; but the candle power sometimes falls to 40 or rises as high as 90.

Tests made at Christmas last year, showed that competitors were still far behind the efficiency of the Auer lamp. In general, the initial lighting power was 20 to 30 candles, and the effective consumption two or three times that of the Auer. But the initial consumption is not decisive. The total consumption over a longer period is what is practically important. On burning the lamps for 230 hours, it was found that the effective consumption exceeded 0·07; while the Auer mantle did not reach 0·03.

But though these first competitors must be considered failures, there was soon a change. This was first observed in the so-called diamond light, manufactured by Trendel. The effective consumption began under 0·24 cubic foot in many cases, and only reached 0·037 cubic foot after 200 hours. Those made by Butzke have shown an approximation to the Auer mantle to within 17 per cent. No lamp need be tested for a period exceeding 300 hours, since that is the normal life of a mantle. In some way or other, the mantle is destroyed within that period. That with proper treatment the mantles may keep longer, has been made evident by previous measurements. For six Auer burners, which up to the present have burnt 3000 hours, the average result is that after the first 500 hours the candle power falls to two-thirds, and after 2000 hours to one-half of its initial value.

The colour of the light emitted by the different makes varies with the nature of the earths with which the mantles are impregnated. The Auer body has a slight green tinge; that of Kramme is very white; while Butzke's lamp is reddish. This is no doubt pleasanter for the eye; but if we bear in mind that the luminous effect of the different colours are red 1, yellow 28,000, green 100,000, and violet 1600, it is evident that the prevalence of green rays will give the greatest efficiency.

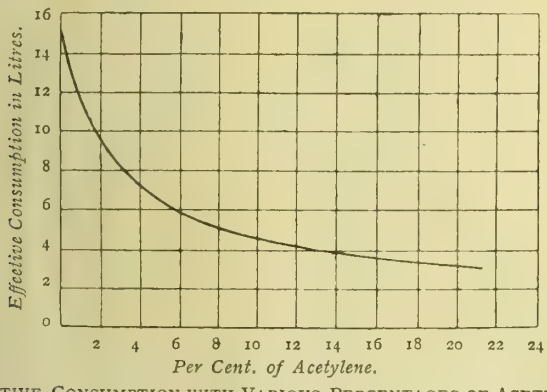
The incandescence of the earths used in incandescent lighting need not be produced by the high temperature of the Bunsen gas-burner, but may also be brought about by using other gases or liquid hydrocarbons converted into gas. The method of illumination by spirit incandescent burners is based upon the latter principle. Imagine a common lamp filled with spirits instead of petroleum. Through a wick the liquid spirit is sucked up in a tube, and is heated to vaporization by a small spirit-flame attached to the side and fed from the same reservoir. The spirit vapour is conducted through the tube into the usual

* Abstract of a lecture delivered before the third annual meeting of the Verband Deutscher Elektrotechniker, Munich; and reproduced from the *Electrician* for Oct. 11.

incandescent gas-burner, which is screwed immediately on to the tube; and instead of the coal gas, the spirit vapour is used to render the mantle incandescent. To ensure greater constancy in brightness when the lamp is moved, the tube containing the heated spirit vapour has recently been widened out into a little boiler; and the mantle is thus kept in a uniform state of incandescence, even when moving it about in the room. According to the amount of spirit vaporized, and especially according to the amount of alcohol contained in the liquid, and the quality and construction of the glaring body, such a lamp, like a gas-lamp, may develop various illuminating powers. In the comparative estimate of cost, we shall again refer to this new lamp. It is possible that this may eventually rival the petroleum lamp as an illuminant. This rivalry would be very important and of far-reaching consequence.

A possibly formidable rival to gas lighting has been born in the now practicable manufacture of acetylene from calcium carbide. It may be taken as generally known that, by the influence of the great heat of the electric arc (continuous or alternating) upon a mixture of lime and coal, calcium carbide is generated, consisting of one part of calcium to two parts of carbon. On pouring water over this, two parts of carbon unite with two parts of hydrogen to form acetylene, while lime remains, which is again mixed with coal and subjected to the same process. Calcium carbide is commercially obtainable; 1 lb. of it costs a little under 3d. at present, and gives out 0·6 cubic foot of acetylene, while the theoretical yield is 2·1 cubic feet. The theoretical yield will, of course, be further approached in practice, especially since the preparation of almost pure calcium carbide (95 per cent. or more) has been accomplished. When there is production on a large scale also, it is to be expected that the present high price will be reduced. Burnt in a two-hole regenerative burner, such as is used for oil gas, the flame gives 34-candle power with an hourly consumption of 0·26 cubic foot of acetylene. Hence the effective consumption is 0·077 cubic foot, and the amount of gas used is one-third of that for incandescent gas.

If acetylene is burnt with an open flame in a Bray burner, such as is usually employed in street-lamps, it is necessary to mix air with it artificially to prevent smoking, and to obtain a brilliant quiet flame. The best proportion for the mixture is 47 per cent. of acetylene. With such a burner, the candle power was 52, and the effective consumption was 0·01 cubic foot of acetylene per candle-hour. But since this mixture is very explosive, we tried carbonic acid instead of air, which made the effective consumption half as high again. Hence this experiment must be considered a failure.



EFFECTIVE CONSUMPTION WITH VARIOUS PERCENTAGES OF ACETYLENE.

If acetylene is to be used for street illumination, the object must be to enrich the coal gas wherever that exists. In experimenting in this direction, we obtained the curve given above, which shows the effective consumption of gas in its dependence upon the percentage of acetylene in the mixture. Without acetylene, the burner had an effective consumption of 15 litres (1 litre = 0·035 cubic foot); with 6 per cent. of acetylene, it only required 6 litres of the mixture of coal gas and acetylene; with 12 per cent., the consumption fell to 4 litres; and with 21 per cent., to 3 litres.

We will now compare the cost of the most usual illuminants. With the present prices of gas, coal, petroleum, methylated spirit, and calcium carbide in Berlin, the 16-candle power lamp, according to the various systems, would cost per hour—

Incandescent gas	0·06d.
Incandescent spirit	0·144 to 0·3d.
Petroleum	0·24d.
Argand burner	0·30d.
Electric glow lamp	0·36d.

The Berlin prices assumed are: Gas, 6s. per 1000 cubic feet; methylated spirit, 1s. 2d. to 2s. per gallon; petroleum, 1s. 4d. per gallon.

As regards acetylene, its economy depends altogether upon the price of the acetylene which is to be mixed with the gas. Coal gas alone would require ½d. per hour for a 16-candle light, and an addition of acetylene up to 21 per cent. would steadily increase the price up to ¾d. If the price of acetylene falls, the cost of the light falls, especially with a slight admixture of acetylene. If the price of the cubic foot of acetylene should ever fall from the present figure of 5d. to ½d., the economy of the gas would increase with every addition of acetylene, although any additional admixture beyond 10 per cent. would have hardly any effect. If the acetylene is not burnt in the open, but in the regenerative burner, the price per 16-candle power would be 0·6d.—*i.e.*, ten times as much as incandescent gas. Hence great reductions must yet take place before the latter can be competed with. We see, then, that the succession of economy is—incandescent gas, incandescent spirit, petroleum, Argand burner, electric incandescent light, acetylene.

Above all these, as regards economy, stands the electric arc light. It is well known that the efficiency of the arc light is seven times that of the incandescent lamp. Hence the arc lamp costs only 0·06d. per 16-candle power. But the arc lamp has advantages which make it in many ways unquestionably superior to all other illuminants. In the first place, the light is chiefly given out at an angle of 45 degrees below the horizontal, which gives a uniform illumination, even at greater distances. In the incandescent gas-light, the maximum lies beyond the horizontal; and the shades applied hitherto have only succeeded in concentrating the light immediately below the lamp. For large spaces, no light approaches the arc light. With gas we can approach 100 or 200 candle power, but not the thousands of the arc. Since arc lamps have been constructed for currents as low as 1 ampère and 40 watts, giving out 40-candle power, with a maximum of 65-candle power, such lamps have come into use for smaller requirements, and can be used unshaded, like incandescent gas. Another advantage of the arc is in its colour. Although it contains many violet rays, the other radiations are present in such quantities that everything of a light colour appears light, whereas red objects appear dark to the somewhat greenish incandescent gas-light. Although, therefore, the costs for arc lights and incandescent gas are the same, still there are such essential and unattained benefits on the side of the arc light, that the illumination of large areas by its means is distinctly the most advantageous.

Gas from Slack or Coal Dust.—Herr A. Friedeberg, of Berlin, has taken out a German patent for the manufacture of illuminating gas from coal dust. The coal is led continuously into an externally heated retort, where the cloud of finely-divided material is instantly carbonized, and the coke falls to the bottom of the retort, and cakes together. The gas is led off through a pipe from the retort.

A New Pulverizer for breaking up refractory materials has been patented by Mr. Coward, and is being brought forward by Messrs. Easton, Anderson, and Goolden, of Erith. Among the defects from which most pulverizers suffer are high speed and excessive wear and tear. The one now under notice is claimed to be free from both these drawbacks. The machine consists of a roller revolving against the inside of the circumference of a drum, which itself revolves, but in the contrary direction; the material under treatment being crushed between them. Its essential feature is that the outside bearing of the spindle carrying the roller is pivoted, while the other bearing is free to rise or fall under the control of a strong spring which can be weighted as required. The crushed material is removed by a fan. The new pulverizer is stated to be very economical in its consumption of power, and less costly to fix and repair, than similar appliances.

The Relative Value of Percolation Rain-Gauges.—At the meeting of the Society of Engineers on Monday last week, Mr. R. E. Middleton, M.Inst.C.E., read a paper on the above subject. The author's object was to examine into the relative value of percolation gauges situated at Nash Mills, Lea Bridge, and Rothamsted, both as regards the records of each, their reliability when compared with other sources of information, and the evidence which is afforded as to the quantity of rain water which may be assumed to pass into the underground reservoirs that supply the wells and rivers. It was shown that there are remarkable discrepancies between the records of the gauges themselves, and that the percentage of rainfall which percolates does not appear to be consistent throughout, although the water percolating follows the records of rainfall more closely than is generally supposed to be the case. We shall notice the paper more fully in a subsequent issue.

Permanganate of Lime as a Water Sterilizer.—M. Bordas lately called attention, at the Academy of Medicine, in Paris, to the advantages of permanganate of lime for the purification of water, on account of the readiness with which it decomposes in the presence of organic matter—splitting up into oxygen, oxide of manganese, and lime. He found that the salt possesses very great oxidizing power and considerable destructive action on micro-organisms. He asserted that the antiseptic properties of this salt are much superior to those of bichloride of mercury; and, moreover, it has the distinct advantage of being neither poisonous nor caustic. M. Bordas estimates that the addition of 10 milligrammes of permanganate of lime to a litre of water is sufficient to effect complete sterilization in five minutes; and from comparative experiments with various antiseptics, more especially permanganate of potash, he comes to the conclusion that the sterilizing power of the latter salt is about 1-100th part of that of the permanganate of lime.

REGISTER OF PATENTS.

Convertible Blow-Pipe and Gas-Burner Arrangement.—Bennett, A., of Glasgow. No. 20,399; Oct. 25, 1894.

This invention has for its object "to provide a swivelling or revolving burner which can be used, as desired, either as an ordinary light or as a flame for a blow-pipe." To effect this, a gas-inlet union or socket is made in one with, or has fitted to it, a conical valve-plug or spigot. This spigot or plug works in a preferably more or less spherical faucet or barrel, provided with two outlet-branches, which project out radially from it. Fitted in one outlet-branch is an ordinary Bray or other flat-flame burner, while the other branch is left open. The barrel can be revolved in a vertical plane on the spigot or plug, so as to bring (as desired) either the lighting branch with the burner in it into the upper position, or the blow-pipe branch without the burner. The spigot has only one passage way in it, so arranged that, when the barrel is turned, only the branch which is for the time being uppermost is supplied with gas.

Coin-Meters.—Moore, F., of Barnes. No. 20,676; Oct. 29, 1894.

In this coin-freed gas-meter, the arrangement is such that, by direct pressure on the coin inserted into the apparatus, a supply of gas can be obtained without the intervention of a handle, pusher, or other device requiring to be operated after the insertion of a coin.

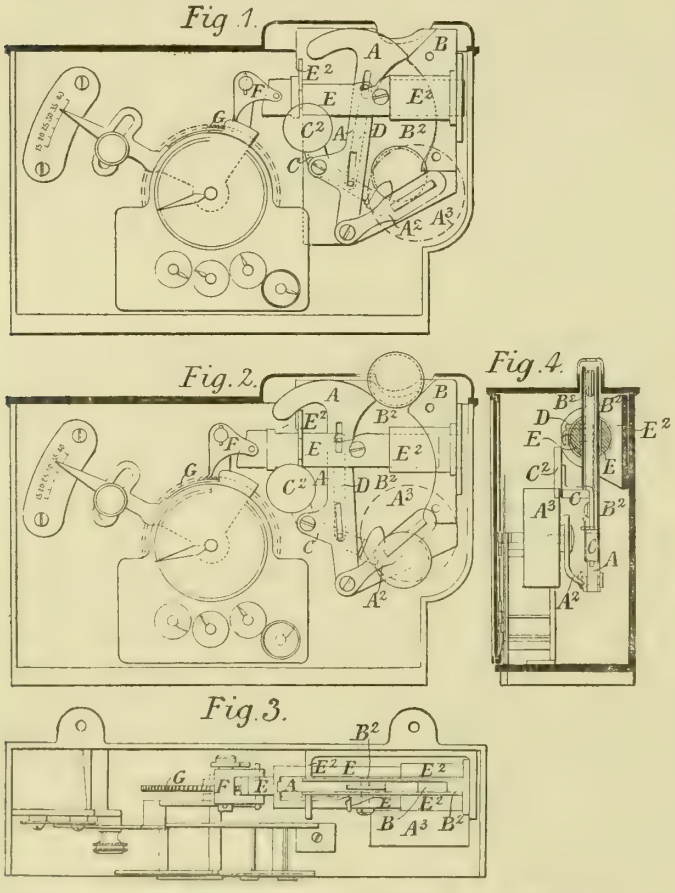


Fig. 1 is a front elevation (partly in section, and with the front of the enclosing case removed) of the apparatus; the moveable parts being shown in their normal positions. Fig. 2 is a similar view, with the moveable parts in the positions they assume while a coin is being inserted. Fig. 3 is a plan corresponding to fig. 2. Fig. 4 is a transverse section of fig. 1.

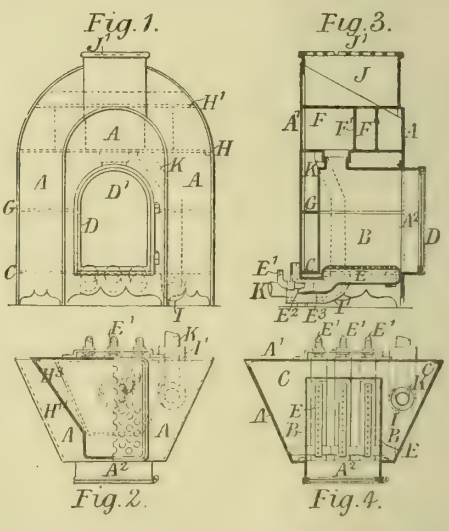
A is a lever, centred at its lower end on a stud; and having connected to it (or to the lever A) an arm A^2, carrying a weight A^3, which tends to maintain the upper end of the lever in its normal position (fig. 1) in contact with a block or stop B, forming one side or end of the mouth of a channel between the cheeks B^2, which the upper end of the lever A is caused to move by pressing a coin of the required size into the channel between the lever and the stop. The upper surfaces of the lever and the stop are cam-shaped, or inclined downward towards each other; so that, by pressing a coin between them, the lever is caused to move on its centre away from the stop—the coin passing thence on to an arm of a lever C centred to the lever A. The weight of the coin depresses this arm against the action of a spring or counterweight C^2 attached to the other arm of the lever. To the arm is pivoted the lower end of a rod D, the upper end of which is provided with a stud or projection, which, when the arm is depressed by the weight of the coin, is caused to engage in a notch or recess in a bolt or bar E, fitted to slide longitudinally in guides E^2, and provided with a pawl F, which, in its forward movement, is caused to engage with the teeth of a wheel G in connection with the gas-supply opening and closing mechanism of a meter—the extent of rotation given to the wheel determining (in any known manner) the quantity of gas to be supplied. When the lever A returns to its normal position, it, by bearing on the pin, also returns the bolt or bar E to its normal position.

In the normal condition of the apparatus, a coin is contained in the apparatus—resting on the arm provided for it, and causing its stud or projection to engage with the notch in the bolt or bar E, as shown in fig. 1. When a supply of gas is required, a coin is pressed into the slot, and acts as a wedge between the stop B and the lever A—causing the lever to turn on its fulcrum and move the arm of the lever C sideways, so as to discharge the coin into a drawer arranged to receive it; and at the same time the bolt or bar E is moved forward by the stud or projection, and, by the engagement of the pawl F with the teeth of the wheel G, a partial rotation is given to the wheel. The wheel is connected to the gas-supply mechanism of the meter in such a manner that gas will not pass the meter until the bolt or bar has returned to its normal position. The arrangement for this purpose may be similar to that described in patents No. 8444 of 1891 and No. 24,490 of 1893.

It will be clear from the foregoing description that, on pressing a coin into the slot to obtain a supply of gas, the coin which had rested on the arm of the lever C is discharged therefrom; and consequently, if the coin which is being inserted be withdrawn, the weight C^2 on the other arm of the lever C will, when the bolt or bar E returns to its normal position, raise the stud or projection out of the notch, so that it will not be possible to obtain a further supply of gas without first inserting a coin into the apparatus to cause the engagement of the stud with the notch, and afterwards inserting another coin for the purpose of moving the bolt or bar E, as already described. It will thus be seen that a supply of gas can only be obtained when a coin is retained in the apparatus.

Gas Heating-Stoves.—Hadfield, T., of Nottingham. No. 21,697; Nov. 10, 1894.

As shown, the body of the stove is formed by an external casing A—of any shape in plan; the back A^1 being preferably secured to the front portion by screws or bolts. Within the casing is a combustion chamber B, provided with openings in the front and a base, which fit up to corresponding openings in the front of the casing and base-plate C respectively. The opening in front of the casing may be extended beyond the face of the casing by a flange or rib A^2; and it is fitted with a door D preferably provided with a glass or mica panel D^1, so that the combustion within the chamber may be visible. In the opening at the base of the combustion chamber are arranged preferably three atmospheric gas-burners E, each provided with an independent gas-supply pipe E^1, to be employed according to the heat required. The nozzle E^2 of each gas-inlet is tapered, and projects into the open end E^3 of the burner, and the interior of this end is formed conical—the smaller diameter being beyond the point of the gas delivery. By this arrangement, "the gas and air are more thoroughly mixed, and a more perfect combustion is obtained than with atmospheric burners of the usual construction."



The products of combustion escape from the chamber B, through the opening B^1, into a secondary chamber F, partially divided with a baffle-plate F^1. On the reverse side of this plate to the inlet B^1 is an outlet, which may be placed either in direct communication with a flue, by means of a pipe, or in communication with the exterior of the building. In the former case, the outlet may be formed in the back or top of the chamber F instead of in the base.

The air space between the walls of the chamber B and outer casing A is divided by a horizontal partition G; while a second partition H is placed level with the bottom of the secondary chamber F, and a third H^1 level with the top—the partitions H H^1, if desired, being formed integrally with the chamber F, as shown.

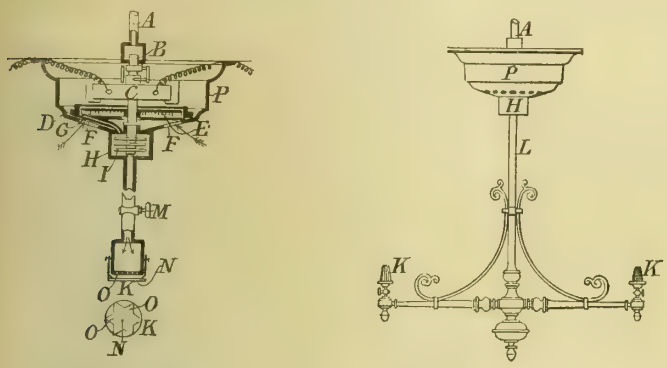
Air is admitted into the lower part of the stove through an opening I formed in the base-plate C, and connected, by means of a pipe I^1, with the exterior of the building, so that a supply of fresh air may be constantly obtained. After passing round the back of the combustion chamber B, the air flows through an opening in the horizontal partition G; and after again passing round the back of the combustion chamber in the reverse direction, it flows through an opening in the partition H. The air then passes once round the front of the secondary chamber F, and escapes through an opening H^3 in the partition H^1 into the chamber J. From this chamber, the air is delivered through the grating J^1 into the apartment in which the stove is fixed.

Illumination by Means of Combustible Gas with Forced Air Supply.—Denayrouze, L., of Ferté, France. No. 22,615; Nov. 22, 1894.

This invention consists mainly in providing incandescent gas-burners, either with a forced air supply or a forced air and gas supply produced by electrical energy.

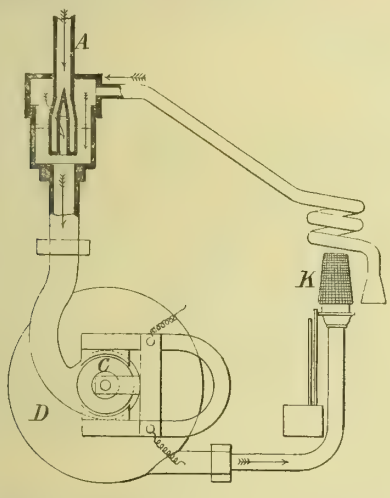
For this purpose, according to one arrangement the patentee employs, in combination with the gaselier or other burner apparatus used, an air propeller or fan, for forcing air under pressure through pipes or channels to the burners; such air propeller being driven by a small dynamo or magneto-electric machine, actuated by electric currents supplied from an electric main for lighting purposes, or from a primary or secondary electric battery. By means of this method of operating,

it is claimed that "an increased illumination is obtained with incandescent gas-burners, without requiring cumbersome apparatus for the purpose, and at a comparatively small cost."



According to one arrangement, a small dynamo or magnetic-electric motor C is combined with a fan or propelling device D, within a casing P forming the upper part of a gaselier; and insulated wires are led to the motor from any convenient supply of electrical energy. The motor may be arranged with its hollow armature-axis vertical—having below it the air-propeller fixed thereon; the illuminating gas supplied at A being made to enter the upper end B of the axis, and to issue through a passage G to perforations in an extension of the axis into a small chamber H, where it mixes with the air supply drawn in at openings F by the action of the fan blades E—the mixing being promoted by revolving wings or discs I fixed to the armature axis. From the chamber H, the combustible mixture is led down through a pipe L, provided with a cock M, to the incandescent burner K, which may be in the form of a sun-burner with a star-shaped finely-perforated incandescence body N (such as magnesia), with numerous jet-holes O.

Instead of the ordinary shaped star, incandescence hoods or mantles may be used as shown in the gaselier, with two branches supplied with combustible mixture from the chamber H.



According to another arrangement, the mixture of gas and air is effected by drawing into the air-propeller not only the air supply, but also the gas supply, so that both are mixed together in the propeller, and the mixture conveyed direct to the burners. For this purpose, the gas-supply pipe A is made to enter a small chamber, where the gas issues in a number of small jets among the air, which is drawn in by the action of the propeller D worked by an electro-motor C. This chamber may have the air supplied thereto by a pipe, part of which may be formed into a coil above the burner K, so that the air supply becomes heated on its way to the chamber, and thus still further increases the effectiveness of the combustion. The air and gas having become partly mixed in the supply chamber, become more intimately mixed in passing rapidly through the tube to the propeller; and the mixing is completed by the rapid action of the propeller blades upon the fluids.

The heating of the air may also be effected by causing it to pass up through the circular group of small tubes forming the glass chimneys now frequently used for incandescent lamps; the upper metal ring of such chimneys being made as a chamber for receiving the heated air from the tubes, and supplying it through a tube to the mixing chamber or propeller.

For increasing the luminosity of the burners, a portion of the electric current employed for working the propeller may also be employed, says the patentee, for "electrolytically decomposing water; the resulting oxygen and hydrogen gases being led through pipes to the mixing chamber for the gas and air so as to combine therewith—suitable precautions being taken for the prevention of explosions."

Manufacture of Gas.—Bosselaar, J. M., and Elshout, J. F. M. van den, of Brussels. No. 23,278; Nov. 30, 1894.

Concerning their proposal, the patentees say: "The industrial manufacture of lighting gas from hydrocarbons, especially petroleum of commerce, has not been successful up to the present time, by reason of the inconveniences which result principally from the difficulty of effecting a gasification which has always been insufficient, and from the difficulty of extracting from the gas the heavy and tarry products, which it carries along and keeps in suspension in a state of extreme division. The insufficiency of the gasification is disastrous as regards the yield, and therefore the cost of the gas; and the proportion of heavy products which the gas contains is a cause of obstruction not only of the burners, but also of the gas-pipes. In the manufacture of gas from mineral oils, and especially from petroleum, the chief points to be considered are the production of the gas in the gas-generator and the condensation of the vapours carried away. For obtaining a normal production of gas, it is necessary for the vaporization to take place instantaneously at a definite temperature, which can vary only within narrow limits; for an insufficient temperature leaves too great a proportion of undecomposed vapours, and too high a temperature decomposes a portion of the hydrocarbons, which are deposited upon the walls of the retort in a carbonaceous form, impeding the progress of the operations, and giving rise to a sensible loss of lighting power. An essential condition for the industrial production of gas is that, on its arrival in the retort, each drop of petroleum encounters a wall uniformly heated to the desired temperature; for it is not sufficient for the atmosphere of the retort to have this temperature—it is necessary that there shall be contact between the petroleum and a suitably heated wall. If the petroleum arrives in the retort in the liquid state, unless it be drop by drop, it rapidly causes a lowering of the temperature of the wall upon which the jet of petroleum spreads, however thin it may be; and from that moment the vaporization no longer takes place properly, and a large portion of the vapours formed leave the retort before their dissociation, and are condensed as soon as they are brought to a lower temperature."

In order to obviate this, the patentees use special retorts, the walls of which are kept at a strictly constant temperature. The retorts are different for industrial or large installations and for domestic or small installations.

The industrial apparatus comprises a retort surrounded with refractory materials, maintaining it at a mean temperature that will not be subject to changes by flames or too great an access of air during the operation. It consists of two compartments arranged one above the other; and (except the heads of the retorts, which are placed outside) it is entirely enclosed in the furnace, in order that all its parts may be heated uniformly. The lower compartment is an elongated rectangle of small height, and having its corners rounded. This form is said to be the most advantageous for obtaining a uniform distribution of petroleum upon uniformly heated walls. The upper compartment of the retort is cylindrical; and the two compartments communicate with each other at their extremities, opposite to the door of the furnace, through a vertical cylindrical tube in the interior. Into the lower compartment of the retort extends an iron or copper pipe, prolonged into the interior a length which may be varied according to the volume of gas to be produced. This pipe may be simply open at its extremity; but for a considerable production of gas, it is preferable to pierce it at a certain distance from its entrance into the retort with a number of holes arranged principally at its upper part and at its lateral parts, leaving the bottom solid. This pipe being heated by the atmosphere of the retort to a comparatively high temperature, effects the vaporization of the petroleum before it comes in contact with the walls of the retort.

On leaving the pipe, the vapours impinge against the red-hot walls of the retort; and contact takes place upon a considerable surface, without a sensible diminution of temperature. Dissociation is effected immediately at the desired temperature, which is from 800° to 900° C. The gas formed, and a small quantity of vapours carried away, escape with very great rapidity through the vertical tube, and impinge against the red-hot top of the upper compartment of the retort; passing through the latter, and turning the whole of its length to the outlet orifice. The shock produced on the entrance of the gas, and the friction of the latter on the walls of the upper compartment of the retort, complete the dissociation of all the vapours which may have been carried away. At its outlet from the upper compartment of the retort, the petroleum has been entirely transformed into a fixed gas, with which are mingled the vapours which cannot be gasified, and which are condensed farther on.

The retorts are arranged horizontally in a return-flue furnace, in order to obtain from the two compartments of the retort as uniform a heating as possible. The flame comes in contact with the retort in its whole passage, and with the lower part as well as with the upper part. Then the flame, returning, in order to pass to the chimney, heats a refractory wall above the upper compartment of the retort; and thus gets a greater amount of heat. The front wall of the furnace, in which the heads of the retort are placed, is formed with an independent portion, which it is sufficient to remove in order to withdraw the two compartments of the retort at the same time, without any need for interfering with the other parts of the furnace.

From the front part of the upper compartment of the retort rises a vertical pipe for the outlet of the gas and vapours. This pipe communicates (as usual) with a horizontal or inclined pipe provided with a test-cock, and which terminates at the upper part of a descending pipe, to conduct the gas to purifying and condensing apparatus. This latter has a cylindrical sheet-metal casing closed hermetically; while through the bottom passes a pipe that determines the level of the water, and whose lower part dips into a reservoir designed for collecting the light products of condensation, which may be removed through a pipe provided for the purpose. The gas-admission pipe dips slightly into the liquid contained in the purifying and condensing apparatus, so that the gas must bubble through the water before leaving the apparatus.

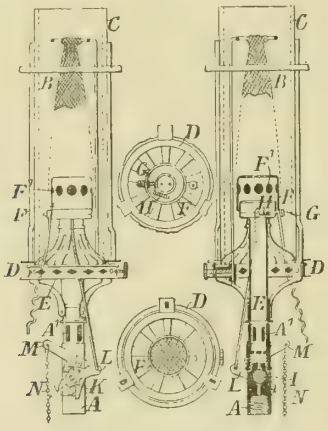
From the condenser, the gas passes to a vertical column, which may be a simple empty pipe, or a pipe containing obstructions or any fragments multiplying the surfaces of contact. Then the gas passes into a second descending column, wherein the last condensable products are deposited; and it finally arrives below the bell of the gasholder, and thence passes into the gas-pipes.

The apparatus operates as follows: The oil from the petroleum reservoir passes through a syphon and a pipe into the admission-pipe, which is in the first compartment of the retort; and as soon as the petroleum is subjected to the heat of the retort, it becomes vaporized, and is precipitated into the retort through the apertures in the pipe. The dissociation commences immediately, and continues in the second compartment of the retort; then the gas passes to the purifier, to the gasholder, and into the gas-pipes.

The arrangement of apparatus applied to domestic uses—for the lighting of private houses and other purposes of little importance—is more simple, and may be portable and automatic in its action.

Electric Lighting Attachments for Gas-Burners.—Webb, F. A., of Beverley, U.S.A. No. 15,216; Aug. 13, 1895.

A represents the usual gas-pipe, having air-inlets A^1, as with Welsbach incandescent gas-lights having the suspended mantle B, chimney C, and socket or chimney support D. E is the burner top attached to the upper end of the gas-pipe, and provided at its upper end with a cup-shaped burner cap, over which is fitted the burner F, having its upper end made of wire-gauze or netting. F^1 are side perforations in the burner, through which a supply of air is admitted. Within the cap are preferably arranged a stationary and moveable electrode, as follows: G represents the stationary electrode secured (insulated) to the cap; and to the said electrode is metallically connected a battery wire. H is a yielding electrode or "sweeper" adapted to be metallically brought in contact with the stationary electrode, at the time the gas is turned on. The electrode H is attached to, or forms a part of, a downwardly projecting metallic rod connected to the gas-cock, so that it shall close and break contact with the stationary electrode G at the time the gas is turned on, and thus automatically ignite the gas and air compound by electric means when turning on the gas. The gas-cock I is shown provided with four ports, adapted to close and open the gas-passages in the pipe A. To the end of the cock is secured a ratchet-wheel K; and on the stem of the cock is loosely hung a spring-actuated lever L, to which is pivoted the lever M, having a pawl adapted to engage the ratchet-wheel K in turning on or off the gas, as is common in electric gas-lighting devices. The lower end of the rod is pivoted to the lever L. N is a cord or chain attached to the pawl-lever M, for actuating the cock, as with ordinary electric gas-lighting devices.



From the above description, it will be seen the yielding electrode H will sweep by the stationary insulated electrode G, when the cord N is pulled in opening the cock to turn on the gas to the burner—causing a spark to be produced between the electrodes, by which the gas is ignited within the burner. When the operator releases his hold on the pull-down N, the lever L is automatically returned, by the influence of its spring, to its normal position; and this causes the electrode H to again sweep by the electrode G, by which a secondary spark is produced to light the gas, in case the primary spark should have failed to ignite it.

APPLICATIONS FOR LETTERS PATENT.

18,257.—White, W., and Wallace, J. A., "Automatically lighting and extinguishing street and other gas-lamps." Sept. 30.

18,263.—Wheatley, W. H., "Incandescence bodies for illuminating purposes." A communication from C. Schmid. Sept. 30.

18,303.—Bragger, J. W., "Lamps or lanterns." Oct. 1.

18,313.—Holt, H. P., "Driving and reversing gear for gas or oil motor cars." Oct. 1.

18,334.—Livesey, F., "Extraction of cyanides and other compounds from illuminating and other gases." Oct. 1.

18,346.—Parsons, C. J., "Apparatus for the control of gas supply." Oct. 1.

18,375.—Thompson, S., "Gas regenerative furnaces." Oct. 2.

18,378.—Johnston, J., "Gas and like engines." Oct. 2.

18,379.—Johnston, J., "Gas and petroleum engines." Oct. 2.

18,395.—Thomas, J. T., and Hunt, A. V., "Manufacture of coal gas." Oct. 2.

18,407.—Delmard, M., "Indicating the height of water contained in tanks." Oct. 2.

18,431.—Lea, J. P., "Gas and oil engines." Oct. 3.

18,445.—Grover, F., "Detecting leakages of gas." Oct. 3.

18,448.—Gamwell, H., and Gamwell, C., "Coin-freed mechanism for gas-meters." Oct. 3.

18,451.—Lawton, J., "Bags for supplying gas to gas-engines." Oct. 3.

18,511.—Dean, A. H., "Pipes." Oct. 3.

18,571.—Dean, W., "Conveying or discharging coal from one level to another." Oct. 4.

18,579.—Gillespie, G., "Burning down the nets of incandescent gas-lamps." Oct. 4.

18,621.—Richmond and Co., Ltd., Smith, W., and Richmond, E. W. T., "Gas-burners." Oct. 5.

18,672.—Wright, F., "Coin-freed apparatus for gas or other fluid meters." Oct. 5.

The Lighting of Laira.—A meeting has been held to consider proposals for the lighting of Laira, a hamlet near Plymouth. It was stated that the Plymouth Gas Company had been waited upon, and, when questioned with regard to supplying the parish, inquired how many persons were likely to have gas laid on for private use. The Compton Gifford District Council were stated to be willing to light a portion of the roads in their district; and it was decided that a Committee should enter into negotiations with the District Council and the Gas Company with a view to the adoption of gas lighting.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Oil-Gas Experiments at Bradford.

Sir,—We have not the time, even if there were any necessity, to answer in full detail the long rigmarole from Mr. Lewis T. Wright which appears in this week's Journal. To reply at length would simply be to reopen the whole question, and tire readers with a repetition of what has already been sufficiently canvassed.

There is one point in regard to which it is desirable there should be a clear impression—viz., that we were equally entitled with Mr. Wright to make the tests, and to say what should and should not be done in conducting them. It is a piece of sheer presumption on his part now to arrogate that he, "the gentleman engaged by the Corporation," was the ruling authority. As proof of this, the order of procedure was arranged between us (Mr. Wright and ourselves) jointly, before the experiments were begun; and these were throughout conducted by us simultaneously—Mr. Wright representing the Corporation, we representing the owners of the process. During the progress of the trials, Mr. Wright accepted some of our suggestions as to matters of detail; and we, in turn, accepted any reasonable suggestion of his. There was, in fact, a mutual interchange of views as the experiments proceeded. Collaboration of reports there was none, of course. He had his report to make to the Corporation; we had our report to make to Mr. Isaac Smith, as representing the owners of the process.

In the same pretentious manner (as though he were a pedagogue addressing a shrinking pupil), Mr. Wright puts a series of questions to us, most of them in regard to matters referred to by others. The question relating to the oil, we have sufficiently dealt with in our report, and since. We took the price at 3¼d. per gallon (1) because it was admittedly inferior in quality, and (2) because that was the price on which the results of other cognate processes were determined.

We observe from the proceedings of yesterday's Town Council meeting at Bradford, as reported in to-day's newspapers, that the Chairman of the Gas Committee, Mr. Dixon, stated that "the coke made from the cannel coal had been almost unsaleable" during the year. This bears out the remarks which we made on cannel coke in our letter of the 7th ult. [*ante*, pp. 590, 636], and affords a fine commentary on Mr. Wright's subsequent dissertation on the same subject.

Thomas Newbigging and Son.

5, *Norfolk Street, Manchester,*
Oct. 9, 1895.

In reply to the foregoing letter, Mr. Wright sends the following:—

Sir,—Messrs. Newbigging, in their letter of the 9th inst., offer no explanation of the two different reasons given by them on two different occasions for the price at which they took the oil into their estimate; but they now restate the two reasons in the reverse order in which they were originally given. These two different reasons, taken in conjunction with the fact that the alleged inferiority is notified to the people who provided the oil before its quality could be known to those who made the notification, and against the evidence of their 33 days' test, merited some more lucid explanation.

If the fact that the cannel coke was almost unsaleable at the retail price of 4s. per ton, and that to sell it a lot of 1000 tons was sold at 3s. 4d. per ton, had been a commentary upon their remark about the coke from many high-class cannels being absolutely worthless, I should not have had occasion to inquire for the object of that apparently irrelevant observation.

Lewis T. Wright.

1, *Victoria Street, S.W., Oct.* 14, 1895.

Sir,—The real "Mr. Wood" of the Bradford oil-gas controversy has at last unmasked himself. To the letter of the 2nd of October [*ante*, p. 733] there are two signatures appended. The last is that of the Mr. Wood I refer to. He is the Assistant-Engineer at the Bradford Gas-Works, is the gentleman who wrote to me in April of this year, who was introduced to me as the "Mr. Wood" who was concerned in the oil gas, and who is regarded as responsible.

I am now able, with the permission of a gentleman it also concerns, to put the affair of the calculations in its true light, with the aid of documents which I enclose for your inspection. They are, as you will notice, originals, and not copies. On the 2nd of April of this year, I received the letter, appended below, from a gentleman who was an entire stranger to me. It relates to a difference of views between A and B about the way of calculating candles from volume and illuminating power of gas. I very frequently receive such letters, which I regard as private between myself and the parties who send them. I wrote the answer across the letter itself, and returned it to the sender on the 4th of April, so that I supposed it reached him on the 5th. There was nothing in the letter to make me suspect that it related to the affairs of the Bradford or any other corporation. On the 6th, I received a letter (now enclosed) from Mr. C. Wood. I did not understand it; for it appeared to me that, if the Bradford Corporation had wished Mr. C. Wood (whose position was unknown to me) to consult me on any business, they would not have allowed him to write to me, without some introductory explanation, on a subject that, so far as I was concerned, was then private between myself and another gentleman who had consulted me, and had paid me a fee. With no more introduction than was contained in the letter, I certainly could not enter into correspondence with Mr. C. Wood about other people's affairs. That would have been a breach of confidence. I therefore telegraphed to Mr. C. Wood asking whether he had been asked by the Corporation to consult me, or something to that effect. It will be remarked that twice in his letter he says, "for the information of the Committee." His reply was *not* an answer to my question; and I then wrote to explain that, in the first place, I could not discuss matters that had passed between the gentleman who had consulted me without his consent; and, further, that I could not discuss with him the affairs of the Corporation without my position was made clear. If he will send the originals of my letters, they can be published.

Mr. Wood replied in a letter that was not coherent with his first one, as it referred to things he had not told me. He knows perfectly well

that I never wrote to anyone to discuss his reports. I never saw them until the Town Clerk put them into my hands on July 2; and I did not want to take them, because I did not see what I had to do with them. They have, however, been useful to me since. Mr. C. Wood should first have obtained permission from the gentleman who had first consulted me, and then have written to me with that permission.

Later on I found out why Mr. Wood could not obtain the permission, or *did not care to ask for it*. It appears that, about the time when I was written to, Mr. F. Wright was also written to; and his reply was put before the Committee, I suppose, on the 4th of April. Thereupon the Committee gave orders to Mr. C. Wood to address a letter to Mr. F. Wright, explaining his views in his own way, and then to give the letter to the member of the Committee who had made the inquiries, in order that it might be forwarded to its destination in the proper manner. He wrote a letter, and took it to the member of the Committee who had been deputed to see that the business was carried out in a formal way, and asked whether it was a fair statement. The member of the Committee said it was, but remarked that the letter was addressed to Mr. L. T. Wright, instead of being addressed to Mr. Frank Wright, according to the orders of the Committee. Mr. C. Wood went away to rewrite the letter, and, I am informed, brought a letter in similar terms addressed to Mr. F. Wright, which was then forwarded by the member of the Committee to the person for whom it was intended; *and all I can say is that I received the letter that Mr. Wood had been told not to send me.* This letter caused me to write to my first correspondent; and I enclosed a statement of my opinions [herewith] about candles, in order that it could not truthfully be said I had retired from my first opinion, or declined to discuss the matter. It is utterly untrue that I ever wrote to anyone to discredit his reports, or that I declined to discuss the matter until I had been paid a fee; and no one knows that better than those who have been engaged in the correspondence, or have seen it.

I am not going to discuss candles with Mr. C. Wood. The statement I wrote expressly to prevent him from being able to say that I had declined to discuss the matter, and that I must therefore be wrong, is now published. And it will be seen that it relates to nothing beyond the mode of calculating candles.

Mr. C. Wood says I attempt to obscure a mistake by making comparisons with a former report. If he had been quite sincere, he would have sent you the correspondence I now enclose; but that would have disclosed to you that it was not necessary for me to go so far as a former report for the statement that the product of volume by illuminating power is foot-candles. That statement is contained in his letter of the 5th of April (the letter he was ordered not to send). That letter deprived him of any temporary refuge he might have taken. He cannot now shield himself behind anybody else. He must stand alone as the man who has taken "1000 feet-candles" and "candle-thousand" as equivalent terms, and as representing the value of 200 candles. The support of Messrs. Newbigging will avail him nothing. They are already committed to the statements in their "Handbook."

He is easily amused if he finds anything in my cannel estimate of that character. It is not that that amuses him, but the dilemma he has put himself on to of having to accept my cannel estimate, that he finds so amusing, or to deny his own figures. He does not like to say that the gas at Bradford is one candle less illuminating power than he states it at; he is equally loth to confess he can buy 28 to 30 candle cannel (enriching) at 13s. 3½d. per ton. He would prefer to raise the candle power of the unenriched gas. But that will go against the oil.

Why does he remind me about the list of coal and cannel tenders accepted that he was ordered to supply me with? Does he think I have lost it? He says that I assume the candle power of the unenriched gas at 15¼. He knows very well that I have assumed nothing, but have written: "Mr. Wood has stated it to be from 15·16 to 15·75." Is the report of March 28, 1895—a report that he is now citing—a spurious document? Did he not write in that report: "The average illuminating power of the coal gas alone was 15·16"? Does he not write: "This gives the coal gas as 15·67-candle power"? Does he not also write that the coal gas now in use "requires about 2¼ candles enrichment in order to supply 18-candle gas"? What is 2¼ from 18 but 15¾. He thinks I ought not to take "profits on manufacture of acid and other [ammonia] products" as part of the net revenue from gas liquor. A gas undertaking makes sulphuric acid (if it does not purchase), because it wants to make "sulphate;" and without gas liquor, there could be no profits on acid, &c. And he should know that, even if in the accounts the "profits" had been separately stated, I should, with propriety, have included them in the estimate and as a deduction from the working expenses.

Mr. Wood knows that what he has stated about me is not in accordance with the documentary evidence as revealed by the correspondence. Let him send the originals of my two letters, to be copied and published.

He knows well that the cause of the trouble is the 350,000 foot-candles per gallon of tar oil volatilized; one gallon of oil, weighing about 9 lbs., being equal to 4 to 5 tons of Lesmahago cannel. He knew well that, when the inventor first came on the scene, in January, 1894, it was with the correct candles the world had hitherto known. Does he suppose that there are men on his Committee so dense as not to see through that rubbish? He was expostulated with, but he would not give way one jot; and he forced his Committee to seek information where they could best obtain it. Does he not know that, months before those A and B calculations were sent to me and others, inquiries were being made? Mr. C. Wood must know that, had I taken him literally, and calculated the costs in 1000 candles, I must have increased them five times, instead of taking them as, as I did, per 200 candles. If certain members of his Committee discovered the error in the candles, it was the Chairman who discovered the error in the carburettor, which has been now so unkindly thrown back on the Engineer's hands by the Syndicate.

LEWIS T. WRIGHT.

1, *Victoria Street, S.W., Oct.* 9, 1895.

[In order to expedite the closing of this correspondence, which is now getting most involved, a proof of the above letter was sent to Mr. Charles Wood, with a request that—if he saw fit to do so—he would send for publication the letters asked for by Mr. Wright. Mr. Wood complies with the request; remarking that it is, of course, quite impossible for him to reply this week to Mr. Wright's present letter, but that he will do so in time for our next issue. Meanwhile we give below the correspondence Mr. Wright desires to see published.—ED. J. G. L.]

April 6, 1895.

Charles Wood, Esq.

Dear Sir,—I am in receipt of yours of the 5th inst., and as I had not had any correspondence with your Committee, I desired to know in what position I stood, since the matter you refer to relates mostly to correspondence between myself and a private individual who, having paid me a fee for an opinion, is, of course, entitled to use it.

I therefore exchanged telegrams; but the matter is still not clear to me as to my position in the matter.

If you desire an answer to your letter of the 5th inst., then I can do so *professionally*, and charge my fee.

If you desire also explanations or amplifications of any opinion I have given to others, that I can also do if you consult me professionally, and obtain the consent of the parties in question.

Yours faithfully,
(Signed) LEWIS T. WRIGHT.

April 11, 1895.

L. T. Wright, Esq.

Dear Sir,—I must confess that I was astonished at the contents of your letter.

Having explained that several of the members of our Gas Committee thought from your letter to Mr. Speight that the figures given in the estimate as the cost of enriching 1000 cubic feet of gas by one candle should be multiplied by 5, I assumed that, as a matter of professional courtesy, you would have been anxious to at once correct this misinterpretation of your meaning.

Yours faithfully,
(Signed) CHAS. WOOD.

April 13, 1895.

Chas. Wood, Esq.

Dear Sir,—I am in receipt of yours of the 11th inst., which is not coherent with yours of the 5th, since in that you did not give the explanation you, in yours of the 11th, now say you did.

If your Committee, or any member of the same, have thought that "A's" answer to the second query brought out the candles five times too high, and the cost five times too low, there is no misinterpretation to correct.

Yours faithfully,
(Signed) LEWIS T. WRIGHT.

[ENCLOSURES IN MR. WRIGHT'S LETTER OF OCT. 9.]

Burlington Works, Thornbury,
Bradford, April 1, 1895.

Dear Sir,—I have read your letters occasionally in the "Gas Lighting Journal" on the question of coal-gas enrichment by oil gas, and know you to be a great authority on the subject. Will you kindly assist us? A difference of opinion exists here between A and B as to the proper way to calculate the cost of that enrichment. I send you a copy of the calculations as worked by each of them. Would you kindly oblige by looking over the same, *and mark in red ink which is correct*, and so help us out of our difficulty. If both are wrong, would it be too much to ask you to correct us?

The problem is: 400 gallons of oil, labour, &c., cost £8 3s. 4d. 400 gallons oil produce 27,200 cubic feet of gas of 105-candle power and 160 gallons of bye-products; the 160 gallons of bye-products being equal to 35,000 cubic feet of gas. What is the cost (per 1000 foot-candles) of enrichment?—Yours respectfully,

Lewis T. Wright, Esq. (Signed) THOS. SPEIGHT.

P.S.—If you will return me this letter, I shall be obliged, so that I may show how the matter has been put before you—whether fairly or no.

FIRST PROBLEM.

A's Calculation.

(M) 27,200 c. ft. gas × 105-candle power = 2,856,000
(N) 35,000 c. ft. gas × 160 gals. bye-products = 5,600,000

8,456,000 foot-candles.

Cost of $\frac{£8\ 3s.\ 4d.}{8456}$ = 0·25d. per 1000 foot-candles of enrichment.

Note by L. T. W.—(M) 400 gals. oil = 27,200 cubic feet of 105-candle gas—*i.e.*, per 5 cubic feet, or 105 ÷ 5 = 21 candles per cubic foot. 27,200 × 21 = 571,200 foot-candles. (N) 160 gals. bye-products = 35,000 cubic feet; but as the candle power is *not* given, it is impossible to calculate its candle value as in N. In these calculations, both M and N are incorrect.

B's Calculation.

(M^1) 27,200 c. ft. gas × 105-candle power = 2,856,000 ÷ 5 = 571,200
(N^1) 35,000 c. ft. gas × 160 gals. bye-prod. = 5,600,000 ÷ 5 = 1,120,000

Total 1,691,200
foot-candles.

£8 3s. 4d. = 7840 farthings.
7840 ÷ 1691 = 4⅝ farthings per 1000 foot-candles of enrichment.

Note by L. T. W.—(M^1) This part of B's calculation is free from the error made by A (in not taking into account that the candle power is stated per 5 *cubic feet*), and is therefore correct (see above). (N^1) This part of the calculation is incorrect (see above).

SECOND PROBLEM.

420 gals. oil, labour, &c., cost	£8 14 4½
Less 126 gals. bye-products sold at 6d.	3 3 0
Net	£5 11 4½

Oil yields 68·15 cubic feet of gas per gallon at 111 c. p.

Required—The cost of enrichment per candle-thousand.

A's Calculation [is incorrect.—L. T. W.].

$$\frac{£5\ 11s.\ 4\tfrac{1}{2}d.}{420 \times 68{\cdot}15 \times 111 = 3{,}177{,}000} = 0{\cdot}42d.$$

Note by L. T. W.—This must be divided by 5—*i.e.*, 3,177,000 ÷ 5.

B's Calculation [is correct.—L. T. W.]

420 × 68·15 × 111 = 3,177,000 ÷ 5 = 635,400.

£5 11s. 4½d. = 5346 farthings.

5346 ÷ 635 = 8⅓ farthings per candle-thousand.

Note by L. T. W.—Correct (8·42).

Corporation Gas Department,
Town Hall, Bradford, April 5, 1895.

Dear Sir,—In reference to the letter of Mr. Thos. Speight, dated April 1, and to your reply thereto, may I ask you to kindly explain matters a little for the information of the Bradford Gas Committee?

Without entering upon the correctness or otherwise of the data upon which the figures are based, the question in dispute is the value per *candle-thousand*.

You say that the actual cost per candle-thousand is five times the value stated—or, in the second query, is 0·42d. × 5, or 2·1d.

Now, I am perfectly aware that the value $\frac{\text{cubic feet} \times \text{ill. power}}{5}$ is frequently given as foot-candles; but I maintain that the values expressed in this way are candle-hours, and not foot-candles at all.

Why should the product *cubic feet × illuminating power* be divided by the gas consumption per hour, any more than by the gas consumption per minute or per day, to obtain a unit of quantity which has nothing whatever to do with time?

I take it that 420 × 68·15 cubic feet of 111-candle gas (as an enricher) represents 3,117,000 *foot-candles*, or $\frac{3{,}117{,}000}{5}$ candle-hours.

If you do not agree with me, will you kindly give your definition of a candle-thousand unit, and state (again for the information of our Committee) *how many* of these units will be required to increase the illuminating power of 1000 feet of gas by one candle, and also the cost upon the foregoing basis?

As considerable misconception has arisen upon this matter, will you be good enough to favour me with your reply by return of post.—Yours faithfully,

Lewis T. Wright, Esq. (Signed) CHAS. WOOD.

Reply to Mr. Wood's Letter of April 5, 1895.
April 13, 1895.

Illuminating Power.—The illuminating power of a gas is the equivalent in candles (each of 120 grains of sperm) of 5 cubic feet of that gas. A candle is the light given by the burning of 120 grains of sperm.

The statement of the illuminating power of a gas is an equation, and states that 5 cubic feet of the gas equal so many candles, each candle being the light from the burning of 120 grains of sperm.

The product of cubic feet by illuminating power is, consequently, the product of cubic feet by the candle-value of 5 cubic feet, and is ⅕-candle, and not foot-candles as Mr. Wood says. This product of cubic feet by illuminating power is not used by people acquainted with the subject, since it would only serve to introduce ⅕-candle, or an inconvenient fractional unit.

The product of cubic feet by the candle power of one cubic foot is, however, *candles;* and to arrive at the candle-value of one cubic foot of the gas in question from its illuminating power, which is the value in candles of 5 cubic feet, we divide by 5, and having thus obtained the value in candles of one cubic foot, we can easily obtain the value in candles of any number of cubic feet of the same gas. The formula is—

$$\text{Cubic feet of gas} \times \frac{\text{illuminating power}}{5} = \text{candles.}$$

Whilst this product is simply candles (each candle being 120 grains of sperm), there is no objection to calling it foot-candles, if it be desired to emphasize the fact that the candles (light given by 120 grains of sperm) are contained in cubic feet of gas. Thus, 1000 foot-candles will mean either one cubic foot of gas of 1000 candles per cubic foot,

Or 10 cubic feet of gas of 100 candles per cubic foot.
" 100 " " 10 " "
" 1000 " " 1 " "

Or any number of cubic feet of the gas by the candle power of one cubic foot that equals 1000.

The error made by Mr. Wood, of multiplying the cubic feet of gas by its illuminating power and calling the result foot-candles, is so obvious as hardly to require remark. It can be thus exposed: The value of 1000 articles at 1od. per five is not 10,000d., but only one-fifth of 10,000d., or 2000d. In the same manner, the value in candles of 1000 cubic feet of gas of 10 candles illuminating power is not 10,000 foot-candles as Mr. Wood asserts, but only one-fifth of that quantity, because the 10 candles is the value of 5 cubic feet, and the value of one cubic foot is only 2 candles, and not 10 as Mr. Wood makes it to be.

When Mr. Wood asks (*vide* his letter of the 5th inst.): "Why should the product cubic feet × illuminating power be divided by the gas consumption per hour any more than by the gas consumption per minute or per day to obtain a unit of quantity which has nothing to do with time?" he shows the manner by which he has fallen into his error.

When dividing by 5, we do so because we want to find, from the equation expressing the illuminating power of the gas, what is the candle-value of one cubic foot. There is no question of time introduced, nor is there any need to introduce the question of time. However, I will follow Mr. Wood, and divide by the consumption per day, or per minute, as he suggests, in order to show that the result is not in any way thereby affected, since with the equation of illuminating power—viz., that 5 cubic feet of gas equal so many candles—the time for the 5 cubic feet of gas is the *same* as the time for the candles; and if we divide both sides of an equation by the same factor, we do not alter its value.

For illustration, I will take the case of a gas said to be of 10 candles illuminating power. That is the customary way of expressing the equation that

5 cubic feet of gas = 10 candles (each candle = 120 grains of sperm).

After the photometrist has given this result, there is no need, in the calculations that are the subject of discussion, to further introduce the element of time, because the time during which the 5 cubic feet of gas is consumed must be the same as that during which the equivalent sperm is consumed.

I will introduce the element of time in order to show that it does not make any difference, and is unnecessary—

5 cubic feet *per hour* = 10 candles, or 1200 grains of sperm *per hour*.
That is to say, in the same time, 1 cubic foot = 2 candles, or 240 grains of sperm.

Again—

5 cubic feet per hour for 24 hours = 10 candles, at 120 grains per candle for 24 hours, is 28,800 grains of sperm.
is a consumption of 120 cubic feet.
That is to say, in the same time, 1 cubic foot = 2 candles, or 240 grains.

Again—

5 cubic feet per hour is at the rate of $\frac{5}{60}$ cubic foot per minute. = 10 candles, or 1200 grains, is at the rate of $\frac{1200}{60}$, or 20 grains of sperm per minute.

That is to say, $\frac{5}{60}$ or $\frac{1}{12}$ cubic foot = 20 grains sperm. Then 1 cubic foot = 240 grains, or 2 candles.

Thus we always obtain the same result—viz., 1 cubic foot = 2 candles

If Mr. Wood wishes to introduce the element of time, he must not forget, in a statement of "illuminating power," that the time for the gas consumption is the same as the time for the sperm consumption, and that a candle is 120 grains of sperm. So that if he divides by the consumption of gas, he must divide both sides of the equation; and then with the same gas he will always obtain the same result—viz., one cubic foot on the left-hand side and its candle equivalent on the right-hand side of the equation.

In dividing by 5, it is really the illuminating power that is being divided by 5, in order to find the candle-value of one cubic foot, since illuminating power is the candle-value of 5 cubic feet.

Thus, in the case of 10-candle gas, cited above—

5 cubic feet of gas = 10 candles, or 1200 grains sperm.

Dividing both sides by 5, which is the consumption of gas which, in the same time, equals a consumption of 1200 grains of sperm, we have—

$$\frac{5\text{ c. ft.}}{5} = \frac{10\text{ candles}}{5}, \text{ or 1 cubic foot} = 2\text{ candles.}$$

Or in grains of sperm—

$$\frac{5\text{ c. ft.}}{5} = \frac{1200\text{ grains of sperm}}{5}$$

Therefore 1 cubic foot of gas = 240 grains of sperm, or 2 candles.

(Signed) LEWIS T. WRIGHT.

Mr. Herbert Lees on Charging Meter-Rents.

SIR,—The argument that Mr. Lees deduces from his table giving the "Ratio of Meter-Rents to the Consumption of Gas at Hexham" [*ante*, p. 722] appears, at first sight, conclusive in favour of charging meter-rents as a simple means of graduating the charges for gas according to consumption. But, upon closer investigation, the thought occurs as to whether Mr. Lees considers that a reduction to consumers of more than 50,000 cubic feet per annum of 0·24d. per 1000 cubic feet (for that is what it would practically amount to if the £85 19s. 7d. received for meter-rents were spread over the total consumption shown) is an adequate concession to make in order that "the accepted principles upon which business is conducted" may be applied to them. A careful reading of his argument conveys this idea.

Though the writer has no wish to enter into the much-vexed question of the rightness or otherwise of charging meter-rents, he would express the opinion that the only way of applying accepted business principles to consumers of gas, where the profit per 1000 cubic feet sold is in proportion to the amount burnt, is by means of a graduated scale according to consumption.

GAS CLERK.

Oct. 9, 1895.

Welsh Authorities and the New London Water Scheme.—The Fishery Boards of Towy, the Wye, and Carmarthen Bay have appointed Committees to consider what action should be taken with reference to the project of the London County Council for bringing a supply of water to the Metropolis from Wales.

The Capacity of Water-Closet Flushing Cisterns.—The inquiry to be held on the 31st inst. by Colonel Ducat, R.E., and Dr. Barry, on behalf of the Local Government Board, on the above subject, as mentioned in the JOURNAL last week, is the result of an application made to the Board by the London County Council for such an investigation. A year ago, the Public Health and Housing Committee reported the result of their correspondence with the London Water Companies with regard to the alterations which the Council had asked them to make in their regulations under the Metropolis Water Act, 1871; and, in view of the refusal of the Companies to make the most important alteration suggested—viz., to increase the maximum capacity of water-closet flushing cisterns from 2 to 3 gallons—and of their failure to alter the regulations in certain other points, they decided on appealing to the Board. The Committee have requested the Engineer, Architect, and Medical Officer to place any information they possess at the disposal of the Solicitor; and, as it may be necessary to retain Counsel, have the evidence of experts, and otherwise incur expenditure, authority has been given for an outlay on this matter to the extent of £250.

LEGAL INTELLIGENCE.

ARUNDEL COUNTY SESSIONS—Monday, Sept. 30.

(*Before Sir* H. FLETCHER, M.P., *Chairman, and other Magistrates.*)

The Quality of the Littlehampton Company's Gas.

To-day the Littlehampton Gas Company were summoned by the Littlehampton Urban District Council for supplying, on the 17th of August, gas of lower illuminating power than that prescribed in their Act of Parliament.

Mr. J. C. BUCKWELL appeared for the Council; Mr. E. B. WANNOP represented the Company.

Mr. BUCKWELL, having briefly referred to the sections of the Act under which the proceedings were instituted, stated that, in 1893, Mr. W. C. Young had been appointed Gas Examiner to the Local Authority; and on the 17th of August last he made a test of the Company's gas, and found it to be 2·47 candles below the legal standard—viz., 15 candles. He reported the result to the District Council, who ordered the present proceedings to be taken.

Mr. *A. Shelley*, the Clerk to the Council, deposed to receiving Mr. Young's report on the 19th of August.

Mr. WANNOP raised an objection that the report was not sent in on the day following the test, as prescribed by the Act.

The CHAIRMAN remarked that the 18th was a Sunday, and probably was considered a *dies non*. But he would note the objection.

Mr. *W. C. Young* was then called. He said he had tested the Littlehampton gas four or five times since his appointment, and on two or three occasions had found the illuminating power deficient. On Saturday, the 17th of August, he visited the works shortly after 7 p.m., and made three testings—ten observations in each test. He began the test at 8.35, and made the last about 9 o'clock, within the hours prescribed by the Act. The mean result of the testings was equal to 12·53 sperm candles illuminating power, or 2·47 candles deficient. He wrote out his report in Mr. Shelley's office the following Monday morning.

Mr. WANNOP said the report was not handed to the Company's Secretary before ten minutes past eleven on the 19th.

Witness said he made it a rule not to do any testing or working out of tests on a Sunday. He then, in cross-examination, stated that his first observations showed a total of 55·8 candles; or, as corrected, 12·2 candles—their consumption being 43 grains. On the second test, with the candles burning 43·7 grains, the total of the observations was 56·7 candles; or, as corrected, 12·6 candles. The third test gave a total of 64·8 candles; or, as corrected, 12·8 candles. He was satisfied with the way in which the candles, which were provided by the Company, burnt, and also with the photometer-room, the temperature of which (70° Fahr.) he did not consider too hot. The apparatus was in good order. If the candles had since been tested, and found to burn less than they ought, he would put no reliance on such a test. Two lighted candles were placed in the holders 20 minutes before the first test, and two were lighted and placed on a shelf screened by a box, so that they could not have any effect on the photometer. At the third test, the consumption of the candles was 38·9 grains. During the second and third tests, only one pair of candles was burnt. On the last two occasions of testing, the Company had objected to his burning the two candles on the shelf. They were lighted and put there to save time. At East Grinstead recently, objection had been taken to his readings as being too low; no proceedings had been instituted by the Grinstead Local Authority upon his reports. He should not object to an expert being present and checking readings; but he should object to Mr. Waite, the Manager of the Littlehampton Company, who was in the room at the third test, doing so. He preferred testing in his own time, and not at the dictation of a gas company.

In re-examination, witness stated that the Manager had been informed, as soon as the tests were concluded, that the illuminating power was only 12·53 candles.

Mr. WANNOP said the case was a serious one for his clients, and also for the public. The Company objected to Mr. Young's tests, and had made offers to the Council to have an examiner from Brighton or Portsmouth to make a surprise visit and test. Since then the matter had been thoroughly gone into; and the report of an impartial examiner, who tested the gas on the 19th of September, would be handed in. The result was that the illuminating power of the gas was found to be more than 15 candles. The Company had done their best to keep the gas up to the standard. He thought Mr. Young, by the way in which he burnt the candles during his tests, had not acted with strict fairness to the Company. No formal complaint of the gas had been made by the inhabitants.

Mr. *A. A. Moncrieff*, the Gas Examiner for the Portsmouth Corporation, was then called, and was proceeding to state that he made a test of the Littlehampton gas on the 19th of September, when

Mr. BUCKWELL objected to this being introduced as evidence.

The BENCH upheld the objection.

Witness went on to say that he took away some of the Littlehampton candles and tested them; and they were such as he should not have used himself. He always understood that the candles were to be used in the photometer; and he would not have any other candles burning in the room when he was testing. He also thought the high temperature of the room might have affected the candles prejudicially. He did not think 43 grains consumption a normal rate, and he would have rejected the second test.

In cross-examination, witness said he considered 38 grains a normal consumption. Mr. Young's test was strictly legal as regarded the consumption of sperm, but it was abnormal.

Mr. D. T. Livesey, Manager of the East Grinstead Gas-Works, was about to be called to speak as to the qualification of Mr. Young, when an objection was raised, and it was allowed.

The Bench then retired for consultation. On their return,

The CHAIRMAN said they had given the case their most careful consideration with regard to the objection as to the reception of the examiner's report on Sunday; and they thought it unfortunate that the test should have been made on a Saturday. They considered the case proved against the Company; and two previous convictions having been admitted, the Bench imposed a fine of £20, and costs amounting to £6 5s. 6d.

Thefts of Money from Automatic Prepayment Meters.

A decision of some importance to gas companies who have adopted the automatic prepayment meter system has been given by the Norwich Magistrates, acting, of course, under the advice of their Clerk. A youth named Burrows was found stealing money from a prepayment gas-meter, which the British Gaslight Company had placed in the house of a Mrs. Leavold, in Pottersgate Street, Norwich; and as the index of the meter had on previous occasions not corresponded with the money found in the drawer, the Company prosecuted the lad in the public interest. "But," said the Chairman (Mr. E. Wild), addressing Mr. Bracey, who appeared for the Company, "how can you have any *locus standi?* In my opinion, money taken from the drawer of the meter would be the property of the hirer of the meter for the time being, and not the money of the Company at all." The Magistrates' Clerk said he was about to point out the same thing, as, the meter being in the house of the hirer, any money placed in the slot did not belong to the Company until after it had been collected. Mr. Bracey said he regarded the prepayment meter as a sort of automatic agent for the Company. The Clerk said that would not do; and if anyone prosecuted, it would have to be Mrs. Leavold. The hirer of the meter then agreed to prosecute; and the lad, pleading guilty, and explaining that he forced the drawer with a pair of scissors, was convicted, and bound over under the First Offenders' Act.

At the Bow Street Police Court, last Friday, before Mr. Lushington, William M'Carthy, aged 33, a journeyman tailor, employed at No. 36, Short's Gardens, W.C., was charged with stealing 13s. 4d. from an automatic gas-meter, the property of The Gaslight and Coke Company. Mr. R. Humphreys prosecuted. He explained that, while the Company had no desire to press the charge, they had instituted this prosecution in the interests of the consumers. It appeared that prisoner slept on a cutting-board in the workroom at Short's Gardens, and that in the same room there was a "penny-in-the-slot" gas-meter. One morning, the prisoner disappeared; and it was found that the meter had been broken open, and the pennies extracted, which amounted, according to the index, to 13s. 4d. Prisoner was seen on one or two occasions by Mrs. Friend, his late employer's wife; but he always ran away. On the previous day, however, she saw him in Cambridge Circus, and, on her information, a police-constable arrested him in St. Martin's Lane. Prisoner, who admitted taking the money, but said he was "very heavy in drink at the time," was sentenced to 14 days' hard labour.

In the JOURNAL for the 10th ult., we reported a case in which John Dowling, a labourer, was charged before Mr. Hopkins, at the Lambeth Police Court, with attempting to steal money from an automatic prepayment gas-meter, the property of the South Metropolitan Gas Company, at No. 274, Camberwell New Road. Prisoner was found in the area of the house; and when asked what he was doing there, he admitted that he was trying to open the meter in order to get out the money. The meter had been wrenched away from the wall; and the gas was escaping. An official of the Company informed his Worship that this class of offence was becoming frequent; four cases having occurred within the previous few weeks. The accused was remanded for inquiries; and on the re-hearing of the case, he was sentenced to three months' imprisonment with hard labour.

A Gadd and Mason Gasholder at Bridgnorth.—Messrs. R. and J. Dempster, Limited, have erected, at a cost of £1750, a two-lift gasholder of 120,000 cubic feet capacity, on the Gadd and Mason principle, at the Bridgnorth Corporation Gas-Works, in place of the existing 50,000 cubic feet holder.

Sunday Labour at the Rochdale Gas-Works.—At the last monthly meeting of the Rochdale Town Council, Mr. Sharp asked the Chairman of the Gas Committee how many persons were employed at the gas-works on Sundays; whether it was an absolute necessity that the men should work then; whether the men so employed were paid extra wages for their work; and how many days' supply the gasholders would contain when full. Alderman Petrie replied that the number of men employed on Sundays varied week by week. At the present time it was increasing; and there were now about 18 hands employed. With reference to their payment, the remuneration was at the rate of time-and-a-half. As to whether they could do without Sunday work at all, he would not say that it was impossible; but he knew it could only be dispensed with at very great inconvenience and expense. They would have to let the fires go down, and considerable damage to the retorts would result. The number of men employed on Sunday was, of course, only a small proportion of the whole of the staff. The answer to the last question put was that the gasholders, when full, contained about two days' supply.

The Public Lighting Question at Bromsgrove.—At the meeting of the Bromsgrove District Council last Wednesday, a letter was read from the Secretary of the Gas Company, stating that after the gross misstatements, insinuations, and insults indulged in by several members of the Council, the Directors could not in self-respect consent to receive the deputation which had been proposed (see *ante*, p. 750). The Directors did not consider such misrepresentations—much too mild a term to apply to the false statements—very conducive to the amicable arrangement the members professed to so much desire. At the same time they were quite willing to take into consideration the supply of gas by meter for the public lamps upon receipt of a definite application and a statement of what was required. Some of the members thought the letter was a great insult. The Chairman said they had tried to approach the Company in as courteous a manner as possible; and he thought the Company had acted in an arbitrary and insulting manner. After some discussion, the Lighting Committee were empowered to at once make experiments with oil-lamps, with a view to their being used as a temporary means of lighting. The present contract with the Company expires on Dec. 31.

MISCELLANEOUS NEWS.

VISIT OF ENGINEERS TO THE SALFORD GAS-WORKS.

The winter session of the Manchester Association of Engineers was opened on Saturday by a visit to the Salford Corporation Gas-Works, which had been kindly thrown open for the inspection of the members. The party, which numbered about sixty, arrived at the works at half-past three, and were received by the Corporation Gas Engineer (Mr. S. Y. Shoubridge), who, with his assistants, conducted them through the various departments; the details of the plant and machinery and the methods adopted in the manufacture of gas being fully explained. Recently considerable extensions have been carried out, and are still in progress at the works; and the visitors had an opportunity of comparing the old methods of gas manufacture with the modern improvements to which they are giving place.

The Salford Gas-Works, which were commenced in 1858, now cover an area of 12½ acres, and are divided into two sections—the Regent Road and the Liverpool Street works. The former were first of all visited. Here there are two retort-houses, containing together 212 through retorts, capable of carbonizing 237 tons of coal, and producing per day 2,370,000 cubic feet of gas. In the larger of the two houses, the work of charging and drawing the retorts is effected by machinery actuated by hydraulic pressure; and the coal passes direct from the trucks into coal-breakers underneath, whence it is elevated and conveyed to the charging-machines by West's conveyors, which tip the coal into hoppers, and from these it is fed into the charging-scoops. This was the first process shown to the visitors; and the average time taken by the machines in drawing and charging was about one minute. It may be added that the hydraulic power for operating the machines is obtained by means of a pair of high-pressure horizontal engines with 12-inch cylinders, having a stroke of 15 inches, and driving two double-acting pumps 6½ to 4½ inches in diameter; the hydraulic pressure required for the machines being 175 lbs. per square inch. The coal breakers and conveyors are driven by two high-pressure horizontal engines with 12-inch cylinders and 18-inch stroke. The visitors were next shown the exhausters—two pairs of horizontal reciprocating engines, each capable of passing 80,000 cubic feet of gas per hour; the condensers, consisting of a series of horizontal pipes 10 inches in diameter, of which a portion is exposed to the air, and the remainder immersed in water; the tower scrubbers; and purifiers, of which there are six, measuring 30 ft. by 30 ft. In this section of the works there are two telescopic gasholders, one, having a diameter of 100 feet, with two lifts, 24 feet each, and a total capacity of 400,000 cubic feet; the other, 150 feet in diameter, with four lifts of 30 feet each, and a total capacity of 2,000,000 cubic feet.

Passing on by a subway to the Liverpool Street works, which are the most modern, and which attracted the chief interest, the visitors were shown the latest developments in gas making that have been adopted by the Salford Corporation. These works have two retort-houses, the first containing 192 ⌂ retorts 20 feet long, 22 inches wide, and 16 inches high, heated by regenerative furnaces, which Mr. Shoubridge explained had been found to work most efficiently and economically. The bulk of coal carbonized in these retorts is 264 tons per day, producing 2,640,000 cubic feet of gas. The coal is supplied for them in railway trucks, which are lifted by two 20-ton hydraulic waggon hoists to elevated railways over the coal-stores; the power being obtained by two pairs of double-acting hydraulic pumps 3⅜ to 2¼ inches in diameter, with 18-inch stroke, driven by horizontal high-pressure steam-engines, with 12-inch cylinders and 18-inch stroke. The second retort-house, which has just been completed, but is at present only partially equipped, has been designed to contain four benches of 72 retorts on the inclined principle. Of the proposed four benches, only one has so far been erected. In this bench, the retorts are set at an angle of 32°. The operation of these retorts was watched with especial interest by the members, and generally most favourably commented upon as representing the correct principle for effecting charging and drawing with the minimum amount of labour. Mr. Shoubridge stated that the retorts had been found to give the most satisfactory results; and he attributed this not only to the inclination at which they had been set, but also to arriving at the correct height at which the coal should be introduced, which was about 4 ft. 8 in. above the mouth of each retort—the machinery being so designed that the charging took place at this height whatever the level of the retort might be. The saving of labour had, he said, been considerable. With regard to the charging-machinery, it may be mentioned that the coal falls from railway trucks into a coal-breaker, and is thence lifted by an elevator into large hoppers placed above the retort-bench; and a smaller hopper, which travels on rails in front of the bench, conveys the coal from the large hopper to the retorts as required. In emptying the retorts, the lid at the lower end is simply opened, and the coke slides out into barrows placed beneath. The coal breaker and elevator are driven by one of Crossley's 14-horse power gas-engines. The retort-house, when completed, will carbonize 400 tons of coal, and produce 4,000,000 cubic feet of gas per day.

The other plant already erected consists of two pairs of rotary gas-exhausters, driven by a high-pressure steam-engine, 16-inch cylinder and 22-inch stroke, capable of passing 200,000 cubic feet of gas per hour. For cooling the gas, there is an annular vertical atmospheric condenser and a vertical tubular water condenser. There are also two rotary washers and four tower scrubbers, 12 feet in diameter and 60 feet high; with six purifiers, 24 feet square. It may be added that the ammoniacal liquor produced at all the works is converted into sulphate of ammonia by means of a Feldmann sulphate apparatus; 14,000 tons of liquid being thus treated last year, and 1250 tons of sulphate made.

After the inspection of the works, which occupied upwards of two hours, the members proceeded to the Grand Hotel, where they partook of tea. During the subsequent proceedings, over which Sir E. Leader Williams presided, the Chairman, after referring to the kind manner in which the members had been received by Mr. Shoubridge, called upon Mr. T. Daniels, the Vice-President, to propose a hearty vote of thanks. Mr. Daniels said he had very great pleasure in responding to the call of the Chairman. He did not know any borough that came in for more criticism than Salford; but he did not think they deserved half the kicks they got. Salford was a thorough go-ahead borough; and those who pushed on in front were sure to be criticized. With regard to the Gas Department, everyone who had visited the works that day could bear testimony to their equipment with the most modern appliances, and to the economical manner in which they were carried on. He, for one, was surprised to find in a gas-works everything in such good order, and the machinery all through so clean, and in such excellent condition. He was sure they could all most heartily support his proposal that the best thanks of the Association be given to the Salford Corporation, and to Mr. Shoubridge and his assistants, for the kindness which had been shown to them during the inspection of the works that day. He might add that Mr. Shoubridge had taken so much trouble in fully explaining all they had seen, that, if any member did not, after his visit, know all about the process of making gas, it would not be due to any fault on the part of Mr. Shoubridge. Mr. E. G. Constantine, in seconding the vote of thanks, said in going through the works, there were one or two points that struck him particularly. One of these was the great degree of cleanliness that existed under such adverse circumstances. Cleanliness in any works paid. It was not only a nice thing in itself, but it was a stimulus to the workmen to be careful in other directions; and therefore it was economical. Another point was the immense production of gas with apparently so few men; and the conditions under which the men worked. A few years back, during the gas strike, they heard a great deal about the dreadful conditions under which gas stokers had to labour. All he could say was that, taking his own experience of the sea, and after observing the condition of labour at the gas-works, he would very much prefer to be a gas stoker than a fireman on a steamship; and if other gas-works were carried out on the same lines, he did not see that the stokers had much to complain of. The vote of thanks having been unanimously passed, Mr. Shoubridge, in briefly responding, said it was a great gratification to know that the members of the Association were so satisfied with what they had seen, and the general condition of the works. He hoped that, from what they had seen, they would be convinced that the gas industry was not in that moribund condition which some people would represent; and that, with modern improvements in the processes of manufacture and with new and improved burners for the consumption of the gas, there was still a long life before it.

INAUGURATION OF THE NEW GAS-WORKS AT SLEAFORD.

On Thursday last, at the invitation of Mr. H. Wimhurst, the Engineer and Manager of the Sleaford Gas Company, a party of gentlemen mainly connected with the gas-works in the district covered by the Association with which Mr. Wimhurst has been for many years identified, met to inaugurate the new works which have recently been completed by Messrs. R. & J. Dempster, Limited, of Manchester, to replace to a large extent those which had become somewhat antiquated at the time of the visit of the Eastern Counties Association to Sleaford in 1892. After light refreshments had been served in the old coal-store, which had been tastefully decorated for the occasion, a tour of inspection was made under Mr. Wimhurst's direction; and before it closed, many were the expressions of praise at the complete and satisfactory manner in which the whole work had been carried out under his supervision.

The new retort-house and coal-store combined are 130 feet long, 36 feet broad, and 20 feet to the eaves. There is a wrought-iron roof, with eleven principals and eight lines of purlins, covered with galvanized corrugated iron, and having an open ventilator extending nearly its whole length. A 12-horse power steel boiler is set at one end of the house. The retort-stacks so far completed consist of four beds of six oval retorts, 10 ft. long by 21 in. by 15 in., arranged to be heated by Winstanley's regenerative system, the subway for which is 7 ft. 6 in. high by 6 ft. wide—being sunk 4 ft. 6 in. below the level of the site, and carried up 8 feet. Six-inch diameter ascension-pipes lead to the wrought-iron hydraulic main, which is in separate sections for each setting, and is fitted with bridge, emptying, and flushing-out valves, connected with a tank over the retort-stack. A 15-inch steel foul-main carries the gas to the condensers; while a 6-inch cast-iron main takes the tar and liquor to the separator. At present there is storage capacity for 700 tons of coal; and the building is conveniently arranged so that, when this space is needed for the extension of the retort-settings, a coal-store can be added at the side of the retort-house. There are two sets of annular cast-iron condensers, 20 feet long by 2 feet diameter, fitted with 12-inch connections and four-way bye-pass valves.

The engine and exhauster house is 25 ft. by 18 ft., covered by an iron roof, lined with varnished matchboarding, and having a tiled floor; a vault being arranged beneath, to afford access to the connections of the exhausters. There are two exhausters so far in position—one of 10,000 cubic feet per hour capacity, driven by a steam-engine, and one of 7000 feet per hour, driven from a countershaft with stepped cones from a 3½-horse power "Otto" gas-engine. The pump-room—10 ft. by 7 ft. 6 in.—is at the side, and contains two pumps; one being for the tar from the underground to the overhead tanks, and the other for raising the liquor into the overhead tank, or for flushing the tank over the retort-stack, or supplying liquor to the scrubber, washer, &c. The washer is of Dempster's improved type, and stands alongside the scrubber, which is 30 feet high by 6 feet diameter, and is fitted with boards and water-distributor.

The gas is then conveyed back to the old purifiers and station meter, which, though sufficient for present requirements, will soon have to be replaced by new and larger plant. A mess-room has been provided for the workmen, of ample accommodation, well ventilated, and fitted with lavatories, bath-room, cooking-stove, &c. The whole of the works' connections are 12 inches diameter, and are fitted with bye-pass valves.

The new gasholder stands in a brick tank 89 ft. by 20 ft., with 18 inches of puddle over the whole of the bottom. The walls of the tank are 2 ft. 7½ in. thick at the bottom, with two sets off to 1 ft. 10½ in.

at the top, with 14-inch inlet and outlet pipes. The gasholder, which is on Gadd and Mason's spiral-guide system, is 85 feet diameter by 20 feet deep; and it is prepared for telescoping at some future time. The present capacity of the holder is about 115,000 cubic feet, which, with the old storage accommodation, brings the total storage capacity up to 180,000 cubic feet, or some 80 per cent. in excess of the present maximum 24 hours' demand.

The tar and liquor tanks are underground; being built in brick and cement, with cement rendering. They are covered with 9-inch brick arches, also built in cement between steel joists of 12 in. by 5 in. section. An 18-inch partition wall divides the tar and liquor tanks. The tar-tank measures 31 ft. 9 in. by 13 ft. by 8 ft. deep; the liquor-tank being 12 feet broader. Above the tanks, built up on 18-inch brick piers, are the overhead tanks for the tar and liquor; each being of 20 tons capacity. They are carried on the piers by steel joists sufficiently high to allow of the residuals being loaded into tanks for placing on rail or to supply local demands.

The whole of the clay for the puddle, and the gravel and sand for the buildings and tanks, were found when excavating for the holder and tar tanks. All the buildings, including the foundations, are constructed in cement concrete; and the floors are covered with blue bricks or tiles. The area of the ground at the disposal of the Company is about two acres; so that there is plenty of room for any extensions that may be required for many years to come.

At the close of the inspection, Mr. Wimhurst's visitors adjourned to the Bristol Arms Hotel, where dinner was served. Mr. Charles Kirk, J.P., Chairman of the Gas Company, presided; and afterwards a short toast-list was gone through. The toast of the "Sleaford Gas Company, Limited," was proposed by Mr. John Carter, of Lincoln, followed by that of the "Health of Mr. Wimhurst," given by Mr. C. W. Grimwood, of Sudbury. Mr. T. E. Priestman responded on behalf of the Contractors (Messrs. R. & J. Dempster). Mr. W. R. Chester, of Nottingham, the President of The Gas Institute, proposed the "Town and Trade of Sleaford," to which Mr. A. Brewitt, J.P., Chairman of the Urban District Council, responded. The toast of the "Visitors," given by Mr. Wimhurst, and replied to by Mr. R. Richmond, of Leighton Buzzard, closed the proceedings.

In connection with the opening of the new works, a supper was given on Saturday to all the employees of the Company and to most of the local men who had been engaged on the extensions. Mr. A. Richdale, one of the Directors, took the chair; and Mr. Charles Smith (another Director) and Mr. Wimhurst the vice-chairs. Music, singing, and toasts were given; and a most enjoyable evening was spent.

LEEDS CORPORATION GAS SUPPLY.

Reduction in the Price of Gas.

At the Meeting of the Leeds City Council last Wednesday—the Mayor (Alderman Gilston) in the chair—the price of gas was under consideration.

Mr. Tweedale moved that the resolution passed in December, 1893, as to the price of gas be rescinded, and that the Council reduce the price to consumers within the city from 2s. 4d. to 2s. 2d. per 1000 cubic feet, and to those outside the city from 3s. to 2s. 10d.; such reduction to take effect on and after Jan. 1, 1896. He said that various corporations, in disposing of the profits derived from the manufacture of gas, adopted different courses. Birmingham, Oldham, Leicester, and some other towns, devoted these profits sometimes to the reduction of the rates and sometimes to street improvements. Leeds, however, considered it only right that the consumers should have the benefit of any profit obtained; and while he thought that sound finance was only just to the consumers, he was opposed to their sailing too near the wind as between profit and loss. As the Council were aware, a deficit had accumulated during the last few years, amounting to £33,000; but they had been able to wipe this off, and to finish the last financial year with a balance in hand of £2500. As it seemed probable that the recent rate of profit would continue, the Gas Committee had considered whether the price to the consumer should not be altered. They had come to the conclusion that it should be reduced 2d. per 1000 cubic feet, and that they would not be justified in recommending any greater reduction. The profit for the first six months of the year had been £13,000; but it must be remembered that this had been used in wiping off the deficit. Then on the past quarter's working, they had had a loss of £2500; and at present the balance in hand was only about £60. Still, they estimated that they would have a profit of £13,000 for the six months ending Dec. 31. If next year's working should follow the lines of this year, they would have at the end a very considerable amount on the right side; and it was the opinion of the Gas Committee that they ought to have a certain sum in hand. They had a capital of a million and a half in the gas undertaking; but they had really no working capital, and no reserve fund against casual contingencies. They had, of course, an exceedingly heavy and expensive overdraft—sometimes amounting to more than £150,000. He asked the Council to support the resolution, as opposed to any further reduction, on various grounds. They wanted a working balance, so that the overdraft might be reduced, and in order that they might be able to make desirable improvements in the plant. They wanted a balance, also, in order that they might be able to meet, if necessary, all contingencies, some of which he hoped were very remote. He thought the Committee had done a good deal of work during the past eighteen months. They had abolished meter-rents, and so conferred a benefit on small consumers, equal to a reduction of 1¼d. per 1000 cubic feet in the revenue of the Committee. They had wiped off a deficiency of £31,000; and at the end of the financial year they had a balance in hand of £2500. He hoped they would not repeat the mistake of previous years, in going too near the line which divided a balance on the right from one on the wrong side. A reduction of 2d. would mean a fall of £18,000 in the revenue, so that they would not have a very large margin on next year's work. In conclusion, Mr. Tweedale referred to the excellent character of the Glasgow Gas-Works, and said that all the modern plant which had been put in there had been paid for out of revenue. He hoped the Leeds Gas Committee would proceed on these lines in future. If they could only succeed in placing the gas undertaking on a sound commercial basis, they would all have cause to congratulate themselves.

Mr. Graham seconded the motion.

Mr. Womersley moved an amendment in favour of making the reduction 1d. per 1000 cubic feet more than was recommended. In support of his contention that such a reduction ought to be made, he stated that the cost of gas in Manchester was 2s. 3d. per 1000 feet; in Bradford, 2s. 3d., with a discount ranging from 2½ to 15 per cent.; in Sunderland, 2s., with a discount ranging from 1d. to 6d.; in Middlesbrough, 2s. 10d., with a discount of 10d. per 1000 feet if paid within the month; in York, 2s. 1d., coming down to 1s. 10d. In Leeds, the price of gas in 1881 was 1s. 10d.; and at this rate it remained for ten years—being raised at the end of that period to 2s. 2d., and in 1894 to the present price of 2s. 4d. As they raised the charge, the number of their customers decreased. When gas was sold at 1s. 10d., they supplied 1000 gas-engines; while now they served only 550. Did not this show that commercial people in the city considered the price too high, and that they were driven to use other means for working their machinery? There were more gas-stoves and lamps being used at present than at any previous period; and the Committee ought to give the public the benefit of a reduction as soon as possible. Last year they dealt with a deficiency of £31,000, the accumulation of several years. Why pay all that off in one year? Why not give their customers the benefit of the increased revenue, in the shape of a reduction such as he proposed, and extend the paying off of the deficiency over a number of years? There were 80,000 gas consumers in the city of Leeds; and by accepting his amendment, the Council would be conferring a benefit on these consumers, while at the same time doing themselves no injustice.

Mr. Battle asked if he was to understand that the overdraft of the Committee at the bank was £150,000.

Several members replied that this was so.

Alderman Boothroyd, the Chairman of the Finance Committee, replied that that Committee had to pay the Gas Committee's bills. It was in this way: The raw material purchased by the Gas Committee had to be paid for; and meanwhile revenue was not coming in. When they came to February, March, and April, the outlay on raw material was low; but the revenue was then coming, and the overdraft was reduced. Still he held that it was an unsound commercial principle not to have sufficient money of their own when it was required.

Alderman Hepworth seconded the amendment, believing that the conditions would permit of a reduction to 2s. 1d. per 1000 cubic feet. He also thought that the exercise of greater economy would enable the Gas Committee to materially reduce its overdraft.

Mr. Lowden criticized the argument advanced by Mr. Womersley; contending that before weight could be attached to the prices of gas elsewhere, they must know all the circumstances in the cases. He held that it would not be prudent to go farther than the Gas Committee proposed to do. They had had disastrous years in the past; and they might have them again. There had been coal strikes and increases of wages; and they might have to contend against these in the future. Taking all the possibilities into consideration, as well as the desirability of putting themselves in a better financial position, he strongly urged the Council to support the Gas Committee, which he held deserved confidence.

Mr. Battle suggested that Mr. Womersley should withdraw his amendment.

Mr. Midgley complained that members of the Gas Committee had not replied to the arguments of Mr. Womersley. For example, they had not made any comparison of the candle power of the gas in the towns where a lower price was charged, with that of the Leeds gas; nor had there been any comparison relating to impurities.

Mr. Gordon, in supporting the resolution, said that the gas when sold at 1s. 10d. did not pay. He would not recommend them to have too much regard to the possibility of another coal strike, or an increase of wages. What was necessary, however, was that they should put the concern, as regarded the overdraft, on a sound commercial basis. Those who advocated a reduction of 3d. should remember that on the 1st of July this year there was no surplus. Assuming that £26,000 was a reasonable estimate of the profit of the concern for the year, a reduction of 2d. would bring the profit down to £8000; whereas, if they took off 3d., they would be £1000 short. Such being the case, he contended that it would not be prudent to do more than give effect to the Committee's proposal.

The amendment was then put, and lost by a large majority.

Alderman Spark moved another amendment, to the effect that it be an instruction to the Gas Committee, before any reduction in the present price was made, to consider the desirability of improving the quality, and report to the next meeting of the Council, or as soon after as possible. He submitted that, by increasing the quality, they would confer a greater benefit upon the consumers than they would do by reducing the price. He could name twenty places where the illuminating power was higher than it was in Leeds; and comparing themselves with themselves, the present quality was considerably below that supplied ten or eleven years ago. Recently the average quality throughout the city was 17·67 candles; in 1883 it was 20·17 candles; and in 1884, 20·40 candles. He asserted that 50,000 cubic feet of 17-candle gas were only equal to 47,500 cubic feet of 18-candle gas. Hence, by increasing the quality by one candle, the consumer would actually save more than he would if he paid 1d. less per 1000 cubic feet; and this was not taking into account the saving from less damage being done by the higher quality of gas.

The amendment was not seconded.

Mr. G. Hirst moved another amendment, that the price of gas charged to consumers outside the city—viz., 3s.—be continued.

This was adopted; and the substantive resolution was then carried by a considerable majority.

With reference to the statement made by Mr. Womersley, as to the number of gas-engines in use in Leeds, and to the falling off in consequence of the high price of gas, Mr. Tweedale sent to the local papers

the next day the following figures, which he could not produce at the meeting, relating to the seven years ending June 30, 1889 to 1895. In the first two years the price was 1s. 10d., in the next three 2s. 2d., in the next 2s. 2d. and 2s. 4d., and in the last 2s. 4d. The number of engines in use in these years was 251, 274, 325, 415, 471, 510, and 591—a gradual rise. "These figures," said Mr. Tweedale, "completely knock the bottom out of Councillor Womersley's arguments." Mr. Womersley has replied to Mr. Tweedale as follows: "My statement as to the number of gas-engines was taken from the following official report, issued to the members of the Council on the occasion of their visit to the gas-works on March 17, 1893: 'There are now upwards of 1000 gas-engines in use within the borough, varying from ⅛th of a horse power to 16-horse power, and on the 30th of June last there were in use 11,050 gas cooking-stoves. (Signed) Peter Gilston, Chairman; James Lupton, Secretary.' 'Official report of the Gas Committee's work: Gas-engines in use on June 30, 1894, 510. The engines range from ⅛ to 60 horse power. January, 1895.—John Tweedale, Chairman.' The Town Clerk, Mr. Townly (the General Superintendent of the Gas Department), and the Chairman of the Gas Committee can testify that the above statements are accurate quotations from the reports. I am informed by Mr. Townly that, while my statement was true according to the report, it is a gross error in fact. So much the worse for official reports. For these I am not responsible; and your readers will, I am sure, acquit me of misrepresentation in the matter. I fear this official error will 'knock the bottom out' of gas reports issued by the Committee."

BRADFORD CORPORATION GAS AND ELECTRICITY SUPPLY.

Financial Statements—The Oil-Gas Controversy—A Personal Explanation.

At the Meeting of the Bradford Town Council last Tuesday—the Mayor (Alderman W. Wood) in the chair—financial statements were presented in regard to the gas and electric lighting undertakings of the Corporation, and reference was made to the controversy now going on with respect to the oil-gas enrichment experiments. It appeared from the minutes of the Gas and Electricity Supply Committee that at their meeting on the 4th inst. the question of the adoption of the oil-gas process again came up for discussion. When Mr. Isaac Smith's amended offer was brought before the Committee a short time ago, the question arose as to what he meant by "the utilization of bye-products;" and he was written to for a further explanation. This he furnished in a letter to the Town Clerk, dated the 3rd inst., in the course of which he said: "To put the matter in a nutshell, what I contemplate is the construction of an improved carburettor, or other simple appliance for the more efficient treatment of the bye-products; and all I ask is that the Committee will provide me with a suitable amount of space at the Thornton Road works and at one of the other gas-works in the town to be selected by themselves. The reason for asking for space at another gas-works is attributable to the fact that the quantity of coal gas produced at the Thornton Road works is not abundant enough to keep pace with the productive capacity for enrichment purposes of the process when associated with the bye-products." He went on to point out that the third clause of his agreement with the Corporation stipulated for a full trial of the process for six months. This, he said, had certainly not been afforded hitherto; and as he was now offering a guaranteed saving on the present cost of enrichment, upon the top of the benefits secured to the Corporation by the agreement itself, he thought the least they could do in return was to fulfil their part of the bargain. After some discussion, the Chairman (Mr. W. C. Dixon), the Vice-Chairman (Mr. Kay), and Mr. J. Hayhurst were appointed a Sub-Committee to meet Mr. Smith, and discuss certain details with him.

Mr. Dixon moved the adoption of the minutes of the Committee. He said a deputation had inspected the gas, electricity, and chemical works, and found them in fairly good working order. With regard to the gas-works, the profits were not so large as he should like to see them, or as they had been in the past; but he thought this fact was explained by the price of coke. Coke made from cannel coal had been almost unsaleable. In the balance-sheet, he had had the gas-works and the chemical works treated separately; so that it might be more clearly seen where the profit was coming from. The accounts of the gas-works for the half year ending December, 1894, showed a profit, after paying interest and sinking fund, of £3842. The cost of lighting and repairing the public lamps for the same period was £10,553. The profit, assuming that the street-lamps were paid for, was £14,395; and the percentage of profit on the amount expended, 2·38. For the half year ending at June last, the net profit, after paying interest and sinking fund, was £1665; this being without taking into account the amount spent on street lighting, which had, of course, been given for the benefit of the ratepayers. The cost of lighting and repairing the street-lamps was £10,558. So that the profit, assuming that the cost of street lighting was paid for, had been £12,223; and the percentage of profit on the amount expended was 2·01. If they took the two half years together, there was an actual net profit for the year of £5507. The cost of street lighting had been £21,111; the profit, after deducting sinking fund and interest, and assuming that street lighting had been paid for, was £26,618; and the percentage of profit for the year on the amount expended on the gas-works was 4·39. The profit on the chemical works for the half year ending in December, 1894, after paying interest and sinking fund, was £2503; while that for the six months ending in June last was £4388—the total for the year being £6891. The percentages of profit on the amount expended on the chemical works were 32·29 for the half year ending December last; 56·62 in the half year ending in June last; and 88·91 for the year. The amount spent on the gas and chemical works up to December, 1894, was £603,925, up to June last, £615,440. The figures regarding the manufacture of sulphate of ammonia could be obtained on analysis of the books. He would only say upon this point that sulphate was put down as being worth £8 17s. 6d. per ton, while last year its value was something like £12 a ton. The price seemed now to be taking a turn upwards; and the Committee hoped this movement would continue. They had commenced to make muriate of ammonia, and had entered into a fairly large contract to supply it. He thought this would be a very satisfactory thing, from the point of view of the Corporation, when they got fairly to work upon it. They had had a large stock of sulphate—200 or 300 tons—for a long time; but by turning it into muriate, they could get a saleable market for it at any time, as far as could be seen at present. With regard to the electricity works, the place had been thrown into some confusion by the necessity for the re-arrangement of pipes and boilers. The new boilers the Committee had had put in were not yet working satisfactorily. They were now doing all the Committee could make them do. But the Contractors had not yet fulfilled their obligations; and the Town Clerk had the matter in hand. The new engines, which were ordered nearly a year ago, had not arrived; and, as Christmas would soon be here, it seemed to him that the Committee were again going to be landed in a difficulty through not having the necessary power to supply the quantity of electricity required. At a meeting held a fortnight ago, they had absolutely to refuse seven or eight customers, for the simple reason that they had no guarantee that the new boilers would be in sufficiently good working order, and that the new engines would arrive. The electricity balance-sheet for the year 1894 showed that the capital outlay had been £58,717; the income, £10,822; the expenditure, £5203; the trade profit, £5619; the amount of interest and sinking fund repaid, £3480; and the net profit, £2139. The percentage on capital represented by the trade profit was 9·57; and that represented by the net profit, after taking off sinking fund and interest, and allowing 5 per cent. for depreciation, was 3·64 for the year. The figures taken out for the six months ending in June last were as follows: Capital outlay, £67,111; income, £6185; expenditure, £3009; trade profit, £3176; interest and sinking fund repaid, £2190; net profit, £986; percentage on capital of trade profit, 4·73; percentage on capital of net profit, 1·47. Taken in the same ratio, the percentages on capital for the twelve months ended June 30 were 9·46 for trade profit and 2·94 for net profit. These works had fully justified Alderman Priestman's prognostications that they would be a success; and he thought that there was a great future before them.

Mr. T. Speight seconded the motion.

Mr. J. Cowgill said he should like to know from Mr. Dixon whether he was in any way interested in the oxy-oil process—better known as the Huddersfield process; and, if he was not, whether his wife or any other member of his family was, either directly or indirectly.

Alderman Edhousie: Is the oil-gas question on the minutes?

The Mayor: I do not think Mr. Dixon need answer the question unless he pleases. It is not referred to in the minutes; and it seems to me a personal matter which does not concern the Council.

Alderman F. Priestman asked if he was right in supposing that the Chairman of the Gas Committee meant to say that the profits of the gas and chemical works were put together in order to arrive at the net profits of the entire undertaking; and he also wished to know upon what basis the ammoniacal liquor was charged to the chemical works. He observed that it depended upon what charge was made for the liquor whether or not a profit was realized.

Mr. Dixon said his answer to Mr. Cowgill's question was that the statement was absolutely untrue. He felt these suggestions very much, because, whatever anyone might say, neither he nor any relation of his had any interest in the oxy-oil process. If he said that most of them did not know the name of the Company, he should not be far wrong. He hoped it would be understood once for all that he had no interest, direct or indirect, either himself or through his family or relations, in the process. Whatever they might think of his views, he hoped they would credit him with being sincere; and this being so, he did not care what became of the matter. With reference to Alderman Priestman's question, he might state that the cost of the ammoniacal liquor was charged at the present market rate—7s. 9d. per ton, instead of 8s. 3d., the price of it last year. The gas-works were now charged with everything they got in the shape of liquor. This was not the method formerly adopted. In previous times, a larger profit had been shown on the gas-works because the liquor had been treated as if it was obtained for nothing. Now it was charged for just as it would be to anybody else.

Alderman Priestman said his question had not been answered. He wished to know whether, to get at the profits of the whole of the undertaking, the profits of the gas-works and those of the chemical works were added together.

Mr. Dixon: The net profits of the gas-works are not added to those of the chemical works. They are entirely separate.

The minutes were then adopted.

The Gas Question in Dublin.—At the meeting of the Dublin Corporation on Monday last week, Mr. Buckley moved—"That timely steps be taken to promote in the ensuing session of Parliament an Improvement Bill, to revise the high price of gas in Dublin, and to provide proper stations and instruments for testing the illuminating power and purity of the gas supplied by the undertakers to the public and the citizens; and that, if need be, a separate Bill in this connection be lodged." The Lord Mayor suggested that the whole question could be considered on a motion which he had on paper for the appointment of a Committee of the whole House to consider what Improvement Bill they should promote this year. Mr. Buckley said he should like to discuss the question on his own motion. The price of gas in 1889 was 3s. 4d. per 1000 cubic feet; but in 1890 the Company raised it to 3s. 7d. When they did so, they publicly assigned the reason to be the increased wages of their men. When a good reason was wanted for anything, it was always well to fall back on the labour vote—the horny-handed sons of toil. The poorest man in Dublin, if he met with a temporary loss, would take it out of his reserve fund. The Lord Mayor urged that the discussion should be postponed until after the Committee met. Mr. Buckley's motion was put and carried; and, on the motion of the Lord Mayor, a Committee was appointed to consider and report to the Council what portions of the Bill promoted by the Corporation last year should be now proceeded with, or what other legislation was required.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

Further correspondence on the above subject has appeared in the *Bradford Observer;* among the letters being one from the Secretary of the Northern Counties Hydro-Oxygen Gas Company, Limited—Mr. J. E. Gresty—dated Oct. 4, in reply to that of Mr. W. W. Shaw which was given in the JOURNAL a fortnight ago (p. 681). Mr. Gresty takes up the various points raised by Mr. Shaw as follows:—

Price of Oil.—Mr. Shaw states that oil used by our process costs £3 10s. per ton, while actually oil has been purchased for some time now at £3 per ton. A little lower down in the same column he goes on to say: "It is impossible to bring the Huddersfield process into comparison, as no independent figures are available, and we have only the interested statements of the owners and officials to refer to." He further states: "Doubts are expressed whether the proprietors of the Peebles process would not step in to prevent its general adoption. Efforts to introduce it at Halifax have failed."

After stating all this, he quotes a figure which he has taken from a paper read by Mr. W. R. Herring (who is the Huddersfield Corporation Gas Engineer), before the Incorporated Institution of Gas Engineers, on May 10, 1894,* the contents of which we were totally ignorant of until they were made public by the technical journals. The figure referred to is the cost per candle enrichment per 1000 cubic feet at the Huddersfield Gas-Works; and this was stated by Mr. Herring at the time to be 0·52d. This item covers cost of oil, cost of oxygen, working of plant, interest on capital, wear and tear, royalty, &c.; and there is nothing whatever to add to same. When this paper was read, oil was £3 7s. 6d. per ton; and as oil can now be purchased at £3 per ton, and there have been several alterations in the plant, the enrichment now works out considerably lower than as stated above.

With regard to his remarks *re* the Peebles proprietors stepping in to prevent the general adoption of our process, this they cannot do, as our process was in front of the public before Peebles was in the market. There is also no similarity between the two processes, and the proprietors of the Peebles process have never intimated that they had any objection whatever to our patents or process.

Referring to his statement that efforts to introduce our process at Halifax have failed, how does he know they have failed? One is more than justified in asking why the Dvorkovitz process was discarded at Birmingham after a lengthy trial there, and why it has not been adopted in Mr. Shaw's native town of Rochdale, and why all the advantages of the process are thrust upon Bradford.

It is altogether wrong of Mr. Shaw to say that we should require £4687 10s. per annum in royalties for enriching the whole output of Bradford 2 candles; and in reply to this, and to certain other statements which have appeared in your editorial remarks, we would point out that the actual offer we made to the Bradford Corporation in August, 1894, was an alternative one. First, that we would at our own cost put down a sufficient plant at one of their stations, and work the same at our cost in all respects, in consideration of the Corporation paying to us one-half the saving effected, and we estimated that at the Valley Road works such half would amount to £1562 10s. per annum. This figure Mr. Shaw quotes as though it were a royalty, whereas it was merely an estimate of one-half of the profit; and to gain this, we were prepared to run all the risk and cost of construction and working. Our alternative offer was that a royalty should be paid to us; and this royalty, for enriching the whole output of the borough 2 candles, would not amount to more than £450 per annum—a sum widely different from the £4687 10s. which Mr. Shaw states.

In saying independent figures are not available with regard to our process, Mr. Shaw has also, apart from Mr. Herring's paper, conveniently forgotten the paper read by Dr. L. T. Thorne, Ph.D., F.I.C., F.C.S., &c., before the Southern District Association of Gas Engineers, on Nov. 23, 1893.†

Mr. Isaac Smith's Offer.—Of course, the Dvorkovitz process is to be given to the Bradford Corporation; but surely your ratepayers are not to be so easily gulled. It is merely a sprat to catch a whale. Why have a thing given which is dear at a gift? I do not suppose the Bradford Corporation want to go begging. Is it better to buy oil at £4 per ton, and get 17,000 cubic feet of gas from same and 30 per cent. of bye-products, worth 1·71d. per gallon, which when worked out amounts to the following:—

One ton of oil, say—252 gallons	£4	0	0
Less 30 per cent. bye-products, 75·6 gallons, at 1·71d. per gallon	0	10	9
	£3	9	3

—*i.e.*, 17,000 cubic feet of gas of 82 candles (enriching value) for £3 9s. 3d.—or to pay £3 7s. 6d. per ton for oil, inclusive of all charges, and get 27,000 cubic feet of gas of a superior enriching value; or, to put it plainer, 10,000 cubic feet more gas of a better quality for 1s. 9d. less?

Comparison between the Dvorkovitz Process and the Oxy-Oil Gas Process.—According to Messrs. T. Newbigging and Son's report, it would require 2000 tons of oil to enrich the whole output of the borough 2 candles by the Dvorkovitz process. By the oxy-oil gas process, it would require 1000 tons of oil, or probably less.

Cost by Dvorkovitz Process for Oil Alone.

2000 tons of oil, at £4 per ton	£8000
Less 30 p. c. bye-products, at 1·71d. per gallon (about)	1186
Cost of oil by Dvorkovitz process, allowing for bye-products	£6814

Cost of Oil and Oxygen by Oxy-Oil Gas Process.

Cost of 1000 tons of oil at £3 7s. 6d. per ton (this price includes all royalty charges on both oil and oxygen)	3375
Difference	£3439
Saving effected by the oxy-oil gas process over the Dvorkovitz process on oil alone	£3439

* See JOURNAL, Vol. LXIII., p. 1054. † *Ibid.*, Vol. LXII., p. 982.

As shown by the above figures, the statement made by Mr. Shaw that the Dvorkovitz process will save twice as much as the oxy-oil gas process is altogether wrong, and should read: "The oxy-oil gas process will save twice as much as the Dvorkovitz process."

I defy Mr. Shaw to prove that we have ever quoted any delusive figures, as stated by him, and have only to refer him to the two papers previously mentioned, in which perfectly fair and independent figures are obtainable. It goes without saying that Mr. Shaw, in championing the Dvorkovitz process, is at the same time grinding his own axe.

Mr. W. W. Shaw has addressed a long letter to the *Bradford Observer* in reply to Mr. Gresty, of which the following is an epitome:—

Dealing first with the price of oil, Mr. Shaw says: "Will Mr. Gresty be good enough to inquire at the Huddersfield Town Hall, for the benefit of your readers, whether it is or is not the fact that their contract for oil at £3 per ton was made twelve months ago, and has only six months more to run? Will he also write to the sellers, and ask whether they would supply the same oil to-day below my figure of £3 10s. per ton, and publish the reply in your columns?" Coming to the Company's offer to Bradford, Mr. Shaw says: "Compare Mr. Gresty's specious assertions respecting his Company's offer to Bradford with the Gas Engineer's report thereon made at the time. It runs thus: 'The Company to work the plant for five years, and the Corporation to pay them one-half the saving in cost of enrichment, calculated upon a basis of 1½d. per candle per 1000 cubic feet. This is a very different offer to the present arrangement, under which the system of Dr. Dvorkovitz is being tested at the Thornton Road works. If the offer of the Huddersfield Company should be accepted, and plant erected either at Birkshall or Valley Road, we could enrich about one-third of our total year's make of gas, or about 500 million cubic feet per year. According to the estimate of the said Company, we should save upon this basis in enrichment one-third of £20,149, or £6716 per annum, according to their showing, of which amount they propose that we should pay them one-half, or (say) £3358. This would amount to £16,790 in the five years, which I think you will agree would be a very good return for an outlay on their part of £4000. This payment of £3358 per annum being for only one of the three gas-works in Bradford, does Mr. Gresty still contend that my estimate of an annual payment of £4687 10s. for all three is an exaggerated one? In the alternative offer of the Huddersfield Company, when Mr. Gresty puts the payment for royalty at £450 per annum, he conveniently forgets to mention that, before that scale could come into force, the Bradford Corporation would have been obliged to buy his Company's oil plant at a cost for the Valley Road works alone of £4000, or (say) £12,000 for all three." The next point dealt with is the comparison between the Dvorkovitz and oxy-oil gas processes, on which Mr. Shaw says: "Any result may be shown by adapting figures to desired rather than justifiable results. Instead of taking the bye-products at the fallacious estimate of 1·71d. per gallon, why does he [Mr. Gresty] ignore what I said in my letter of the 21st ult. (to which he is professing to reply), in these words: 'We are, however, prepared to give double that amount (say, 3½d. per gallon); and on that basis the cost of enrichment would be only two-fifths of a penny.' His figure of 2000 tons of oil for annual consumption by the Dvorkovitz process is still more ridiculous, and exists only in his own imagination. Half the quantity would be much nearer the mark. With the bye-products taken at 3½d. per gallon, and at the ascertained percentage of 38 per cent., as against Mr. Gresty's imaginary one of 30 per cent., the cost per ton of oil (as shown in my letter) settles down from his convenient figure of £3 9s. 3d. to the actual one of £2 14s. per ton. Tested by actual facts, Mr. Gresty's carefully-devised structure rapidly crumbles away; and I maintain that the figures I gave in my letter of the 21st ult. stand unshaken, and the saving then shown, over cost of cannel enrichment, of the Dvorkovitz process, £10,500, against the oxy-oil process, £4687 10s., a difference in favour of Dvorkovitz of £5812 10s., holds good to-day. I still adhere to the accuracy of this result. It is a conspicuous fault that Mr. Gresty's figures do not include anything for oxygen, though his heading reads 'Cost of Oil and Oxygen.'" As to Mr. Smith's offer, Mr. Shaw says: "Bradford people know enough of Mr. Smith to appreciate the sufficiency of his guarantee; and in accepting his offer, they will not be committed to the expenditure of a single penny until the result of the process has been doubly confirmed by continuous six months' working, and then only to the bare cost of the plant, which will not exceed the guaranteed saving." Mr. Shaw concludes as follows: "In spite of all Mr. Gresty can say or do, it remains an incontrovertible fact that, after three or four years' trial at the expense of the Huddersfield rates, no gas engineer of acknowledged reputation outside that town believes in his Company's process; nor has any other gas producer in the kingdom adopted it. Paris tried forty years ago to mingle oxygen with gas, and failed."

Mr. Wright has replied to Messrs. Newbigging as follows:—

To W. C. DIXON, Esq., Bradford. *Oct.* 8, 1895.

Dear Sir,—In their letter of the 2nd of October [see *ante*, p. 740], Messrs. Newbigging sagely remark that in a controversy of this kind the resort to personalities should have been avoided. This comes very well from the people who commenced an offensive and personal attack upon me in a letter published in the *Bradford Observer* of the 10th of September, and circulated in leaflet form on that day—a letter that was similar in character to that of Mr. Wood, published in the same journal on the 5th of September—a letter that opened with an insinuation that I had fabricated my actual working experience—an insinuation unworthy (well, I will say) of experts, and contained a serious accusation that I shall have no difficulty in proving to be untrue. They now deprecate the use of personalities. Are they frightened of mine? I shall have but little need of this weapon, on which they apparently depend. As a proof of their sincerity, they go on using it to the end of their letter.

They know quite well that I have not abandoned any single detail of my cannel analysis and estimate—that is only their way of conducting a controversy that they, with Mr. Wood, have opened; for they go on to remark that I have the temerity to say that it is not possible to

affect it by one-hundredth part of a penny. I wrote that they could not *increase* it; and I have shown that those who adopt Mr. Wood's figures must *decrease* it. Every pitfall into which Mr. C. Wood stumbles becomes a receptacle for Messrs. Newbigging, since they immediately plunge in after him.

The revenue from ammonia products we are told includes profit on sulphuric acid and other things. But if the coal contained no ammonia, there would be no profit from this acid and other things; and even if the profit had been separately stated, the profit would have been revenue due to the use of coals yielding ammonia, and would have been included in the estimate as a deduction from the working expenses. That was a lame excuse.

With the inaccuracy of statement that characterizes them, they speak of my arrangement with them about the suppression of the carburettor tests. Mr. Newbigging, sen., was not present at those tests; and I have never seen him since. If it is Mr. Newbigging, jun., who is speaking, would it not be better for him to drop the editorial "we," and reveal himself as Mr. Charles Wood has now done?

They say that the carburettor is no part of the Dvorkovitz process. That is a question I cannot express an opinion about. Mr. Shaw thinks as they do; but the inventor had another opinion. That is a question they should settle with Mr. Wood and the inventor before rushing into print. My test with the carburettor was a good one, and favourable to the process; it gave 1550 candles to the gallon of tar oil evaporated. The test made at the request of Mr. Newbigging, jun., gave about 130 candles per gallon of tar used. This result I did not use—not because of any arrangement, but because I had a better one that was more favourable to the process, and one that I do not think could be very much exceeded, even if the objectionable features of the carburettor were removed. If Mr. Newbigging, jun., thought that my result was still unfavourable, after he had seen the disastrous result of the trial made according to his ideas, why, I ask, did he let me go away without requiring another? My own opinion was (but it is not founded upon more than an impression) that he had had quite enough of experiments tried on his plans.

They want to know why I took cannel (23 candles enriching) at 13s. per ton. I have written a letter giving the reason—one in reply to Mr. Wood's of the 3rd of September, dated the 21st of that month [*ante*, p. 683]. Why do they ask me to repeat the reason? Do they think that if I give the reason a second time, it will not accord with the first, and that I shall follow their example about the price of the oil? It would be much better for them not to invoke personal qualities, high or low, until this business is so developed that one can judge which they possess. They have attacked me in a very personal manner after I had, on the 3rd of July, spared them from the affront of being excluded from the Thornton Road Gas-Works, after I had arranged for the legitimate presence of Mr. Newbigging at the second trial, and after I had given them every facility to conduct their operations at the same time that they watched my own, and take copies of every test I made.

That part of their letter relating to the charge they have brought against me of being the cause (they now say proximate cause), I shall not further discuss with them. The letters I am now sending for publication will, with the other facts of the case, be a sufficient answer for them. I am waiting for an answer to the questions that I have put to them; and I hope they will not forget to explain that remark about the many high-class cannels.—Yours, &c.,

(Signed) LEWIS T. WRIGHT.

GAS-WORKS EXTENSIONS AT HINDLEY.

Local Government Board Inquiry.

An inquiry has been held at Hindley, by Mr. G. W. WILLCOCKS, relative to an application to the Local Government Board by the District Council for sanction to borrow a sum of £13,500 for gas-works purposes.

The CLERK (Mr. S. Holt), in support of the application, stated that while in the year ending March, 1889, the number of consumers of gas was 1022, and the gas sold was 22,865,100 cubic feet, in the year ending March last the number of consumers was 1693, and the quantity of gas sold was 44,557,200 cubic feet. This showed an increase in the quantity of gas sold during the past six years of above 94 per cent. The capital authorized to be borrowed under the Hindley Local Board Act of 1872, was £40,000; and by their Act of 1875, a further sum of £30,000 was authorized to be borrowed with the consent of the Local Government Board. Of this latter sum, the Board had consented to the borrowing of £12,500, £1550, £450, £1000, and £1000—a total of £16,500, which made the total sanctioned and borrowed £56,500. The expenditure on capital account up to March 25, 1889, was £52,091; and there had been spent up to March 31 last the sum of £55,914. During the current year, a further £324 had been expended; bringing the total to £56,238, which left the Board with £262 unexpended. The price of gas in 1888 was reduced from 4s. to 3s. 4d. per 1000 cubic feet, and further to 2s. 11d. from March last; leaving the net price to large consumers at 2s. 4d., and to small consumers at 2s. 7½d. The large reduction in the price had induced people to become consumers; and the additional plant for which the money was asked had become absolutely necessary, in order that a proper supply of gas might be kept up in the district. From 1893 to 1894, the net profit on the gas-works was £338, out of which a reserve fund was formed to meet current expenses. In 1894-5, the profits rose to £1250; and since then the price of gas had been reduced.

Mr. *W. Dickinson*, the Manager of the gas-works, submitted a statement showing the necessity for the proposed extensions. The make of gas in the year ending March, 1889, was 24¾ million cubic feet; and in 1894-5, 46 million cubic feet. This was an increase in six years of 86 per cent. The maximum output of gas in 24 hours in 1889 was 142,000 cubic feet, and in 1895 it was 550,000 cubic feet; whereas the capacity of the present holders was only 150,000 cubic feet, or twelve hours' consumption. The exhausters were of ancient design, and incapable of passing the quantity of gas made. The purifiers were four in number, and designed to deal with about 26 million cubic feet per annum; whereas the quantity treated last year was 46 millions. The proposed extensions were as follows: Rotary exhausters (in duplicate) to pass 20,000 cubic feet per hour each. Two steel boilers to work at 80 lbs. pressure, and tested up to 150 lbs. A Livesey washer to assist the scrubber, capable of dealing with 500,000 cubic feet per day. Four new purifiers to treat 600,000 cubic feet per day, roofed over and cased in suitable brick building. A station meter to pass 20,000 cubic feet per hour, also a meter-house. A new tank and holder, with a capacity of 366,000 cubic feet, which, together with the present holders, would make a total of 516,000 cubic feet, or double the present output per day. A new governor to replace the present one, which was too small. Tar and liquor wells of increased capacity. The scheme also provided for the equipment of workshops; and for a weighing-machine, house, office, and store-room. Mr. Dickinson added that the Council supplied gas to Abram, which was a rapidly increasing place, and also to parts of Ince and Aspull.

There were no objections to the scheme.

ELECTRIC LIGHTING NOTES.

There was a lengthy discussion at the last monthly meeting of the Wigan Town Council in regard to a proposal for the establishment of the electric light in the town. A Sub-Committee appointed to consider the question presented a voluminous report recommending the adoption of the new light by the Corporation. Several members opposed the scheme, which is estimated to involve an expenditure of £16,000; while others suggested the calling in of a specialist before anything definite was done. But the majority of the members were in favour of the project being proceeded with under the direction of the Gas Engineer and the Borough Engineer. An amendment, to the effect that an expert be called in, was lost by 18 votes to 3; and a further amendment, that the scheme be not proceeded with, was also defeated—6 voting for, and 17 against it. The minutes and recommendation of the Committee were then approved.

The electric lighting fever has attacked certain parties in the town of Eccles, in Lancashire; and the worthy councillors were exercised on the subject at their monthly meeting on Monday last week. A Committee had been instructed to obtain tenders for a scheme of lighting; and these were submitted on the 1st inst. They provided for the lighting of the whole of the street-lamps at present lighted by gas, and for such an amount of private lighting as the Committee considered at present advisable, and fulfilling the obligations the Council were under pursuant to their Electric Lighting Provisional Order. The tenders were for amounts which showed that the whole of the works, including buildings, &c., and adding 10 per cent. for legal charges and contingencies, could be carried out for £18,761, or £210 below the Engineer's estimate, which was £18,971. The Committee resolved that the Council should be recommended to accept the tender of the Manchester Edison-Swan Company, Limited, for £13,792, subject to the Local Government Board granting borrowing powers adequate to the carrying out of the whole scheme. A further resolution of the Committee recommended that application be made to the Board for power to borrow £20,000 for the purpose. Alderman Kendall, in moving the confirmation of the Committee's proceedings, said he thought the carrying out of the scheme would be to the best interest of the district. Mr. F. Oldfield seconded the motion. Mr. F. Smith moved, as an amendment, that the acceptance of the tender be deferred. He said there would certainly be five members of the Council who would not return after November, as they did not intend to seek re-election; and the matter of the electric lighting of the borough was one of such magnitude that it should be deferred until the new Council—who would have the carrying out of the work, and who would be responsible for it—were elected. There was no doubt that gentlemen would join the Council who would be pledged to oppose the letting of the contract. If they passed the resolution now, and the scheme should not turn out as the Committee expected, the new members of the Council would be able to say that they had had nothing to do with it. At the present juncture, they should not rush the contract through in what appeared to him to be indecent haste. Mr. W. Oldham seconded the amendment, and quoted a number of towns where, he said, electric lighting had not proved to be profitable or successful. They had been told that, unless the Corporation undertook the work, a company would come in and take it out of their hands; but he was convinced that no company would come into Eccles unless they were given the lighting of the streets. Alderman Spary said they were at a critical period in connection with Corporation matters; and it behoved them to be careful. He thought it would be a mistake to introduce the electric light into Eccles now. In five or six years' time, they would know a great deal more about it; and it could then be adopted with much greater advantage. Alderman Kendall, in reply, said he was rather astonished at the force of the opposition. There was no desire for unseemly haste on the part of the Committee. If their recommendation were rejected, the responsibility would not lie with them. But the Local Government Board would not grant a further extension of their Provisional Order. On a division, the amendment was carried by a majority of one.

We mentioned last week that the Swansea County Council had, by a majority of one, decided to adopt a scheme of electric lighting; and at the same time we ventured to express the opinion that the decision would be challenged, there being eleven members of the Corporation absent. There is a local feeling, which finds expression in the *Cambrian*, that no unseemly haste should be displayed in pushing on with the project until it has been submitted to the judgment of a larger and more representative meeting. Our contemporary does not doubt for a moment that those who brought forward the matter in the Council "are perfectly sincere in believing that the scheme is destined to benefit the town; but, on the other hand, there are people who are equally sincere in the conviction—and some of them speak with far greater knowledge and experience—that it is likely to prove a costly experiment. To assert for a moment that electric lighting in Swansea

'is expected to become a lucrative monopoly in a very short time,' is—well, the height of optimism, to use the mildest possible term." Our contemporary considers there is little to recommend the scheme to Swansea; and whether or not it is eventually carried out, the Corporation have to face the ominous fact that many of the largest firms have already abandoned electricity in favour of a cheaper, if not of a better, illuminant.

The Electric Lighting Committee of the Islington Vestry have found it necessary to apply to the Vestry for £25,000 in addition to the £60,000 already sanctioned for electric works in the parish. The increase seems to be the result of under-estimates, together with the acquisition of more property for the station. The Committee report that machinery working to the extent of 1000-horse power, and capable of serving 11,000 incandescent lights of 8-candle power each, or their equivalent, and 100 arc lamps for street lighting, is now being erected at the station, which, it is said, will, with very slight alterations, afford sufficient accommodation for further machinery equal to between 3000 and 4000 horse power. The necessary works and appliances for lighting the leading thoroughfares of the parish are rapidly approaching completion.

Last Wednesday, the ceremony of installing the electric light in Tunbridge Wells was performed by the Mayoress (Lady Salomons), in the presence of a large company. The Consulting Engineer of the Corporation (Mr. W. H. Preece) at first recommended an outlay of £25,000; but the Town Council decided to ask for £13,000 only. This has proved insufficient; and a further outlay of £12,000 has now been sanctioned. The charge made to consumers is 6d. per unit.

Dr. J. A. Fleming has presented a voluminous report to the Plymouth Corporation on the subject of electric lighting of the town, and the adoption of electricity as a mode of traction for the tramways, which are owned and worked by the Corporation. With reference to the electric light, he recommends the adoption of the alternating current system with transformer sub-stations, and with either separate dynamos or the use of rectifiers for supplying current for arc lighting in the streets and public buildings. He approves of the proposed site of the station, which is on the banks of the Cattewater, and to which coal may be delivered direct either by rail or water. The buildings should, he suggests, be designed for an ultimate output equal to 30,000 8-candle power lamps; but he advises that at first only one-third of the buildings should be erected, and provision made for generating plant to supply 7500 lamps of 8-candle power operated at once, or 10,000 lamps connected to the mains. The cheapness of gas in Plymouth will, he thinks, retard the use of electricity for power; and he therefore recommends the Corporation not to furnish a day supply of the current, but to make it a dusk-to-dawn service. He advises them to charge 8d. per unit for the supply to all lamps which burn one hour or less per day, and 4d. per unit for all units supplied over one hour per day. He estimates the capital outlay at £80 per kilowatt; and providing for a capacity of 400 kilowatts, and adding £3000 to cover contingencies, he calculates that the Corporation will have to expend £35,000 upon the works now recommended. The probable revenue will be about £5000 a year, and the whole operating cost within £3500; leaving £1500 to pay the share of sinking fund and interest. This estimate does not include the cost of street lighting, which Dr. Fleming puts at £7260, which will provide for 90 arc lamps of 300-watt power, sufficient to replace the gas-lamps over a street-run of at least 12,000 feet, and probably over three miles. The gross revenue for the public and private lighting he estimates at £7000 per annum; and the balance at £1950 to meet the interest on the loan. A suggestion that a refuse destructor should be erected and the heat employed to raise steam for the generation of electricity is not favoured by Dr. Fleming, who says that the greatest caution is necessary in accepting many of the statements which have been made on this subject. In order to provide the current for the incandescent lighting which he proposes, 500 or 600 horse power must be available at the time of maximum load; and the direct heat from a destructor would not probably amount to more than 50 to 60 horse power. He advises an experimental trial of electric traction by overhead conductors on one branch of the tramway system; but he says a separate system of generating-machines should be provided, and that those for the electric lighting should be used for that purpose only. The Electric Lighting Committee recommend the Council to authorize them to visit some of the towns where electric lighting is in successful operation before coming to a decision upon the subject-matter of the report.

We have on a previous occasion (*ante*, p. 352) alluded to the decision come to by the Wimbledon District Council to adopt electric lighting, and to apply to the Local Government Board for power to raise the necessary money—£32,000 is the amount specified—for the purpose. We presume the action of the Council has not yet been formally sanctioned by the ratepayers; for we find that one of them has shown sufficient public spirit to "circularize" his fellows with the view of putting them on the alert to prevent the introduction of what he calls a "treacherous and costly scheme." According to the published report of a year's working of the Parish Council, the existing oil-lamps, of 8-candle power, cost only £2 11s. 6d. each per annum. The ratepayer ventures to question the accuracy of this sum, as no detailed figures are given. But assuming it is correct, why should the lamps be thrown out of use, and replaced by electric light of the same, or even less, illuminating power at double or treble the cost? The ratepayer very pertinently remarks: "If any change is desirable, and at this date necessary, would it not be cheaper, cleaner, and more satisfactory to have gas in the lamps, with burners that would give 16 to 40 candle power, at (say) £4 or £4 4s. per lamp? Gas would give a better light than the dirty oil, or the uncertain, unreliable, flickering, and expensive electric light." He finds, as do the householders in other districts, that the rates are at present quite heavy enough, and that the tendency is not to decrease. Why, then, add to the existing burden by indulgence in a luxury which would not be of the slightest benefit to the majority of the ratepaying population? Among these are the Gas Company, who are possibly the largest ratepayers, and are surely entitled to some consideration when discussing such a question as this. If their rating is increased by the introduction of an expensive (and unnecessary, as we venture to think) scheme of lighting, how can the large body of gas consumers reasonably expect to get a reduction in price? Why not approach the Company, and see what they can do with—or even without—incandescent burners.

In Monte Video, the capital city of Uruguay, the electric light appears to be in a bad way. Three rather serious interruptions were reported in the month of July last, and two in August; while the *Monte Video Times* of the 13th ult. thus refers to the latest, which had just then occurred: "A most unfortunate *contretemps* occurred to mar the brilliancy and success of the 'Cinderella' dance held in the Exhibition Pavilion on Wednesday evening. Dancing to the strains of a capital orchestra, conducted by Sr. Formentini, had barely commenced when, just about 9.30 p.m., the electric light went out, and all efforts to restore it were ineffectual until past midnight, when it once again blazed forth, only to disappear abruptly at 2 a.m., giving a rather premature signal for the dispersion of the visitors. Dancing, in the meanwhile, was carried on to the light of such kerosene lamps and candles as could be procured at so short a notice. But it may easily be imagined that this improvised illumination deprived the scene of much of its brilliancy and animation, though it cannot be said that the dancers seemed to enjoy themselves any the less. Another unfortunate result was that many families who arrived immediately after the electric light went out, finding the place almost in darkness, turned home again; thus considerably diminishing the attendance."

METROPOLIS GAS SUPPLY.

Dr. Williamson's Quarterly Report.

The following is an extract from the report of Dr. A. W. Williamson, F.R.S., the Chief Gas Examiner for the Metropolis, on the quality of the gas supplied during the quarter ended the 30th ult.:—

I. *With respect to Illuminating Power.*—The average in standard sperm candles at each of the testing-stations was as follows:—

The Gaslight and Coke Company—	
106, Fenchurch Street, E.C.	16·6
10, Kinghorn Street, E.C.	16·6
1, Dorset Buildings, E.C.	16·6
21, Millbank Street, S.W.	16·5
123, Ladbroke Grove, W.	16·4
3, Vincent Terrace, N.	16·4
1, Carlyle Square, S.W.	16·3
170, Camden Street, N.W.	16·3
14a, Graham Road, Dalston	16·6
47, Kingsland Road, E.	16·7
Spring Gardens, Charing Cross	16·3
1, Vinery Villas, North Bank	16·2
116, Lambeth Road, S.E.	16·2
121, Hornsey Road, N.	16·5
66, George Street, N.W.	16·5
Commercial Gas Company—	
6, Wellclose Square, E.	16·3
24, Parnell Road, E.	16·3
South Metropolitan Gas Company—	
104, Hill Street, Peckham, S.E.	16·7
37, Bedford Road, S.W.	16·2
1, Stoney Lane, Tooley Street	16·8
180, Lewisham Road, S.E.	16·4
99, Blackfriars Road, S.E.	16·6
211, Burrage Road, S.E.	16·4

It will be seen that the average illuminating power at all the stations was higher than the parliamentary standard of 16 candles.

II. *As regards Purity.*—Sulphuretted hydrogen was not present in the gas at any of the stations. The average amount of sulphur in other forms than this was considerably less than the limit allowed at all the stations. Excesses of sulphur were reported during the quarter in the gas tested at the George Street, Stoney Lane, Parnell Road, Hill Street, and Blackfriars Road stations. Ammonia was generally present in the gas more or less frequently during the quarter at all the stations, but only in slight quantities. The limit allowed was not exceeded on any occasion.

Georgetown (British Guiana) Gas Company, Limited.—The accounts of this Company for the half year to June 30 show an income of £2434, and an expenditure of £2135—leaving a profit of only £299. The balance on the profit and loss account, after transferring £200 from the reserve fund, is sufficient to enable the Directors to recommend the declaration of a dividend for the half year at the rate per annum of 8 per cent. on the preference share capital, and of 2 per cent. on the ordinary share capital, both less income-tax, except upon those dividends payable to the local shareholders. The Directors announce the retirement of one of the Auditors (Mr. J. Manwaring), and the appointment, in his place, of Mr. H. J. Hartley, one of the original shareholders.

Irish Incandescent Gas-Light Company, Limited.—The statutory meeting of this Company was held last Thursday—Major-General de la Poer Beresford in the chair. The Chairman stated that the prospectus of the Company was issued on June 26 last; and the result was that 69,207 shares were applied for, and an allotment of 30,000 shares—all they had—was made on July 1. Payment to the English Incandescent Gas-Light Company of £15,000 in cash and £15,000 in fully-paid shares had been made; and a licence to the Company had been granted. The business of the parent Company in Ireland—the English Incandescent Company—who were working the patent over there, had been transferred, the stock of fittings taken over, and new and very convenient premises secured in a very good position. These had been well fitted up by the Manager (Mr. Buchanan). They advertised the business thoroughly in Ireland; and the result had been that one of the principal railway stations in Dublin had applied to the Company to put up the lights, and the gas companies were approaching the Directors with a view to street lighting in Belfast, Londonderry, and Cork. Orders for street lighting were coming in faster than they could be executed at present. A vote of thanks was accorded to the Chairman and Directors.

THE RECENT SCARCITY OF WATER AT THE EAST-END.

Local Government Board Inquiry.

At the close of the proceedings on the inquiry before Colonel DUCAT, R.E., and Dr. F. W. BARRY, two of the Local Government Board Inspectors, as reported in the JOURNAL last week (p. 743), the case for the East London Water Company was opened.

Mr. *G. J. Symons*, F.R.S., was the first witness called. He put in tables of rainfall, and said the intensity of the deficiency had been greater in the valley of the Lea than anywhere else.

Dr. *W. R. Smith*, the Medical Officer of Health and Public Analyst for Woolwich, and the President of the British Institute of Public Health, said that diarrhœa was not affected by the water supply. It was a seasonal incidence, mainly occasioned by a high temperature of the ground—rising to 56° Fahr. to the depth of 4 feet. The amount of rainfall influenced diarrhœa to a certain extent, by hastening the fall of the temperature. He gave a table with the average annual death-rate from diarrhœa in ten years; and it showed that London had the lowest percentage per 1000. There were certain towns which were looked upon as diarrhœal towns by the Registrar-General, because they had a persistently high death-rate from that disease; and these had a constant supply of water. The year 1895 had been a bad one for diarrhœa, though not quite so bad as 1893. The diarrhœal death-rates in London were small as compared with several towns which had a constant supply. Asked if any exceptional distress was caused in East London owing to the deficiency of the water supply and the return to the intermittent system, witness said there was nothing in the mortality returns to show it. He did not think that the diarrhœa had anything to do with the alleged deficiency of water. He did not find any substantial effect upon the public health of the district owing to the East London Company having to go back to the intermittent supply for a few weeks. Out of the 33 large towns in the Registrar-General's tables, 25 of them had a higher rate of mortality than London for the quarter ending in September; and they all had a constant water supply except two. Asked if, from a sanitary point of view, he had anything to say about a constant supply of water, witness replied that an ideal system would be for the pipes to be always full; but it would be almost an impossibility to provide such a condition of things. In his judgment, it was advisable that storage should be provided in all houses—the tap for the domestic supply being attached to the main, and the water in the cistern not being used under ordinary circumstances. He assumed, of course, that such cisterns were of proper construction, and placed in suitable positions, so that they could be regularly emptied and cleaned.

On the resumption of the inquiry on Friday, the 4th inst., Dr. *Smith's* examination was continued by Mr. PEMBER. He said he was the medical adviser to the London School Board; and, though great inconvenience was caused to the schools by the shortness of water during the crisis, no direct evidence as to any injury to the public health was brought under his notice as regarded the children. There were 96 of the Board's schools in the East London Water Company's area, and attending those schools were 104,852 children. The School Board were aware that he was giving evidence that day; and he wished to add that the want of a continuous supply of water was a serious inconvenience to the schools, both during the winter and summer, and, of course, the Board were extremely anxious that some proper steps should be taken in order that there should not be a recurrence of such a state of things.

In cross-examination by Mr. BALFOUR BROWNE, witness stated that he was not appearing for the School Board, nor did they instruct him to give evidence; but he was told by the Vice-Chairman that they would be glad if he would bring out strongly the inconvenience the Board had suffered. As to his statement that diarrhœa was a seasonal disease, he had not made any direct observations himself; but all his statements on the subject of diarrhœa had been drawn from Dr. Ballard's report. At a certain condition of temperature, specially found at a depth of 4 feet, Dr. Ballard said that diarrhœa would become prevalent. Diarrhœa was undoubtedly a filth disease; and certainly he (witness) would deprecate a short supply of water, even if there were no other disease. There were many towns with constant supplies of water, and with very high death-rates from diarrhœa; and he thought this showed that the water supply did not play a very important part in the question of the prevalence of diarrhœa, though it certainly contributed to it. Taking the years 1893 and 1895, which were diarrhœal years, he admitted that, according to his tables, the death-rate in London from this disease had doubled in 1895 as compared with 1893; whereas Wolverhampton was a little lower in 1895 than in 1893. He could not account for this, except on the supposition that there must have been something prevailing in London which did not exist in the latter town. It was not, however, fair to say that the rise in London was due to an increase in the East-end. He had not mixed up districts where there was shortness of water with others where there was no shortness. He had taken what he considered the fairest basis—the whole area of the East London Company. It was quite impossible to divide it up into streets. He could not check Counsel's statement that of the 903,720 persons who formed the population of that district in 1891, there were 232,480 who did not get their supply from the Company. The diarrhœa death-rate in London had been higher in 1895 than in other years; but it had not gone up in any abnormal proportion in the East-end.

Mr. *T. O. Dudfield*, the Medical Officer of Health for Kensington, examined by Mr. CRIPPS, said he saw no sanitary objection to cisterns, if properly looked after. The law provided for dealing with those which were in a state to cause nuisance, though the difficulty in enforcing the provision to keep them in a sanitary condition arose from the fact that the inspectors were so few and the houses so many. With regard to the question of diarrhœa, he had prepared a table to show how it worked out with regard to his own parish, to Hackney, and to London. In his own parish, 45 per cent. was the increase in the diarrhœal death rate in 1895, over the number in 1893; in London, it was 65; and in Hackney, 87. These figures were quite irrespective of any increase of population; and Hackney was a district in which it was increasing rapidly. Turning to the question of cisterns in Kensington, they had an almost general constant supply of water. They were served by the Chelsea, the West Middlesex, and the Grand Junction Companies; and all these required that cisterns should be provided, notwithstanding the existence of the constant supply. He thought they were quite right in doing so; and he understood they might refuse to supply if no cistern was provided. He had been very much astonished to find that cisterns had been abolished in some cases. In Kensington, during the last five years, they had put up as many as 800 additional cisterns, mostly for the purpose of separating the water supply of the closet from that given to the house generally. They, however, always recommended the provision of a draw-off tap from the rising main, so that water for drinking, cooking, and domestic purposes might be obtained fresh, without the agency of cisterns.

Mr. BALFOUR BROWNE said he had no questions to ask the witness.

Mr. *W. B. Bryan*, M.Inst.C.E., the Engineer of the East London Water Company, was then examined by Mr. PEMBER. He stated that he had been Engineer to the Company for fourteen years, and had also had previous experience in the same branch of his profession at Blackburn and other places. The rainfall for 1895, in the Lea Valley, had been unprecedented for many years. From the month of January to the 16th of July—6½ months—it was only 5·20 inches; and in consequence of this, during the period of the intermittent supply given by his Company, the flow of the river was abnormally small. On the 26th of May, his Company's reservoirs were all perfectly full and overflowing. From that date to the 28th of June, the amount of water stored rapidly decreased, until more than half the entire volume had been drawn off. It was then decided to make the supply intermittent to some extent. The water was therefore turned off for an average period of nine hours at night in about two-thirds of the whole of the Company's area. The one-third of the district to which this remark did not apply was the part connected directly to the large mains traversing the district from end to end; and the shutting off of these mains would have completely stopped the supply for fire and every other purpose in those places which might be miles away from the pumping-stations. On the 27th of May, the flow of the River Lea commenced to decrease pretty suddenly; it being then 10 million gallons less than it was on the previous day. It steadily decreased until the end of June. On the 26th of May, the flow of the river was 43,209,000 gallons for the day; and the average flow for the month of June was 24,300,000 gallons daily. Out of this 24,300,000 gallons, the Lea Conservancy were entitled to take, under their Act, a maximum of 5,400,000 gallons for navigation. From the end of June to the middle of July, the water further decreased; the average flow of the river during that period being 22 million gallons daily, from which, of course, the 5,400,000 gallons for the Conservancy would still be deductable.

Mr. BALFOUR BROWNE: As a matter of fact, I do not think it was deducted.

Mr. FREEMAN: Please do not put the question quite in that way—that it was deducted—because it was not.

Mr. PEMBER: I did not say it was; I said "deductable" on purpose.

Witness (continuing) said the Company then found it necessary to still further curtail the supply to three hours a day. This was on the 13th of July. The reservoirs were then practically empty, so far as being able to supply water by gravitation to the filter-beds. This limited supply of three hours a day lasted a fortnight, till the 28th of July, when there were some rainstorms; and the supply was increased to six hours a day. In addition, a very large number of stand-pipes were fixed in several districts. This supply lasted until the 17th of August, when it was increased to eleven hours a day. This limitation was maintained to the 8th of September; and from that time a continuous supply had been given. With the exception of those persons who were on the trunk mains traversing the system from end to end, where the great fire-plugs were, everybody was in the same position; so that it was nonsense to suggest that there were houses where there was only a trickle for a quarter of an hour or a little flow for an hour. Local circumstances in various houses might, however, cause this to be so. Notices were served on the different local authorities on the 28th of June, informing them of the intention of the Company to curtail the supply; and large placards were posted throughout the Company's district. In addition, 170,000 or 180,000 small handbills were printed and distributed as quickly as possible in all the streets affected; and advertisements were inserted in the local papers from time to time, giving particulars of the hours that the water would be turned on and off. A further circular was also sent to each of the local authorities, urging them to exercise the greatest economy in the use of water for road watering and similar purposes. The quantity of water delivered per head per day for each week during which the supply was curtailed was as follows: Week ending July 5, 40 gallons; July 12, 39 gallons; July 19, 33 gallons; July 26, 29 gallons (that was the minimum week); Aug. 2, 32 gallons; Aug. 9, 32 gallons; Aug. 16, 33 gallons; Aug. 23, 36 gallons; Aug. 30, 36 gallons; Sept. 6, 37 gallons. He ascribed the deficiency to the unprecedented drought, and the very small flow of the River Lea; but he would point out that the Regent's Canal Company pumped large volumes of water from the river for their canal up to the 21st or 22nd of June, when the Lea Conservancy Board obtained an interim injunction restraining them from doing it any longer. But if there had been sufficient storage, there would have been no deficiency of supply by the Company. He had looked forward for some years to the necessity of providing additional storage, and increasing the pumping power. In the year 1890, he began to look about for sites; and the Company, acting on his advice, purchased in the following year 90 acres of land, and immediately afterwards 6 acres more. This 90 acres was mentioned in the statement laid before the Royal Commission; and he also had put before them the fact that, if the Company were to maintain, in these seasons of drought, the present supply to the existing population, they must have more storage. He had repeated this evidence two or three times in Parliament. As was well known, the Company in the session of 1893 deposited a Bill for the purpose of constructing certain works to enable them to carry out their obligations to the public. He was then of opinion that, if they did not get the power to carry out fresh storage works, the supply of the Company would be jeopardised. If this Bill had been allowed to proceed, the Company's

storage capacity would have now been increased by 200 million gallons; and they would have been able to pump 3 million gallons more a day. These two sources of extra supply would have tided them over their difficulty. The Bill was reintroduced in the following session; and, in spite of the opposition of the County Council, it was passed. If the 1893 Bill had passed, the whole scheme would have been sufficiently advanced to give the Company two-fifths of its ultimate capacity.

Mr. PEMBER here suggested that Colonel Ducat and Dr. Barry should inspect the works before their report was made, accompanied by Mr. Bryan and Mr. Binnie, and someone representing the Vestries.

In further examination by Mr. PEMBER, witness went on to say that the Company regretted the abolition of cisterns, and were trying to induce people to put them in. With respect to Mr. Binnie's statement that the deficiency of water was caused by the mains which had been shattered by the frost in February last, it was in his opinion entirely erroneous, and was based upon an insufficient knowledge of how the business of the Company was carried on. All the broken mains in London were repaired by the 8th of April, and every supply restored. He accounted for the increased consumption of water in May and June, referred to by Mr. Binnie, in two ways. The first was the immense number of consumers' private pipes which were found to be leaky. So many of them were broken, that it was impossible to get them all repaired in less than three months owing to the lack of plumbers. The second was waste from consumers' taps, and especially garden hoses left running all night during the drought. A complaint had been made against the Company that they had not cut off the supplies to those of their customers who were supplied by meter. This was untrue, for more than 1000 of them had been placed on the intermittent supply. The same complaint had been made respecting the supply given to one Vestry for watering the roads; but the authorities themselves did not think it worth while to curtail the consumption of water from their meters until a letter was sent by the Company asking them to do so. There was no truth whatever in the statement that one of the Company's reservoirs had been emptied just before the drought. He could not imagine how such an idea got into anyone's head.

Cross-examined by Mr. BALFOUR BROWNE: He agreed with the statement made at the time the Company were pumping 30 gallons per head per day for all purposes, that it should have been ample, as it exceeded the quantity distributed by the Manchester, Nottingham, Birmingham, and many other municipal water-works. The reason it was not ample was the excessive carelessness and waste going on throughout the Metropolis, which did not exist in the towns mentioned. If the Company had cut off the 8 gallons per head per day supplied for trade consumption, there would probably have been no shortness in the domestic consumption at all; but they had no power to cut off that supply. They had not purchased water during the drought from any other Company but the new River Company. Their mains did not meet those of any other Company. The Thames main ran through the district; but this had been taxed to its fullest capacity the whole time of the scarcity.

In cross-examination by Mr. FREEMAN, witness said the Company depended in a great measure upon their storage, because they had not the Thames to fall back upon. If they had a huge river, they would not require so much storage. In most of the northern towns, there was from 150 to 220 days' storage. The less the river, the greater the storage, so that advantage could be taken of the high flow of the river in wet seasons, and give it out again in dry ones. There was no comparison between his Company and the Companies drawing water from the Thames. The cause of the breakdown was the deficiency of the supply, and not something inside the district itself. If 35 gallons per head sufficed for other London Water Companies, that was no reason why it should do so for his Company. Their population was a very improvident one; and the waste was infinitely greater through carelessness and bad fittings, and the constant loss of fittings by theft, as had been stated in evidence. This caused a greater consumption in his district than there was, on the average, in those of the four Companies mentioned. The Company enforced, as far as they could, all the regulations under the Metropolis Water Act, 1871. The number of supplies they were serving was 104,000; and immediately after the frost, until the day of the commencement of the intermittent supply, they had, with the permanent waste inspectors and others helping them, not less than 100 people at work. He knew that the County Council objected to water being taken from the Lea; and he was also aware of the fact that the Council put forward the objection that the extra storage reservoirs would be unnecessary if all the Water Companies were placed under one authority. He did not know if this was one of the principal objections of the Council. They had so many that if one did not suit them they would have taken another.

Re-examined by Mr. PEMBER: The capacity of the existing reservoirs, as reported by General Scott, the Official Water Examiner, was 610 million gallons, exclusive of a considerable quantity of water lodged in the gravel between the puddle walls and the inner slopes of the reservoirs; and the Royal Commission, in their report, found that their subsidence reservoir capacity was 615 million gallons. In another paragraph of that report, it was stated: "The Company has at present storage for 740 million gallons, and proposes immediately to increase it to 1200 million gallons by raising the banks of the Racecourse reservoir, and constructing two new reservoirs on land in its possession." This was a correct *résumé* of the evidence he had always intended to give; and at any subsequent inquiry he had never swerved from that. The Company had failed to get convictions for waste. The clauses as to fittings in the 1893 Bill were a copy of the regulations laid down by the Manchester Corporation. Two of the chief consumers supplied by meter were the Great Eastern Railway Company and The Gaslight and Coke Company. The effect of cutting off their supply would have been infinitely greater than anything that had actually happened.

Mr. *C. Tuckwell*, a builder at Walthamstow, said he always fixed cisterns in the houses he erected; and none of his tenants had been inconvenienced by the drought.

The inquiry was resumed on the following morning.

Mr. *N. Anstey*, in reply to Mr. PEMBER, stated that he had the management of 409 houses of all classes in the East London district, and that as, with few exceptions, they were supplied with storage-tanks or cisterns, no inconvenience had been felt by the tenants during the period of intermittent supply.

Mr. PEMBER then addressed the Inspectors on behalf of the Company. He began by acknowledging the fair, moderate, and candid way in which the witnesses against him had given their evidence, in striking contrast to the people who wrote inflammatory letters to the papers, where they could not be cross-examined, but cautiously kept out of the Town Hall, where this could be done. The Inspectors had three things to inquire into, which perhaps would be stamped on their minds all the better if he made them alliterative—cause, consequence, cure. Mr. Binnie's was the only evidence given on the subject of the cause; and he had stated it to be neither drought nor insufficient storage, but the unrepaired mains of the Company shattered in consequence of the great frost of last winter. It had been proved by Mr. Bryan that no main had been repaired since the 19th of April; and yet the flow of water into the mains had now gone back to its normal point. They had had six of the driest months that had been known for years; and yet the reservoirs were full to overflowing on the 26th of May. How could these things be with unrepaired shattered mains? It must be remembered that Mr. Binnie's theory was not founded upon a physical investigation of the facts, although it would have been easy to make it. The true cause of the deficiency was, to some extent, the extra waste which was going on in a very dry season following a terrible and unprecedented frost, and also to the want of sufficient storage, to which Mr. Bryan and the Company had looked forward for years, but which they had not got owing to the action of the London County Council and Parliament in 1893. The Council were ready to run any risk, whether of cholera or of a diarrhœa epidemic, notwithstanding all the Royal Commission had told them, rather than that the question of the purchase of the undertakings of the Water Companies should, in their judgment, be hampered or affected in any way. So great was the force of public opinion in the direction of hostility to the Companies, so great was the hatred which had been created against them, that it was a very difficult thing to persuade anybody where the blame really lay. In regard to the consequence, there had, of course, been inconvenience; but that inconvenience had been much exaggerated, and, such as it was, it had been largely intensified by the abolition of cisterns. With regard to public health, death percentages were fallacious; and Dr. Bate's statistics showed that the number of deaths from diarrhœa in his district were so few that, though they had been spoken of as a national calamity, they practically dwindled away almost to nothing. With regard to the continuance of the supply to those who had water by meter, as stated at first it looked a little awkward. But the facts were that one-third of the meter supplies were on the same mains as the domestic supplies, and were cut off; while as to the others, they were on the fire mains, which the Company were bound to keep charged, and included very large employers of labour, such as the Great Eastern Railway Company and The Gaslight and Coke Company. Thousands of persons would have been thrown out of employment if the water supply to those great undertakings had been withheld; and a very large amount of gas would have been cut off from the consumers of London. As to the third point—the cure—he suggested, first, whether the Company should not have more power over private fittings. The next thing was the provision of cisterns. Considering that constant supply, like all other known institutions, must always be liable to occasional failure, it was a question whether there had not been some rashness in deciding to rely entirely upon constant supply, and to have nothing to do with cisterns. But the real, the great remedy, and the main thing that would prevent a recurrence of what had lately happened, had already been achieved—that was the legislation of 1894, and the provision of the works which had already been constructed, and were in course of construction, under the Act of that year. If that had been allowed to be the legislation of 1893, it would not have been a remedy—it would have been prevention.

Mr. BALFOUR BROWNE, in reply, said he had the honour to appear for the 750,000 poor people who drank the East London Company's water when they could get it, and who paid their rates whether they obtained it or not. The failure to give a constant supply was admitted; but the blame was thrown upon the County Council. It was, however, the action of Parliament which threw out the Bill of 1893; and, with great respect, it was not the duty of the Local Government Board to review a decision of Parliament. Besides, for £30,000, which might have been spent out of revenue, the Company could have increased their storage capacity—they could even have gone without their 10 per cent. dividend for one year; and it would have been better to do that than that even thirty lives should have been lost from diarrhœa through their default. Another excuse was that the people of the East end were more careless than those of Nottingham, Birmingham, or Manchester. This was absurd. Human nature was the same in all great towns. The Company had full power to prevent waste. They had failed in their duty; and now they sought to excuse themselves by laying the blame on everybody else. Mr. Crookenden, the Company's Secretary, had stated that they were pumping 30 gallons per head per day for all purposes. That should have been ample. It exceeded by many gallons what the people could use; and it exceeded what they could abuse. There was great waste going on which the Company did not detect. Mr. Fraser had told the Royal Commission that it was far cheaper to pump water than to prevent waste. This was the view of the Company, who had only 30 Inspectors for 50 square miles of territory. The only way in which they could detect waste was by an elaborate system of waste-water meters, which had been tried in other districts, and had reduced the consumption enormously.

Mr. PEMBER said they put one down on the previous night; and it was stolen immediately. The Company had a large number of such meters at work, and had made thousands of inspections by them.

Mr. BALFOUR BROWNE said the Company's next excuse was the unprecedented drought. But this had been absolutely disproved by their own witness, Professor Symons. As to the meter supplies, he suspected that the Great Eastern Railway Company were not cut off because, if they had been, that Company might in future have taken the whole of their supply from the New River. As to The Gaslight and Coke Company, their principal station was quite close to the Thames; and

Thames water would have sealed their large gasholders as effectively as the East London Company's water. In regard to the effects, the medical witnesses, though they could not trace the thirty or forty deaths absolutely to the want of water, were right in not doubting that the absence of water in the district was a condition which conduced to an epidemic of diarrhœa. The Company had suggested as a remedy the clause in their Bill of 1893 relating to fittings. That would have entailed a cost of something like £5 for every house in the district; and the Company saw that, and withdrew it before going into Committee, and did not reintroduce it in their Bill of 1894. The remedy was that they should prevent waste by all means in their power, and readjust their mains so that all customers would be treated alike. There was one other remedy, and he did not hesitate to suggest it: Sweep them away, and put the water supply in the hands of some public authority. He was not advocating the London County Council or anyone else, as the Vestries were divided in their views; but that was the remedy he asked the Local Government Board to enforce.

The proceedings then closed.

Last Thursday, Colonel Ducat and Dr. Barry completed their inquiry by inspecting the works of the East London Water Company. They were accompanied by Mr. W. B. Bryan, M.Inst.C.E. (the Engineer of the Company), Mr. A. R. Binnie, M.Inst.C.E. (the Engineer of the London County Council), and Mr. Lovegrove (the Surveyor to the Hackney Vestry). The party drove first to the chief pumping-station and filter-beds in the Lea Bridge Road, where they were taken round the works by Mr. Bryan, and shown specimens of the Company's fittings. They examined the method of connecting mains and service-pipes in use by the Company, and the means of controlling the supply through any section of pipes. They then drove to the storage reservoirs at Walthamstow, where the large new works are in progress. The East Warwick reservoir was first thoroughly inspected. This is one of the new reservoirs on which the Company rely to bring their storage up to 1200 million gallons. The plans were prepared immediately on obtaining the Royal Assent to the Bill of last year; and the contract was signed with Messrs. John Aird and Sons on March 28. Within a fortnight, £10,000 worth of plant was on the spot, and very rapid progress has already been made in excavating the bed of the reservoir and constructing the embankment. When completed, the area will be 40 acres, and the storage capacity about 250 million gallons. From there the party proceeded to the Racecourse reservoir, the level of which is being raised about 10 feet. This work, which has been entrusted to Messrs. Kirk and Rendall, is approaching completion. Finally, the Inspectors visited the Hagger Lane pumping-station, near Woodford, and examined a new covered reservoir in course of construction. They will probably report to the Local Government Board on the inquiry within the next fortnight.

With reference to the supply of water to the London School Board, on which evidence was given by Dr. W. R. Smith, their Medical Officer, a report dealing with the subject has been submitted to the Board. It appears therefrom that the Works Committee of the Board were of opinion that a representation should be made to the Commissioners on the subject; and, as a matter of emergency, a memorandum dated the 3rd inst. was forwarded for their consideration. A copy was also sent direct to the Local Government Board. In the memorandum, it is stated that the East London Water-Works Company supplied water to 96 of the Board's schools, providing accommodation for 104,852 children, situated in the School Board Divisions of Hackney and the Tower Hamlets. A deficiency of water was a great source of danger, and might seriously affect the health of the children in attendance at the schools. During the severe and prolonged frost which occurred in the early part of the year, many of the schools of the Board were, owing to the bursting of the Company's mains, or the freezing of the water in the mains, absolutely unprovided with water; and, as a consequence, it was necessary for the Board for some weeks to employ special assistance to carry water from the hydrants nearest to the schools—the quantity so obtainable being quite insufficient for keeping the schools in sanitary condition. During the months of July and August, when water was most required, the schools of the Board were placed on short supply; the water being turned on at the mains for only two or three hours a day. A letter was forwarded by the Board to the Company, pointing out that the schools were greatly inconvenienced in consequence of the arrangement of the Company, by which the water was only turned on for about two or three hours a day, and asking what action the Company proposed to take, so that the health of the teachers and children might not be endangered. The reply of the Water Company's Secretary was: "No domestic supplies should be without proper storage cisterns, as provided by Act of Parliament. Owing to the unprecedented drought, the period of supply per day has been limited to the extent named. This will be increased should the stock of water justify such a step." The Clerk of the Board further wrote: "The schools of the Board are provided with storage cisterns on the roof for supplying the w.c.'s, lavatories, and fountains in the upper part of the school buildings, but those on the ground floor are, as a rule, supplied directly from the main; and the cessation of a constant supply of water must of necessity make it difficult, if not impossible, to keep the schools in proper sanitary condition." The Committee hope the Local Government Board will take such steps as will ensure in the future a plentiful and constant supply of water to all the schools of the Board in the district of the East London Company.

Fylde Water-Works Company.—The half-yearly accounts of this Company have been issued. They show that the capital account has been increased by an expenditure of £931, and amounts to £360,319. The water and other receipts, including £1759 brought forward, reached £17,877. Allowances for empty houses and bad debts are made, of £360, interest on loans, £1085, and £3529 for working expenses bring down the available balance to £12,912. Dividends of 10 per cent. on stock "A," 7 per cent. on stock "B," and 4 per cent. on the preference stock are recommended; leaving a balance of £3590 to be carried forward.

METROPOLIS WATER SUPPLY.

The Future Source of Water—A Criticism of the Royal Commissioners' Report.

The following letter by Lord Farrer, dealing with the question of the future water supply of London, and criticizing the report of the Royal Commission of 1892-3, appeared in *The Times* last Wednesday, under the heading: "Where Shall London Get its Water?"

To the Editor of *The Times*.

Sir,—Will you allow me, as a former Chairman of the London County Council Water Committee, to say a word on the above question? It is the question of questions; but it is apt to be overlooked in the excitement caused by the Purchase Bills of the Council and the recent short supplies of the East London Company. It is paramount in importance to all other questions—even to the question of the purchase of the Companies. It is paramount in urgency; for, unless immediate steps be taken, there will be no water area in England left unoccupied. It should have been solved by the late Royal Commission; and it is often assumed to have been so solved. Is this the fact? Have they really solved it? Let us examine the main features of their report.

The Commissioners begin (par. 27) by assuming forty years as the extreme period to which they have to look forward in calculating the supply which London will need. Now, forty years is a long period to look forward to for many purposes; but it is a very short period in the history of a great city—a shorter period than other great cities have looked forward to in calculating their future supplies. But the case does not rest here. If at or towards the expiration of the forty years which form the self-imposed limit of the Commissioners' inquiry, London were sure, by the ordinary expenditure of capital, to be able to secure the additional supplies which might then be needed, and if her present supplies were certainly adequate until that time arrives, it might be consistent with reason and prudence to postpone the consideration of further supply until the future want had made itself felt. But this is notoriously not the real state of the case. The history of recent water enterprise is a history of struggles by different towns for the areas in Great Britain which still supply pure water. Glasgow has secured Loch Katrine; Manchester, Thirlmere; Liverpool, a large area in North Wales; Birmingham has, even since the London County Council began to stir in the question, succeeded in anticipating them by grasping the best area in South Wales. The districts to which London can have recourse, if ever the supplies from the Thames Valley prove inadequate, are very few. Indeed, it is doubtful whether they can now be dealt with as plural in number. Long before forty years have elapsed—probably before ten years have elapsed—they will all be so far appropriated as to render them unavailable for London.

It is scarcely credible, but it is the fact, that these are considerations to which the Royal Commissioners do not even advert. They content themselves with arguing that there are sufficient supplies in the Thames Valley for forty years, and do not suggest the question: What is to be done at the end of forty years if those supplies then prove to be inadequate? This fact alone renders the report of the Commission useless to those who are responsible for the future health and management of London. Indeed, the report is, on this ground alone, worse than useless. It is misleading and mischievous; for it is calculated to lull Water Companies and consumers, Governments and Parliaments, into a false sense of security.

The limitation of the Commissioners' inquiry in point of space is as unsatisfactory as in point of time. They did not ask: "Where can London best get its water?" but: "How can London for forty years be supplied from sources now appropriated by the Companies?" Nor did they compare the merits of the scheme they proposed with the merits of any other scheme, such as that for bringing water from Wales, now under the consideration of the Council. Such limitations as these would have prevented the Commissioners from giving any satisfactory answer to our question, if their inquiry had been satisfactory within their own limits. But this is far from being the case.

Unsatisfactory as the report is with regard to times or areas which the Commissioners refuse to contemplate, it is almost equally unsatisfactory with regard to the time and to the areas which they do contemplate. The supply which they contemplate as probably necessary within forty years from 1893 is about 420 million gallons daily (pars. 70 and 183); and this quantity they say may be provided as follows:—

(1) By 27½ million gallons from wells in the district of the Kent Company (par. 180). This quantity the Commissioners think may be increased, if necessary, by a very large addition from the chalk in the eastern part of Kent (par. 184). This proposed additional source of supply has, since the Commission reported, been carefully investigated; and while the supply proves to be far less than is suggested in the report (pars. 106-108), the cost and difficulty of obtaining it, which the Commissioners did not inquire into, prove to be so great as to be prohibitory.

(2) By 52½ million gallons from the River Lea, and an additional 40 million gallons from wells in the valley of the Lea (pars. 180 and 181). It is not surprising that this proposal has been much criticized, for, while admitting that a constant flow of water must be left in the Thames below the intakes of the Water Companies, the Commissioners practically propose that all, or almost all, the water shall be taken out of the Lea; and while affirming (pars. 100-103) that in other parts of the valleys of the Thames and its affluents water cannot be taken from wells without depleting the surface supply, and while admitting that in the London basin pumping from wells has lowered the level of the water (par. 101), the Commissioners propose that, after taking the whole of the Lea, an additional quantity equal to four-fifths of that supply shall be also procured from wells in its valley. This apparently inconsistent proposal appears to be founded on an hypothesis (pars. 101 and 119) that there is a large underground stream perpetually flowing away somewhere from the chalk in the valley of the Lea. To the uninitiated, this hypothesis certainly appears to be one which requires confirmation. (See par. 105.)

(3) By 300 million gallons taken from the River Thames (par. 182); being 170 million gallons more than the 130 millions which can now be

taken (par. 50). In order to support this proposal, and show that it is practicable, the Commissioners approve and adopt (pars. 87, 134, and 182) a scheme of large storage reservoirs at Staines, proposed by a Director and the late Engineer of the Grand Junction Company, with the approval of all the Companies. But the Commissioners did not make any thorough examination of this scheme; they did not inquire into questions of construction and expense, they did not even submit the scheme to criticism; they did not even advert to the cardinal fact that, after the present abstraction of about 100 million gallons by the Water Companies, the daily flow of the Thames at Teddington, where there is more water than at Staines, is now, in times of drought, occasionally as low as 141 million gallons, and for whole months as low as 200 million gallons. Nor do they attempt to say what the capacity of the proposed reservoirs must be in order to maintain the 300 million gallons which they propose to extract, *plus* the minimum of 200 millions which they admit (par. 86) are needed in order to purify the lower river. The scheme has since been subjected to careful criticism by the London County Council, and has been shown to be extravagant in cost and of very doubtful efficiency. But it is unnecessary to dwell on these points, since, as soon as the scheme had served the temporary purpose of giving the Commissioners a ground for their report, it was dropped by the Water Companies, two at least of whom have since gone in for schemes of a totally different nature, subject to none of the conditions which the Commissioners deemed necessary. With the collapse of this plan of huge reservoirs at Staines, collapses the main recommendation of the Commissioners' report.

Upon the subject of the quality of the present supply, I own to considerable sympathy with the views expressed by the Commissioners. Opinions, no doubt, differ. Science has not said her last word; but experience—in London, at any rate—does not show that disease has hitherto been propagated by the use of Thames water. But even on this point the Commissioners are scarcely consistent, for, while they speak in the highest terms of the purity of the present supply, they insist on the necessity of large and costly additional storage and filterage; and they lay great stress on the necessity of new and stringent measures for keeping sewage and other filth out of the Thames and its affluents—a process which, if practicable at all, must involve great friction and great cost both to water consumers and to the inhabitants of the Thames Valley, and which will every year become more difficult with the rapid growth of population on the banks of the river.

Such, in their main features, are the recommendations of the Royal Commission. Are they, in case of purchase of the Companies, as was apparently assumed last session, to be deemed final? Above all, are all steps for securing the only remaining water area in England to be postponed in deference to the report of the Commissioners? If so, the look-out for Londoners is indeed a bad one. London will, in case of purchase, have to pay compensation to the Companies as if for an adequate supply; and when they have paid it, they will find that they have to go to immense additional expense to supplement that supply. What is worse, they will probably be too late to secure a new source of supply. The process of purchase, including parliamentary litigation, tedious and expensive arbitration proceedings, and very difficult settlements between London and the adjacent counties, will take years, in addition to those which have already been wasted. If no steps are taken to secure the requisite water areas until these arrangements are completed, it will be too late, for those areas will have been grasped by others.

Upon the question of purchase, there is, no doubt, much difference of opinion; but, whether the Companies are to be bought up or not, it is equally important to London that the means of future supply should be secured while there is yet time. Even if no purchase should ever take place, the new source of supply will still be available; and the Companies would in all probability be glad hereafter to give reasonable terms for using it. Nor need the acquisition of the necessary areas necessarily or immediately involve the expense of further works. These may be proceeded with if, and so far as, they prove necessary.

I cannot doubt myself that the supply of water to London must, sooner or later, be vested in the hands of the London County Council, or of some other municipal body or bodies representing all interests. But so strongly do I feel the urgency of at once securing the only available sources of future supply, that, if the Companies were to unite and produce a decent scheme for that purpose, I should, in the absence of a better scheme, welcome their action, and think better of their public spirit.

I conclude as I began. The question of questions for Londoners is how to secure the only available means for a future supply. The Royal Commission, so far from clearing up the question, has muddled it by an incomplete and unsatisfactory report. Six precious years have been wasted; and if due provision is now to be made for the future, the report of the Commission must at once be treated as inconclusive, and immediate steps taken to secure means of supply adequate in quantity and quality to the growing wants of future London.

Writing to *The Times* on the subject of the foregoing letter, Mr. George Livesey suggests to Lord Farrer that his question is hardly complete without some effort to show that London will ever require more water than the Royal Commission contemplated as probably necessary within forty years from 1893. In other words, is it possible that London can continue to grow indefinitely? Mr. Livesey believes the rate of increase is already appreciably diminishing.

Spalding Water Supply.—The Spalding Urban District Council have appointed a Committee to investigate the condition of the town's water supply, and also to report as to the advisability of purchasing the undertaking of the Spalding Water Company, at a probable cost of £17,000, and relaying the mains between Bourne and Spalding, or preferably to apply for a Provisional Order to construct new works altogether. Some feeling has, it appears, been imported into the question through the Company accepting the tender of Messrs. Easton, Anderson, Goolden, and Co., for the erection of a new pumping-station at Bourne, in preference to one sent in by a local firm at a lower figure.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Dundee Town Council met in committee on Thursday, to further consider the proposal to promote a Bill in Parliament giving increased borrowing powers for the gas undertaking. The Clerk (Sir Thomas Thornton) has given it as his opinion that the Act may be got for less than £300; and according to Treasurer Ritchie, they would save this amount in interest, during the first year. Mr. Speed again opposed the proposal. In his opinion the present arrangements are quite sufficient. Mr. M'Kinnon, who took the same side, was quite satisfied that the investment of the Council funds at present was all that could be desired; and he insinuated that the proposal to go to Parliament was made in the interests of one or two parties. On being asked to withdraw that remark, he declined to do so. Other two members supported the opposition, which made four in the division that was taken; but as there were fifteen the other side, the Bill is to be proceeded with.

The Glasgow Town Council have been experimenting with the Welsbach system of incandescent gas lighting in the public lamps in seven different parts of the city. In all 82 lamps have been in use—45 of "C" size, 27 of "S" size, and 10 of "D" size. Taking into account the cost of the lamps, gas, and renewals, it has been found that the outlay per candle power of light per annum amounts to from 7·34d. to 12·43d. for the "C" lamps, to 8·28d. for the "S" lamps, and to 7·51d. for the "D" lamps. The annual cost per candle power per lamp by the ordinary method of lighting is 22·44d. This is, so far as I have seen, the clearest demonstration of the comparative cost of public lighting by the Welsbach method. The Corporation are satisfied with the result of their experiments; and they have ordered that the incandescent lamps be fitted up along Bridge and Eglinton Streets, which constitute the main thoroughfare in the southern portion of the city. In moving that this extended experiment be made, Bailie Primrose said that after that had been done the Watching and Lighting Committee would have more to say regarding a still greater installation of the system in the near future. It appears that there is a great variation in the cost of the lighting in different districts. Thus while in Gordon Street it was only 4s. 9d. per lamp per annum, at Bridgeton Cross it was 26s. 10d. This is due to vibration, which shakes the mantles to pieces. Experiments are being made to try to overcome this drawback. As showing the life of the mantles in some places, it may be stated that in St. Vincent Street there is one which has been in use for 3026 burning hours, and is still doing duty.

The public installations of electric light in both Edinburgh and Glasgow have been before the Town Councils of those cities this week. In Glasgow, Mr. Nelson wanted to know who was responsible for the erection of the lamps; because, he said, with the exception of London, Glasgow was the worst lit city by electricity in Europe. He pointed to the Edinburgh installation as the best thing of the kind; and gave notice that he would move an instruction to the Committee on the subject. Now it is quite true that the Edinburgh installation is a brighter one than that of Glasgow. In Glasgow, the lanterns are upright on the top of the posts, and are hexagonal in form, with heavily ribbed glass. In Edinburgh, the lamps are of the bracket pattern, and are circular globes of thin glass, slightly opaque, enclosed in wire netting. More light is consequently emitted by them; but they have a serious drawback, in respect that they are easily broken. The Committee had this subject before them recently; and to account for so many breakages, they entertained the suspicion that these were not the result of accidents, but of wilful mischief on the part of persons using catapults. The Committee gave instructions to the police to take special precautions to detect and punish offenders. The globes are specially manufactured in Austria; and as they cost 9s. each, breakages are costly. At the meeting of the Town Council, a question was asked as to the faulty condition of the light during the preceding few nights. In reply, Mr. Mackenzie said that it was owing to the heating of the bearings of the high-tension plant, which was common to new machinery. This, of course, will soon wear away; and the light will then be steadier. By the way, I saw a flickering lamp the other night; and a man, who seemed to possess some authority, was vigorously kicking the post, as if to shake it into condition. School-boys are sometimes impelled to study by the application of punishment; but I have never heard, hitherto, of a lamp being induced, by castigation, to give out light.

The annual meeting of the Newport (Fife) Gaslight Company, was held on the 5th inst. It was reported that the revenue for the year had been £1954, and the expenditure £1436—leaving a profit on the working of the twelve months of £517. The net amount received for gas was £1671; and for meter-rents, £50. For coal, £762 was spent; lime, £29; fire-bricks, retorts, apparatus, &c., £175; and wages and expense of management, £363. The Company have a capital of £5958 in £1 shares, and a reserve fund of £500; while in assets they possess £4467 as cost of works and plant, £94 as the value of stock in hand, £1645 in investments, £806 of cash in bank, and £120 of outstanding accounts. The Chairman at the meeting said that, on account of the increased consumption of gas, the Directors were considering the desirability of carrying out extensions and improvements on the works; but they had difficulty in procuring suitable ground in the vicinity. A dividend of 5 per cent. was paid, with £201 carried forward.

The extensions and improvements, including an installation of the Peebles oil-gas plant, which the Falkirk Gas Commissioners ordered to be made upon their gas-works, have been completed; and an inauguration ceremony in connection with them is to be held on Tuesday first.

The Edinburgh and District Water Trustees have fixed their rates of assessment at the same figures as last year—viz., 5½d. per pound domestic rate, 2d. per pound on shop rentals, and 1d. per pound for public supply. The estimate is to raise a sum of £51,989. The estimated expenditure is £87,675; but as an amount of £38,867 is expected to be derived from special supplies, the assessments which have been imposed will raise a sum of £3181 more than is required. Mr. Colston, in moving the adoption of the rates, said they might have reduced that for domestic supply by ½d.; but in view of the new works,

and of the desirability of keeping their rates uniform, they had resolved to make no change.

The Trustees the other day formally began the construction of the new works for the augmentation of the water supply. A large party of the Trustees and their friends journeyed by special train from Edinburgh to Broughton, from whence they were driven a distance of eight miles to the Crook, about a mile below where the Talla—the water to be impounded—flows into the Tweed. The ceremony of cutting the first sod was performed by Mrs. M'Donald, wife of the Lord Provost of Edinburgh. The proceedings were opened with praise and prayer, led by the local clergyman, after which the Lord Provost gave a historical account of the water supply of the city. Three cheers were then given; and Mrs. M'Donald, with a silver spade (the gift of Messrs. J. Young and Sons, the Contractors), lifted a sod and placed it upon a highly-finished barrow, which was also the gift of the Contractors to Bailie Archibald, whose duty it was to wheel it and tip the sod. After that, the health of Mrs. M'Donald was pledged with Talla water, out of a large silver tankard. The last part of the ceremony was the recitation, by Mr. Colston, of a poem which he had composed for the occasion. Dinner was then served in a marquee, which had been erected close by, after which there were some complimentary speeches.

A Sub-Committee of the Glasgow Corporation Water Trust had before them this week eleven offers for the construction of the last section of the new scheme for the doubling of the water supply from Loch Katrine. This is known as the Loch Katrine contract. The Committee found the offer of Messrs. G. Lawson and Son, of Rutherglen, to be the lowest; and they resolved to recommend that it be accepted. The amount is £40,450. The highest offer was £58,480; and the next highest, £43,637.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 12.

Sulphate of Ammonia.—Consumers are buying only sparingly; but there is greater firmness in the market (to be attributed mainly to covering by dealers), and prices show an increase all round. Supplies in Scotland are not too plentiful; and prices there have become relatively higher than they have been for some time past. The quotations, f.o.b. at the ports, range from £8 17s. 6d. to £9 per ton. There has been some business doing for forward delivery, in this instance by makers, at £9 7s. 6d. per ton Leith, and at about the equivalent London, over spring months; and some advance on this price is now required.

Nitrate of Soda is weak in all positions. On spot, 7s. 10½d. per cwt. is full value of fine quality; and late autumn shipments are worth barely 7s. 9d., ordinary quality.

LONDON, *Oct.* 12.

Tar Products.—The improvement mentioned in benzols last week has continued; and 90's have benefited considerably during the period. Business is reported having been done for delivery this year at 1s. 2d. in 90's, and 1s. 1d. for 50's; and inquiries for next year, especially for 90's, are plentiful. No doubt, the largely increased use of benzol for carburetting gas is, to a considerable extent, responsible for the improvement. Solvent naphtha is also being done at better prices for next year's delivery than for prompt. Pitch maintains its advanced value; and, both for prompt and forward delivery, recent high prices are still obtainable. Creosote is slack; and there seems no immediate prospect of better prices, although one can scarcely see how values can be reduced below their present rate. Carbolic acid is a little more inquired for; but very little change has arisen in the price. Crystals are steady. Anthracene is being sold at Committee's prices. Prices are: Tar, 18s. 6d. to 22s. Pitch, west coast, 36s.; east coast, 38s. 6d. Benzols, 90's, 1s. 1½d. to 1s. 2d.; 50's, 1s. to 1s. 1d. Solvent naphtha, 1s. 1½d. Toluol, 1s. 1½d. Crude, 30 per cent. naphtha, 5d. Liquid creosote, 1⅛d. Naphthalene salts, 27s. 6d. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d.; 75's, 1s. 9d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia.—There are more inquiries after sulphate, more especially for forward delivery; but little improvement has taken place in the prices, which still range from £8 12s. 6d. to £8 17s. 6d., less 3½ per cent., although considerably above £9 can be had for January-March. Gas liquor is quoted at 6s. to 7s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—So far, the change in the weather has had but little appreciable effect in bringing forward any increased demand for the better qualities of round coal. Here and there, collieries have been booking sufficient orders to enable them to work about five days per week—which is practically full time; but this is very exceptional, and four days is still more nearly the general average. Supplies are plentiful, and heavy stocks are held in most cases to meet the winter demand. Quotations remain at 10s. to 10s. 6d. per ton at the pit for best Wigan Arley; 8s. 6d. to 9s., for Pemberton four-feet and seconds Arley; and 7s. to 7s. 6d., for common qualities of house-fire coals. With regard to the lower descriptions of round coal, it is anticipated that the improvement in the iron trade may before long make itself felt as regards the demand for this class of fuel; but at present the output is so large, and stocks are so heavy, that no early material improvement in this direction can be looked for. Prices continue extremely low, not averaging more than 6s and 6s. 6d. per ton at the pit for ordinary steam and forge coals. Engine fuel is also plentiful for present requirements. But there are expectations that, with the improvement in the iron trade, the supply of slack will be largely drawn upon for coking purposes; and in some quarters there is a disinclination to quote for forward contracts. Prices at present are barely maintained at 3s. to 3s. 6d. per ton at the pit for common, and 4s. 6d. to 5s. for best qualities. In the shipping trade, business continues very slow, with no improvement as regards prices. Ordinary steam and forge coals do not average more than 7s. 3d. to 7s. 6d. per ton, with inferior descriptions for bunker purposes obtainable at 6s. 9d. to 7s. in some instances, although 7s. 9d. to 8s. is quoted for the better qualities of steam coal for cargoes, delivered at Mersey ports.

Northern Coal Trade.—There has been a rather marked change in the coal trade of the north-east in the last few days; and the stormy weather seems likely to add to the alteration by delaying vessels. There has been a lessened demand for the best steam coals, which is to be expected now that some of the northern ports are about closing their receipts of coal for the year. Best Northumbrian steam coals are thus weaker, and may be readily had at 8s. 6d. per ton f.o.b. Second-class steam coals are dull, at 8s. per ton; and steam smalls are at 4s.—the latter quality being now very scarce. In regard to gas coals, the demand is steadily increasing. The deliveries to London are on a very large scale; and are likely to get heavier for two months yet. Prices quoted generally for good Durham gas coals are 6s. 9d. per ton; but other kinds are obtainable at about 3d. per ton less. There is a continual increase in the local consumption of gas coal; and thus the pits are beginning to work more fully. Manufacturing coals generally are dull; but coking coal is in full demand, and is a little dearer. Coke itself is now in a much better position; there being more furnaces in blast, both in the Cleveland district and in the north-west. There is an addition of probably 9000 tons of coke weekly to the consumption—an increase which is very greatly stimulating the coke market. The price is about 13s. 3d. per ton delivered at local furnaces; and for shipment, it is 14s. 6d. to 14s. 9d. per ton f.o.b. There is no alteration in the price of gas coke; but in some inland centres, stocks are increasing.

Scotch Coal Trade.—A dull week has been passed; the commercial world being disturbed by the shipbuilding conflict. The demand for all sorts is small; and prices do not improve. The quotations are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. During the week, the shipments amounted to 156,923 tons—a decrease on the preceding week of 8937 tons, but an increase, as compared with the corresponding week of last year, of 131,081 tons. For the year to date, the total shipments have amounted to 5,610,123 tons—an increase compared with the same period of last year of 1,796,089 tons, but a decrease on 1893 of 231,827 tons.

Proposed Purchase of the Mid-Sussex Water-Works by the Local Authority.—At a meeting of the Cuckfield Rural District Council last Friday, it was resolved to make application to the Local Government Board for their consent to the Council giving notice to the Mid-Sussex Water Company of the intention of the Council to acquire the undertaking, pursuant to section 91 of the Mid-Sussex Water Act, 1890, provided the Board would make an order that the cost should be a special charge on the district to be supplied by the works.

The Experimental Water Borings at Richmond.—The Richmond Corporation having expended the whole of the last loan which had been sanctioned for their borings for water, the Committee who have the matter in hand, in view of the possibilities of obtaining an economical supply from other directions, have declined to recommend any further loan at present. Mr. Watney, one of the members of the Town Council, has offered to pay the whole expense of continued experimental borings during the next three months; and this generous offer the Council have accepted with thanks.

The South Molton Corporation and the Gas-Works.—At the suggestion of the Mayor (Mr. A. E. Shapland), the South Molton Town Council have decided to open negotiations with the Gas Company for the acquisition of the works. The subject was considered at a meeting of the Council last Tuesday, when the Mayor expressed the opinion that the time was opportune for the acquisition of the works, as the term of the present lessee was about to expire. The Corporation were the largest consumers of gas; and if they had control of the works he believed they would be able to reduce the price. Mr. J. E. Eldridge, a Director of the Company, said they would not stand in the way of the Corporation acquiring the works. They were at present in good order; and the Company were paying a dividend of 6 per cent. Their capital was £3300, and their rental was £247, which, after deducting £12 for fire insurance and repairs, left a net annual income of £235; so that the purchase-money would be equal to only fourteen years' purchase. Mr. Moor, a shareholder, also expressed the opinion that it would be a good investment for the Corporation; and a motion was carried in favour of negotiations being opened for the purchase.

Swansea Gas Company.—At the recent half-yearly meeting of this Company, the Chairman (Mr. T. Travers Wood) presented the Directors' report, which showed that the concern is in a prosperous condition, despite the two reductions in the price of gas since April, 1894. Mr. Wood remarked that it was gratifying to find that, after the payment of the full dividend, they would carry forward a small sum. There had been a decrease in the quantity of gas consumed, which had come as a surprise. He attributed it, firstly, to the introduction of the incandescent light, which had certainly been an important factor, during the last six months, in the consumption of gas; but he maintained that, so long as it gave a good light, the Directors were rather in favour of its use. In the next place, the bad trade of the town was too apparent to call for any remarks; but he trusted that the improved apparatus which the Company were now erecting, and which would shortly be at work, would encourage consumers to burn larger quantities of gas. No doubt the incandescent light would become the illuminant of the future, notwithstanding the electric schemes which were brought forward from time to time. There was no doubt that, with ordinary coal gas, consumed in incandescent lamps, the cost of gas was one-eighth that of electricity. He (Mr. Wood) did not think the towns people seriously agreed with the decision of the County Council with reference to the erection of electric lighting plant. The expenditure of the large sum of money required was entirely dependent upon one member. He thought, however, that the absent members of the Council would have something to say in the matter. The report was adopted; and votes of thanks to the Chairman and the Manager (Mr. Thornton Andrews) concluded the meeting.

Additional Borrowing Powers for the Huddersfield Corporation Gas Department.—The Huddersfield Town Council last Thursday instructed the Finance Committee to obtain powers, in the next application to Parliament, to raise £100,000 in respect of the gas-works extension capital account.

Proposed Extension of the Middlesbrough Water-Works.—The Finance Committee of the Middlesbrough Corporation have decided to make the necessary application to the Local Government Board for sanction to borrow £20,000 for a period of fifty years for the extension of the distribution plant.

The Automatic Prepayment Meter System for Middlesbrough.—At last Tuesday's meeting of the Middlesbrough Town Council, Alderman Hugh Bell, in moving the adoption of the Gas Committee's minutes, said the Committee desired as far as possible to put the benefit of the gas-works within the reach of the smaller consumers, and they proposed to adopt "penny-in-the-slot" meters.

Opening of New Water-Works at Coventry.—In the presence of the members of the City Council and a large number of citizens, the new Whitley Water-Works were opened by the Mayor of Coventry (Alderman Loudon) last Wednesday. The Engineers were the late Mr. T. Hawksley and Mr. Charles Hawksley; and in the borings at Whitley they have given the city an additional million gallons of water per day—a quantity which, with the existing provision, is sufficient for a population of 100,000 persons. New reservoirs have been built on the opposite side of Coventry to Whitley. The total cost of the scheme is about £65,000. The Mayor set the engines going, and the new supply flowed through the city.

The London Vestries and the Water Question.—At a meeting of the Lewisham Board of Works last Thursday, a letter was reported as having been received from the Kensington Vestry, referring to a resolution they had passed in favour of steps being taken for bringing the undertakings of the several Water Companies in the Metropolis under the supervision of a Central Board representing the ratepayers, as an alternative to the proposal for the purchase of the undertakings by the London County Council; and asking the Lewisham Board to send delegates to attend a conference which it is contemplated to hold in connection with the matter at an early date. The Works Committee reported that they did not think it necessary for the Board to take any action in the matter; and this was agreed to.

The Falmouth Corporation and the Gas and Water Works.—In answer to an inquiry from the Corporation as to the terms upon which they will sell their works, the Falmouth Water Company have written that they have no intention of disposing of the undertaking. The letter was laid before the Town Council last Thursday, when it was decided to refer it to the Gas and Water Committee. Mr. Grose, a member of the Council, said he hoped the Corporation did not think the Gas Company wished to dispose of their works; but they could be compelled to do so. Until the Corporation obtained these two undertakings, he should vote against all expenditure of money on other improvements. Mr. Phillips said he believed that by purchasing the water-works now the Corporation might save £1000.

The Meter-Rent Question at Halifax.—At the last meeting of the Halifax Town Council, Alderman Tattersall moved a resolution instructing the Gas Committee to consider the advisability of dispensing with meter-rents. He remarked that if the Committee were willing to entertain the resolution, he was not anxious to discuss the matter until they had had the opportunity of reporting to the Council. He should like to say, however, that the reason he brought the question forward was because the greatest bulk of the meters rented were 2-light ones, and were used by the poorer section of the community. He knew a great many people within the borough who were paying more for meter-rents than for gas. All he was concerned with was to get the Council to consider the matter. After some further talk, Alderman Brook seconded the motion, saying that when the next estimates were formed the Committee would probably make some provision to meet the matter. The motion was carried.

The River Dee and the Chester Water Supply.—A resolution was adopted at last week's meeting of the Chester Town Council, that application should be made to Parliament by the Council in the ensuing session for an Act authorizing the construction of sluices near the weir on the River Dee, and conferring powers for the prevention of the pollution of the river above the weir. A scheme for carrying out the work has been submitted by Messrs. Ransome and Rapier, of London and Ipswich, at an estimated cost of £21,890. The Chester Water Company are greatly in favour of the proposal, and are prepared to contribute towards the cost. By constructing the sluices across the old weir, there will be a complete division between the tidal and fresh waters; and the present intake of the Company will be relieved of the suspicion that the water taken in there is contaminated by the city sewage and the pollution that comes up the river. It is also understood that the Duke of Westminster will financially support the scheme.

Extension of the Bradford Water-Works.—At the meeting of the Bradford Town Council last Tuesday, the Chairman of the Water Committee (Alderman Holdsworth) moved the adoption of the minutes of the Committee, which included a resolution accepting the tender of Mr. P. Drake to construct, and maintain for twelve months after completion, a service reservoir, filter-beds, and other works at Chellow Heights, for £59,950. He said the works included the excavation, the construction of masonry walls, an earthen embankment, and filter-beds, the laying of pipes, &c. Mr. Drake's tender was the lowest of the twenty. There would be five filter-beds, each 50 yards square. The water would be distributed by gravitation to districts shown to be below 820 feet by the Ordnance survey, and also to some districts up to 840 feet, according to the level of the reservoir. Including Mr. Drake's, the total contracts entered into to date in connection with the Nidd scheme amounted to £565,000. This was the last of those involved in bringing water to Bradford; but the amount named was exclusive of valves and other appliances and the cost of the land. Alderman F. Priestman asked if the cost of the filter-beds was more or less in proportion than the other two. Alderman Holdsworth said it was less. The minutes were adopted.

New Water-Works for Cleveland (Ohio).—Messrs. R. Hering G. H. Benzenberg, and Desmond FitzGerald, the engineering experts who were recently retained by the city of Cleveland (Ohio) to consider the threefold problem of how best to increase the water supply, improve the sewerage system, and purify the Cuyahoga River, have made a preliminary report on the question of water supply. It was made in advance, in order that immediate steps might be taken to prepare for construction. The Engineers report that the two tunnels which now supply the city with water are large enough for several years to come if the pumps are lowered so that the water in the pump-wells can be drawn down to at least 20 feet below the lowest lake-level. As the pumps now in use are insufficient for even the present needs of the city, it is recommended that new pumping plant of at least 30 million gallons daily capacity be contracted for. The extension of the two tunnels to a new intake about 2½ miles farther out is advised; and also that surveys and borings should be made for a tunnel in the eastern part of the city, though its immediate construction is not recommended.

Sewer Assessments in Pittsburg (Pa.).—The plan of assessing for main sewers which has been in operation in Pittsburg for the past forty years is upon a watershed basis, by which all properties upon the watershed were assessed according to the benefits they received. The Supreme Court of Pennsylvania has recently upset this method in a decision made in a case affecting sewer assessments in Williamsport. Justice Mitchell has decided that the cost of a sewer cannot be assessed on this basis, and that assessments can only be made upon abutting property or on property draining directly into the sewer. Such property also can only be made to pay to the extent that it is benefited. The difference between the cost of the sewer and the benefits assessed on abutting property must be paid by the city. In justification of this decision, the Court points out that sewerage systems are a benefit to the city at large, as the sanitation of one part is a protection against the spread of disease to other parts, and that the whole city should be taxed for such benefits. In consequence of this ruling, considerable temporary inconvenience is anticipated, not only in Pittsburg but in other cities and towns of the State.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 774.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	24½-25½	+½	4 2 4
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	+½	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼—7¾	..	4 3 10
40,000	5	,,	6½	Do. New	4	5¼—5¾	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	207—212	..	4 4 11
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	222-227*	..	4 16 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	2 Sept.	11¼	British	20	54—55	..	4 1 10
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	..	5 2 2
51,510	10	,,	8½	Do. 7 p. c.	10	16½—17½	..	4 17 1
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8½—9	+½	4 8 11
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	101—104	..	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	305—310	..	4 7 1
165,000	,,	,,	10½	Do. New do.	100	225-230	..	4 11 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	280—285	+2½	4 11 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	+8	4 10 11
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25—26	..	4 4 7
351,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	294—298	+1	4 5 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c.Pf.	100	282—287	..	3 9 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145—150	..	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	248—253	−1	4 14 [illegible]
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	5¾—6¼	..	4 16 0
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113-116*	..	4 6 2
541,920	20	12 June	5	Monte Video, Limited	20	18—19	..	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 [illegible] 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	108—112	..	5 7 1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	26 Apl.	7	San Paulo, Limited	10	11½—12½	+½	5 12 [illegible]
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	310—315	..	3 16 2
308,685	,,	,,	13	Do. C do.	100	325—330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	..	2 16 6
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	293—298	+1	3 7 1
1,719,514	Stck.	10 Apl.	7†	East London, Ordinary	100	223—227	..	3 1 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	307—312	+4	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—265	..	2 16 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143 148*	..	2 13 4
500,000	100	14 Aug.	12¾	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147—152	..	2 12 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	295—298	..	3 7 1

* Ex div.

† Next dividend will be at this rate.

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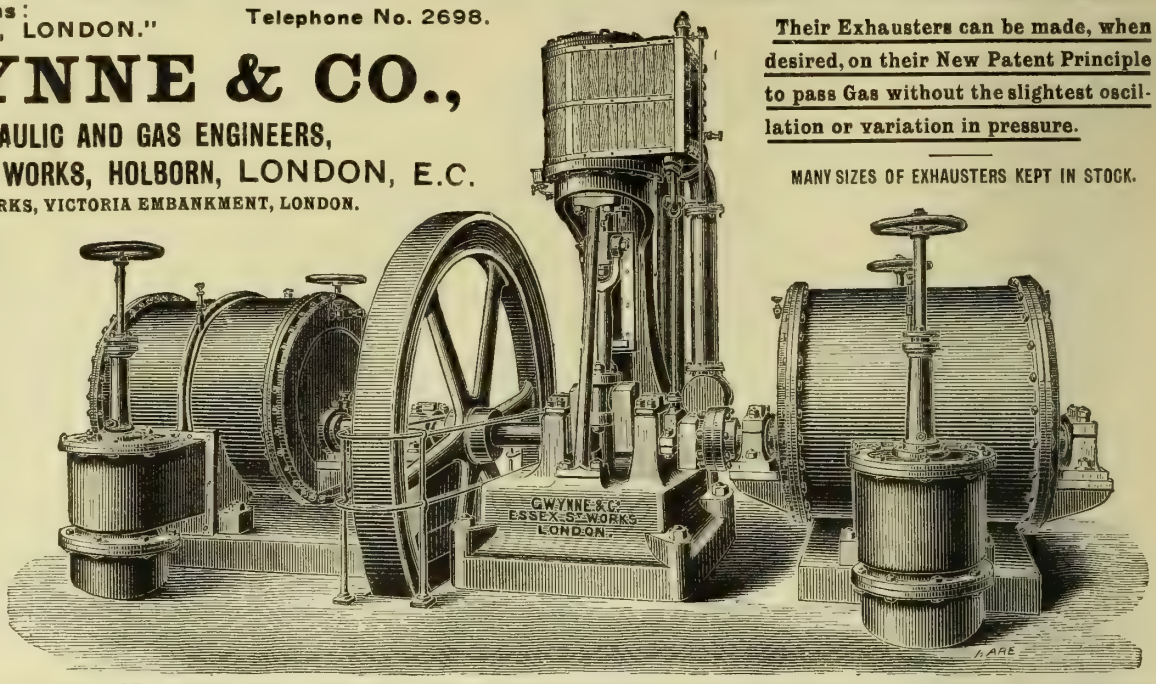

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

Why Should Municipal Gas Capital be Redeemed?

THERE is one aspect of the question recently raised in these columns respecting the redemption of gas capital, which—although touched upon in the last paragraph of Mr. George Livesey's letter of a fortnight ago only to be dismissed as not susceptible of useful discussion—may be very briefly considered as a sort of side-issue. It is the question why local authorities should be required to pay off their gas loans, any more than gas companies are permitted or enjoined to redeem their capital. Mr. Livesey thinks it useless to discuss such a question; and possibly he is right. But if he is also in the right in holding it to be "just that the consumers of any article should pay such "a price as will cover not only the cost of manufacture, "but also the equally fair charges for interest on the "capital required to carry on the business"—then the actual practice of municipal gas undertakings in this regard is unjust, and ought to be altered as soon as may be. Observe, it is not now a question of wiping off the extra capital indebtedness of a corporation undertaking attributable to the charges for goodwill, compulsory purchase, or any intangible but very real property of this kind. Municipalities have to pay for gas undertakings founded and developed by private enterprise, and safeguarded by statute, double the price at which the same material equipment could be started anew.

If the process of redemption were restricted to that proportion of the capital of a municipalized gas undertaking which is not represented by actual value in the shape of assets and money, there would not be so much difference between the condition as to capital of such a concern and that of one not so circumstanced. Seeing, however, that the process is not so limited, but that on the contrary everything has to be repaid within one or at most two generations, the time must come when consumers of municipal gas will be relieved from paying any capital charges whatsoever, except those for making extensions and for working with. It is not every such gas consumer who will reap the full benefit of this condition of affairs; for many will be required to subsidize the ratepayer the more heavily. But in places like Glasgow, the disappearance of cost of capital will put the consumer in a very different position from that occupied by the customer of a gas company of the same period. The question is, why the consumer of municipal gas should have this advantage, for which his predecessors will have paid. Is there not something inconsistent with the position of other property of the same kind, in the idea of a town possessing a gas-works worth any day a million of money—the amount, of course, is really immaterial—yet standing for nothing in the town books?

The inquiry is suggested as to whether this kind of eventuality was ever contemplated when local authorities were first permitted to trade with public money. How was it that the Local Government Board, who are supposed to look after these things, did not at least draw the attention of Parliament to the essential difference that exists between the application of public money to sanitary or administrative purposes and its utilization in trade? It is obviously desirable that money borrowed (say) for paving or sewering a town should be redeemed within a reasonable time. Money spent upon the improvement of a town is not always represented even by a definite increase in the rateable value; and it can, of course, never be recovered. A gas undertaking stands in a totally different category. It is always worth its value. The Manchester Corporation may never see back, in any form, the money they have poured into the Ship Canal; but if they were in danger of getting into serious financial difficulties over this venture, and needed to realize their property, a purchaser for the local gas undertaking could be found in a few hours. Why, then, tax the present consumer for reducing its capital below the actual, realizable value? The question may evoke no useful answer, but it is certainly pertinent to the whole problem of gas finance.

Liverpool Gas Affairs.

THE gas affairs of Liverpool continue to attract a considerable amount of attention, and furnish the local newspapers with something to interest their readers about, in connection with municipal politics. The name of Mr. George Livesey was mentioned in a Liverpool newspaper

as being that of the "eminent gas engineer in London" who would be retained by the Town Clerk to report upon the gas supply in accordance with the resolution of the City Council to set up competitive gas-works; but, as will be seen from a letter which appears in another column, this was a mere *canard*. It has afforded Mr. Livesey the opportunity, of which he has not been slow to avail himself, for giving the Corporation a bit of good advice as to how they ought to treat the gas question, which they have themselves raised. The Corporation have, of course, sadly muddled the business they took in hand, and now the Directors of the Gas Company decline to have any more interviews with the Corporation Lighting Committee, in face of the hostile action of the Corporation in passing their ridiculous resolution at the instigation of perhaps the least qualified of all the city councillors to guide them to a right decision in such a matter. Alderman F. Smith has not taken our advice to study the working of competitive gas supplies in the United States. But he thinks he knows something about how they manage these things in France; and, in a letter to the newspapers, he actually holds up the system in force in Paris as a model for Liverpool to admire! Does he know what is the quality of Paris gas, what it costs the consumer, what dividends the shareholders receive, and what is the nature of the perpetual *question du gaz?* To judge from the public discussions of the Liverpool Gas Company's doings, nobody in the city would be supposed to know anything about the existence of auction clauses in connection with the gas undertaking. The Corporation have appealed to Cæsar, as represented by the High Court of Parliament, for permission to expend public money in the laudable enterprise of ruining the "monopolists" who oppress the city to the extent of paying about 4 per cent. interest upon the capital sunk in the gas undertaking. If they have the courage of their opinions, to Cæsar they will go—and a pretty figure they will cut at Westminster, if they ever get so far. It would be an inestimable privilege to get the present men of light and leading in the Corporation before a Parliamentary Committee, and hear Counsel at the congenial task of obtaining from them a display of the special knowledge and general wisdom that elevated them to their pre-eminent position as experts in gas supply matters.

Meanwhile, there can be no question as to why there is in Liverpool that modicum of popular discontent with the gas supply which supports the agitation in the City Council. It is all a matter of the price; and this again is all a matter of the illuminating power. If the Corporation had the works to-morrow, they would not make gas of the same quality as the Company are compelled to send out. There is no gas in England like it. This is what makes the present agitation so unfair to the Company. Not being able to say that the gas sold in Liverpool is not all that it should be, the enemies of the Company have tried to make out that it is no more costly to produce than that supplied in other towns, which is absurd. If the new City Council should happen to contain a few more sensible men than the present egregious collection, and these should take up the gas question with the idea of doing some good to the city in the matter, without despoiling the Company, they will act upon Mr. Livesey's sound advice, and take counsel with the Directors as to effecting a reduction in the standard of illuminating power. The Town Clerk has been instructed to initiate parliamentary proceedings in this connection; and the notices that must be drafted can be made to cover anything and everything it will be found advisable to do. Mr. Livesey cannot help the Corporation to attack the Gas Company; but he would probably consent gladly to help both Corporation and Company to settle what is the most economical standard of illuminating power that could be adopted for the gas supply of the future. In this direction, and no other, is cheap gas to be sought. Only those who are wilfully blind can fail to see this way out of the trouble of Liverpool, which arises simply from the fact that the fetish of the photometer receives sacrificial offerings to the tune of at least £80,000 a year.

The Need for Neat and Clean Street Lamp-Posts.

Favourable mention was made in a recent issue of the *Daily Graphic*, of some new street-lamp standards that have been fixed by the Vestry of St. Martin's-in-the-Fields in front of the new buildings of the National Portrait Gallery, which stand at the back of the National Gallery. It is somewhat surprising that the writer who does the art criticism for our brilliant daily contemporary should have taken the trouble to notice such a comparatively small contribution to the embellishment of the London streets; for it is probable that hardly one of a hundred passers-by would observe anything particularly striking about these unobtrusive lamp-posts. But we nevertheless hail the circumstance as gratifying, and at the same time encouraging. As we have often urged in these columns, there is a very great deal of lost ground to be recovered in this direction before London can challenge comparison of its public lighting arrangements with Paris, which is the cynosure of everything that can be designated municipal civility. The street lamp-posts of Paris, it must be admitted, err on the side of ostentatious adornment; but it cannot be denied that ours are, as a rule, very much the other way. The new St. Martin's pattern is a very neat specimen of iron casting, tastefully painted olive green, lined and picked out with dull red. The ladder-rest projects equally on two sides; and the only special attempt at adornment, under the suggestion of the *genius loci*, is a medallion on the base portraying St. Martin dividing his cloak with the beggar. Nothing could be neater or nattier, with due observance of the proprieties that circumscribe the opportunities of the designer of a street lamp-post intended for use rather than as a monument, than these standards. Few people, unless their attention had been specially drawn to them, would bestow a second glance upon them as they stand in front of a public building intended to fill the observer's eye; but when noticed they would not be a disappointment, much less an eyesore. It is for leaders and formers of public opinion, on the platform and in the press, to instruct local authorities in all these points, great and small, upon which the character of the aspect of our streets depends.

There exist in the St. Martin's and in other districts, town and provincial, hundreds and even thousands of lamp-posts put up half-a-century and more ago, which, rude enough originally, have been smothered since under so many coats of paint, that they are now about as defined in outline as a sausage, and incline so far out of the perpendicular as to appear to implore that rest from their prolonged vigil which considerations of false economy still deny. It is greatly to be wished that the authorities who are responsible for giving and maintaining an air of smartness in the streets, would look more keenly into this matter of the lamp-posts, and remove the old stagers which, although aged, are not in the smallest degree venerable or picturesque in their decrepitude. And when they do set up new and acceptable lamp-posts, it could be desired that they should show more solicitude about keeping them clean. A dingy or smeary lantern is a great reproach to whoever may be responsible for its condition; and cracked and broken glass is the abomination of desolation. But, in England, lamp-posts, railings, guard-posts, and all the miscellaneous appurtenances of a modern thoroughfare, usually exhibit an innocence of soap and water that is anything but creditable to us as a cleanly people. We claim as a national trait the habit of washing ourselves oftener and more thoroughly than our Continental neighbours. Our consumption of detergents is enormous, and its statistics would probably show that the claim of the people to be cleanly in their persons and habits is just. But it is only too obvious that, in the matter of maintaining the appearance of those streets and other public structures and fittings which are everybody's business to use and defile, these same neighbours leave us far behind. We make the best roads and pavements in the world, and do not half clean them. We erect the most attractive-looking business buildings, and leave them to be splashed and stained out of half their beauty. Our railway stations, post-offices, churches, public offices, places of entertainment, are lost in filth where the daily sweeper does not perform his perfunctory duty; and so it is small wonder that the street lamp-post is similarly neglected. The last-named is a small thing to clean; but if a beginning were made with it, who knows what the force of example might effect?

The Law of Local Authorities and Gas Shareholders.

A special meeting of the Reigate Town Council has been recently held for the purpose of considering various local questions in regard to electric lighting; and in the course of the proceedings—shortly reported in another column—objection was taken to an Alderman, who is a Director

of the Gas Company, voting in connection with the matter. This point has often been raised on similar occasions, with the usual result of the gas shareholders declining to take part in discussions of, or voting upon, such questions. Reference was made at Reigate, however, to an opinion of Mr. G. Humphreys, Barrister-at-Law, recorded in the JOURNAL for April 10, 1894, which was to the effect that in the case of certain members of the Monmouth Town Council who were also shareholders and Directors of the Monmouth Gas and Water Company, there was nothing in the Municipal Corporations Act, 1882, to prevent their taking part in the discussion of, or voting upon, any resolution dealing with the electric lighting scheme. The Act declares that no members of a local authority, having pecuniary interest, direct or indirect, by themselves or their partners, in a question to be decided by such local authority, shall vote upon it. The principle of the enactment is clear enough; and the only question that arises concerning it is as to whether the fact of being a gas shareholder does give a member of a local authority a pecuniary interest in the settlement of an electric light project by that authority. Mr. Humphreys opines that it does not; but when the Town Clerk of Reigate (Dr. Clare J. Grece) was about to overrule the point raised the other day in this sense, a contradictory opinion by Mr. R. S. (now Mr. Justice) Wright, as well as one by Sir R. E. Webster, was brought to his notice; and he therefore refused to put his own ruling in opposition to such authorities. In the end, it was decided to take further Counsel's opinion upon the point; but, in the meanwhile, it may be of interest to trace the history of Mr. Wright's adverse construction of the statute. This opinion seems to have seen the light at Wells early last year, when the same difficulty cropped up at a meeting of the Town Council, sitting in Committee. The question was referred to the Municipal Corporations Association; and a reply was received that it is illegal for gas shareholders to vote in regard to such questions. The persistence of a Wells town councillor in maintaining his right to vote, drew the attention of an electrical journal to the subject; and the Editor thereupon published Mr. Wright's opinion, with the explanation that it had been obtained by Mr. Sidney Morse, and made known originally by Mr. E. Garcke. It was reproduced in a local newspaper. It is therefore evident that it was in the supposed interest of the electric light industry that the law was invoked to stop gas shareholders taking part in this kind of public business. It appears to the ordinary man, however, that, if Mr. Wright's interpretation of the law is correct, it is a straining of the statute that may, in certain circumstances, work grave practical inconvenience, while it can hardly do very much good at any time. Of course, the converse proposition must equally hold good; and no electric light shareholder upon a local authority can act in the settlement of any gas business. It is easy to imagine a case where a large proportion of the members of a local authority might, for this reason, be incapacitated from taking part in a class of public business in regard to which the ratepayers might desire to have their assistance.

Personal.—The Right Hon. David Robert Plunket, upon whom Her Majesty has recently been pleased to confer the dignity of a peerage, will be remembered by many of our readers as the Chairman of the Select Committee of the House of Commons who had referred to them the London Water Bills of last session. He was born in 1838; was educated at Trinity College, Dublin, where he graduated B.A. in 1859 and M.A. and LL.D. in 1875; and was called to the Irish Bar in 1862. He was appointed Q.C. in 1868, was Law Adviser to the Irish Government in 1868, Solicitor-General for Ireland from 1875 to 1877, Paymaster-General (and Privy Councillor) in 1880, and was First Commissioner of Works from 1885 to 1886 and again from 1886 to 1892. He is a Director of the London and North-Western Railway Company; and he has represented Dublin University in the Conservative interest in Parliament since February, 1870.——Mr. G. F. Cutting, of Hull, has been selected to fill the position of general foreman at the Bombay Gas-Works, applications for which were invited in the JOURNAL for the 10th ult.——The appointment of Mr. F. Gibson, of Carlisle, as Manager of the Chelmsford Gas-Works, has already been announced in our columns. Last Thursday, Mr. Gibson was the recipient of a handsome black marble timepiece as a memento of the good feeling entertained towards him by the officials and workmen of the undertaking he is now leaving.

WATER AND SANITARY AFFAIRS.

LONDON is in perplexity as to the prospects of the water supply. The County Council have negatived a proposal that "the Bills for the purchase of the London Water "Companies be proceeded with." It is true that this decision was arrived at by a bare majority of one. But it was enough; and it was just such a majority which secured the second reading of the Bill of the East London Company in the House of Commons last year. This majority of one seems destined to work wonders in connection with the Metropolitan Water Question. Lord Farrer may be said to have turned the scale on the present occasion, by casting in his lot with the Moderates. Had his solitary vote been given on the Progressive side, the majority of one would have been in favour of going on with the Transfer Bills. The Deputy-Chairman (Mr. Dickinson) declared himself "amazed" at Lord Farrer's attitude on this occasion. From our own point of view, his Lordship's reasoning was none of the best; but his vote was right. The result of the debate was certainly a surprise. The question came before the Council on a report that was presented by the Parliamentary Committee, recommending—as we mentioned last week—that the Council should invite Her Majesty's Government either to deal with the subject of the Metropolitan Water Supply themselves, or else appoint a Royal Commission for the purpose. To this an amendment was moved by Mr. Stuart for proceeding with the Purchase Bills; and it was this amendment which suffered rejection by a majority of one. It could not be called a very small division, though it might have been larger; the votes being 53 for the amendment and 54 against it. Had the recommendation of the Committee been forthwith put to the vote, presumably it would have been carried. But the debate was adjourned; thus opening the way for further amendments. For the present, the Progressives are discomfited. We might say they are astounded. Certainly they are indignant. The *Daily Chronicle* hurls its choicest epithets at the Moderates. Their policy is asserted to be "a policy of blackmail—a trick on the ratepayers—an "insult to the water consumers—a wrong to the poor—a "peril to the community." Mr. John Burns, M.P., threatens that, if things go on in this style, "the Pro-"gressives will no longer feel themselves responsible for "the administration of London government." It happens that London has already gone a long way towards relieving the Progressives of any such responsibility, and may be expected to complete the process at the next election. This dire threat of leaving London to the mercy of the Moderates was even uttered by the *Daily Chronicle* in a leading article on the morning of last Tuesday. If the Progressives failed to get their own way on the water question, it was advised that they should "throw up the reins of power on the Council ,and give "the obstructives on the Parliamentary Committee full "responsibility for an odious policy." We can only say, if this is the spirit of the Progressive party, it abundantly proves they are not the proper party to govern London.

The accusation launched against the Moderates is that they have changed their policy, and are opposed to a municipal water supply. "Municipal" is a word to conjure with. "Public authority" is the term used by the Parliamentary Committee, and is a recognized phrase, dating back to the time of the Duke of Richmond's Commission. It is for a public authority that the Parliamentary Committee and Lord Onslow contend. His Lordship boldly declared, in last Tuesday's debate, that "the time "had come when they could no longer allow the water "supply of London to remain with the Water Com-"panies." But Lord Onslow went on to say explicitly that "he joined issue with the Progressive party "as to what should be the Water Authority." The practical help to be derived from a Royal Commission was expressed in three propositions, and yet the organs of the Progressive party see nothing in this proposal but a device to delay the final settlement of the question, and promote the interests of the Water Companies. The proposal to hand over the undertakings to a public authority is also opposed as something which is intended to procure better terms for the present proprietors. Nothing is right unless it is in the hands of the County Council. The Moderates who form part of that body are

attacked by *London* as having "betrayed the interests of "the ratepayers," and acted with "treachery" towards the Council in respect to the water question. On the other hand, a well-toned article in the *St. James's Gazette* congratulates the Moderates on having "reversed the "impracticable policy adopted when the Progressives "were in power." Objecting to a Royal Commission, as unsuitable, the *Gazette* commends the idea of "putting the "whole thing into the hands of the Government," and hopes the Council "will decide boldly to demand a Bill." The Government are urged to undertake the task, seeing that "the responsibility for the new scheme, fashion it "who may, must in the long run rest with the Cabinet." Our contemporary says: "The question is ripe for settle-"ment." We remarked last week: "It is evident that "the Metropolitan Water Question is fast ripening;" but we further said: "There are indications that the fruit is "not likely to be to the taste of the County Council." So we find the *St. James's Gazette* giving weighty reasons why the Council should not have possession of the water supply. But why should a "settlement" of this question necessarily involve any change of proprietorship? The *Daily Chronicle* vehemently asserts that "the water mono-"polies have broken down in their function of supplying "London with a prime necessary of life." Such a statement is simply contrary to fact and to common sense. But it is supposed to answer a purpose.

The Staines scheme of storage in connection with the Thames, has been the subject of further reference in *The Times* on the part of Lord Farrer, who seems anxious to know whether, if the plan were carried out, the Water Companies concerned would exercise some new rating or charging powers. Of course, that depends on the wisdom of Parliament, as intimated by Colonel W. T. Makins, who advises Lord Farrer that he will obtain some answer to his inquiry when the Companies give their parliamentary notices and deposit their plans—events "for which he will "only have a short time to wait." With respect to the Welsh plan of the London County Council, an organized opposition is growing up in Glamorganshire and other counties affected by the project. An agitation for a Parliamentary Commission is talked of. Two long articles in the *Pall Mall Gazette* favour the Welsh scheme, though giving many facts which point the other way. At the adjourned debate on the recommendation of the Parliamentary Committee in the County Council to-day, Mr. Beachcroft will move an amendment referring the question of the Metropolitan Water Supply to the Government, without any allusion to a Royal Commission. Colonel Ford has an amendment, proposing that the Government should be asked to communicate its decision to the Council before the reassembling of Parliament, "so that, in the "event of the decision not being acceptable to the Council, "the Council may have the opportunity of reconsidering "the whole question."

Masonic.—Bro. Thomas Acland (Secretary and Manager of the Brynmawr and Abertillery Gas Company) was last Thursday installed W.M. of the Homfray Lodge, No. 1562, meeting at Risca.

Imperial Continental Gas Association.—The Directors of this Association recommend the declaration of a dividend of 5 per cent. for the half year ended June 30, together with a bonus of 1 per cent.

Water-Works for Madras.—On Thursday, the 10th inst., the Periyar Water-Works, constructed to supply the Madura district of Madras, were opened by Lord Wenlock, the Governor, in the presence of a large concourse of visitors. Colonel Pennycuick, Secretary to the Madras Public Works Department, has been created a Companion of the Order of the Star of India in commemoration of the event.

"Practical Gas-Fitting from Main to Burner."—Under this title, Mr. H. O'Connor, Assoc.M.Inst.C.E., who a short time ago relinquished his appointment at Beckton to take the management of the gas-works apparatus department of Messrs. James Milne and Son, Limited, in Edinburgh, is contributing a series of articles to the *Building World*—a new weekly trade journal which Messrs. Cassell and Company, Limited, started upon its career last Saturday. We lately felt it incumbent upon us to comment somewhat adversely upon a book which professed to be an up-to-date production on this subject by a practical man, but which was really much behind the times. We are sure that Mr. O'Connor's will be free from the defects to which attention was then called, and that the special classes of workmen for whom the publication is intended will peruse—and not merely peruse, but study—his articles with profit.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 812.)

NATURALLY, the feature of the Stock Exchange during the past week was the settlement of the account in the South African market, dominating every other consideration. The air was full of rumours, industriously put about by interested "wreckers;" and a good deal of nervous apprehension was engendered. The other markets held their breath awhile, not daring to move until it was seen how things in the focus of agitation were going to turn out. However, the worst was avoided. Prices fell freely, and weak holders were knocked out; but there was nothing like an important failure which would produce much trouble. The business went through very smoothly, all things considered; and the markets will be all the better for the storm by-and-bye. There is no change in the Money Market. The Stock Exchange requirements elicited better rates; but they could have been met twenty times over. Business in the Gas Market was somewhat more active than in the preceding week. The general tendency in favour of firmness was well maintained. A large number of quotations made substantial advances; and the chief exception to the upward movement was in the same undertaking which retrograded in the week before. Gaslight "A" opened very steady, and touched 297¼; but later prices realized were not so good, though the quotation showed no change. There was nothing worth mentioning in the secured issues; very few bargains being done in them, and at middle figures. Transactions in South Metropolitans were extremely limited. Prices for the ordinary stocks were not very grand; but the debenture stock rose in value. A couple of transactions in Commercial new saved it from absolute stagnation. The quotation of both stocks was slightly, but very inadequately, advanced *ex div.* The Suburban and Provincial Companies were just as quiet as usual; but an unusually large number of them improved upon their old prices. Brentford new, which had been put a great deal too far in front of the old, was brought back a couple of points. The Continentals were again irregular; European rising, while Imperial fell back a point. Among South Americans, Buenos Ayres and San Paulo again moved up. The Water stocks were very quiet; and the only noticeable feature was a smart advance in East London.

The daily operations were: Very quiet business in Gas on Monday; but prices were good. Both Bromley issues rose 1; European, ½; and Malta, ¼. But Imperial Continental fell 1. East London Water gained 2½. Tuesday was not much busier in Gas; and the only move was a fall of 2 in Brentford new. There was a shade more activity on Wednesday; and prices were good. South Metropolitan debenture rose 1; and Buenos Ayres, ¼. Thursday's transactions were much the same. British advanced ½. Friday's business was mostly in Gaslight "A"; figures being only moderate. Bromley new rose ½. Saturday was quiet as usual; and quotations underwent no further change.

ELECTRIC LIGHTING MEMORANDA.

The Opening of the Bristol Electric Tramway—The Interest of the Bristol Gas Company in the Execution of the Tramway Works—Sufficiency of the Board of Trade Regulations.

SIGNS are multiplying as to the disposition of electricians to turn towards electric traction in the hope of redeeming the fortunes of an industry to which the lighting business has proved so unkind. There has been jubilation in the electrical journals over the opening of the Bristol electric tramway, as being the first example in this country of the application of the trolley-wire system to tramway work in an important city. According to the local newspapers, this event duly came off on Monday of last week, and was "a wonderful success in every respect." We are unreservedly glad of this, for many reasons. It will be a good thing for the electric industry if there should prove to be a fair amount of reasonably paying work to be done in the matter of electric tramway equipment and working in this country; and it will also be good for the community if the generally slow and too often distressing work of horses upon tramways can be superseded by something better. At the same time, we do not share with some of our electrical contemporaries in the confident anticipations they indulge in respecting the effect which even the general substitution of electric for horse traction would have upon the industry represented by them. If there should be ever so much fresh work of this kind to be done, there would be an even greater increase in the number of contractors to compete for it; and after a very short time, that would happen in this connection which has blighted the prospects of the firms who laid themselves out for lighting business. One at least of the electrical journals perceives this danger looming through the rosy future which the advent of electric traction for tramways is to bring to the industry, and remarks upon this head: "It will be most gratifying if electric traction is the means of revivifying the condition of some of our manufacturing firms; but, without desiring to minimize expectations, it is of vital importance that there should not be in tramway

contracts a repetition of some of the methods that have been adopted in electric lighting work. There are manufacturers who can point to long lists of contracts which they have carried out for this and that municipality; but we doubt whether they are a penny the better for it. Others would have been wise if they had retired from business before they commenced. Next to losing a lighting contract, the worst that can happen is to obtain one." This is a bitter saying, but it is doubtless true; and, unfortunately for those whose fate it will be to "face the music," there is no apparent reason why the latter state of the electric manufacturing industry should in this respect be better than the first.

To return, however, to the Bristol tramway. The line is four miles long, running from near the centre of the old city to Kingswood. Bristol is a hilly city; and part of the line has a very steep gradient, which seems to have been too much for the horses formerly employed by the Tramway Company. The streets traversed carry a heavy general traffic; and it remains to be seen whether the electric arrangements will interfere with the ordinary use of the road for other purposes. It is stated, as might be supposed, that the posts and wires do not spoil the appearance of the thoroughfare, and are not in anybody's way. But this again must be regarded as a question for time to answer. At any rate, the Company have been solicitous to avoid giving occasion for complaint in these respects; and although, to avoid making mistakes, the equipment of the line has been entrusted to experienced American contractors, the style in which everything has been done is very superior to that with which most American towns have to be content. On the occasion of the formal inauguration of the line, the eight cars constituting the rolling stock easily covered the distance, including stoppages, in half an hour; and there can be no doubt that such a service will be highly appreciated by the residents of a district which, by reason of the steepness of the roads, has been without railway accommodation. We notice that Dr. Silvanus P. Thompson attended the opening function, and gave his benison upon the undertaking. He told the company present on this occasion that he had been engaged by the Bristol Gas Company and the Water Company to keep an eye upon the execution of the works, and advise them if anything prejudicial should occur. After seeing how the job was being done in all respects, he has formed the opinion that there is not likely to be any trouble from leakage or anything of the sort during the next ten years. A full and elaborately illustrated account of the line appeared in the *Electrical Review* for the 11th inst.

There is not a great deal to be said concerning the electric equipment of this, the pioneer city trolley-wire tramway of the United Kingdom. The large margin of power inevitable in every system of electric traction is also noticeable here; three Willans engines, indicating 135-horse power, being provided in the power-house, which is situated near the middle of the line. There should be no fear, therefore, of the cars refusing to start in any circumstances. There is an admitted risk, in connection with this overplus of power, of the motors being injured by careless handling on the part of the driver. Drivers have to be trained in the matter of starting, which is the critical operation. Afterwards, with a good trolley appliance, all is plain sailing. An interesting feature of the Bristol line is the fact that it is the first to be constructed under the new Board of Trade rules, which have been characterized by some electricians as superfluously stringent. These rules set out, among other things, that the difference of potential between the farthest and the nearest ends of a return shall not exceed 7 volts, and that the leakage shall not exceed 0·01 ampère per mile of tramway. The importance of the latter provision, in the interest of the owners of pipes buried underneath the surface of the roads covered by the tramway, is evident. It is satisfactory to learn that the tests made of the Bristol line show that it is possible to keep well within the Board of Trade limits of difference of potential and leakage. On the occasion of a severe test, when half-a-dozen cars were bunched up at the end of the line, the drop of pressure only amounted to 3½ volts, while the leakage current was 0·01 ampère for the whole length of the line. It is not for gas or water companies to object to electric tramways, if these undertakings can be safely installed and worked. The officials of the Bristol Gas and Water Companies were justifiably troubled in mind during the execution of the works which we have now briefly described; and the attention of gas and water works engineers all over the country may be directed to the Bristol experiment, as a foretaste of what we may get a good deal more of, if the system succeeds upon its merits. It is therefore a matter for thankfulness that the regulations of the Board of Trade have proved proper and sufficient for attaining the end to which they are directed.

Midland Association of Gas Managers.—The autumn meeting of this Association is called for Thursday next, at the Grand Hotel, Birmingham. The technical business will consist of the reading and discussion of two papers—one by Mr. John Young, on "Two Years' Experience of Prepayment Meters;" the other by Mr. W. T. Tew, entitled "An Incident in Purification." The officers for the ensuing year will be elected; and a motion will be proposed, on the recommendation of the Committee, to the effect that future meetings of the Association be thrown open to representatives of the technical press.

WRIGHT'S PREPAYMENT METER.

The history of automatic prepayment gas-meters will perhaps be written some day by a competent authority, who will be able to appraise, with the fairness that distance lends to the view, the comparative value of the labours of the many different hands that have been busied with this particular application of the popular principle of the "penny-in-the-slot." At present, it is only possible to chronicle, as they arise, the appearances upon the horizon of commerce of one after another of the prepayment meters that owe their first introduction to the technical world to the publications of the Patent Office. It has been our duty to commend to the notice of our readers several promising gas measuring and retailing instruments of this order; and in every case we have been constrained to believe that the force of ingenuity could no farther go in the direction of satisfying the requirements of both suppliers and consumers of gas. As time has rolled on, however, it has been made apparent not only that there is an insatiable demand for as many good and reliable automatic prepayment meters as the makers of accepted articles of the kind can turn out, and more; but also that some of the best of these, when put to the practical test, still left something to be desired. All sorts of unsuspected difficulties and hitches have been discovered, and for the most part overcome, in the practical working of the automatic prepayment system; but it appeared by the transactions of the last meeting of the North of England Gas Managers' Association that there still remains a blemish upon the system which, unless and until it is entirely removed, will operate far more seriously to its prejudice than all the cruder troubles due to the trickery of fradulent consumers, and so forth, which at first troubled those who had to do with the introduction of the system. We allude to the alleged frequency of discrepancy between the operation of the prepayment mechanism and the registration of the meter itself. How serious and troublesome this feature of the system—as illustrated by the meters already in the market—may be, is not for us to say; still less is it our task to explain how the trouble arises. The object of the present article, however, is to bring before the gas industry a meter for which it is claimed, among other good qualities, that it is practically and mechanically impossible for the contents of the cash-box and the registration of the meter-index to disagree, for the very simple reason that *the money does not enter the box until the corresponding volume of gas has actually passed through the meter.* This meter is the invention of Mr. Frank Wright, of the firm of Messrs. Alexander Wright and Co., and is being manufactured and placed upon the market by a newly-formed Company called Frank Wright's Prepayment Gas-Meter Corporation, Limited, who have already started large works in London for this purpose.

The general appearance of the meter and the mode of setting it in action are shown by the illustrations given on pp. 826-7. It will be seen, to begin with, that the whole arrangement is extremely neat; the only outside addition to the meter consisting of the money-box on the left-hand side, and another attachment, which is also a money-box, on the top of the case. The former is for money that has purchased gas and is ready for the collector; the latter is for the coppers, or the shillings, as the case may be—for the meter can be set to sell gas by any chosen unit of value—which are actually in reserve for effecting the same operation. The user merely has to lift the latch on the top of the tube, as shown, and insert the coins, of which as many as twenty-four can be accommodated, the exact number thus held in suspense being indicated by a pointer on the front of the tube. An index over the ordinary measurement dials shows how much gas will be dispensed for every penny paid. What happens when money is put into the slot is briefly as follows: The sliding cover to which the latch is attached, and lifts up to take in the money, is a weighted tube that presses down the coins; the first or lowest one coming into contact with the rounded top of a spindle carrying the gas-valve. This valve is kept closed by a counterbalance weight, until opened by the coin in the manner just described. Be it observed that it is not the weight of the coin that is depended on to open the valve, but this weight *plus* that of the sliding cover. After (say) three or four pennies are inserted, the additional weight of the cover is not required; but it is necessary in order to make only one or two coins operative. At the bottom of the tube, there are provided claws, which hold the lowest coins down upon the bearing, and prevent their rising in case the weighted cover should be lifted again for adding more coins. This is an important safeguard. The lowest coin not only presses down the gas-valve, but also drops into a hole cut to take it in a disc-wheel, the rim of which is cut into teeth that engage in a worm-wheel on a sleeve carried upon the first spindle of the index. It is obvious, therefore, that as the worm-wheel turns, it will revolve the disc-wheel, and so cause the latter to carry its coin away from the top of the gas-valve spindle. Not until the allotted volume of gas has passed, and has (in passing) revolved the worm-wheel and the wheel with the penny sunk in it, can the latter clear itself sufficiently to drop down into the shoot that conveys it into the money-box. As one coin drops, another takes its place; and the last coin leaves the gas-valve spindle with sufficient slowness to warn the consumer, by the gradual rise of the valve, and consequent lowering of his light, that it is time to put in more money.

It will be understood from this much condensed description

of a highly ingenious and strikingly simple device, that only one coin at a time is really allowing gas to pass. There is no setting back the index; no drag upon the index to close a gas valve; no passing coin after coin directly into the money-box after it has been made instrumental in pushing some adjustment into place which may or may not work out correctly in harmony with the registration of the meter. The gas-valve is a simple gravity dead-action valve; and the moment the last coin has cleared itself from its operative position, the gas must be shut off—although not suddenly, as already observed. The same attachment will take pennies or half-pennies, and will pass a proportionate quantity of gas for each denomination of coin.

The adjustment of the volume of gas to be dispensed for every unit of cash prepayment is simply made, and can be effected *in situ* after a seal has been broken. It is actuated from the first spindle of the index train—the same that carries the sleeve upon which the worm-wheel already mentioned is mounted. It consists merely of an arrangement of cams and pawls whereby the sleeve in question can be made to revolve with the spindle, or can be made to miss any portion of a revolution up to about one-half. Thus the speed of delivery of the penny from its duty of allowing gas to pass, can be modified within wide limits; and as it is the revolution of the first spindle of the meter-index that does all the work, not only is the operation of the prepayment attachment really automatic and dependent upon the passage of the gas itself, but the accuracy of the adjustment of the two elements of the meter can be brought to the greatest possible nicety.

So much for the prepayment apparatus. The meters, however, that are to be made by the Company named above, will not depend for purchasers upon this attachment alone, but will claim attention for general excellence of design, workmanship, and material, as well as facility for repairs. Mr. Wright has devised a remarkable series of machines for making every part of all sizes of meters; and he has reduced the need for skilled labour in assembling the parts to an astonishing minimum. Moreover, by far the greater part of the soldering that has hitherto gone to the making of the dry meter is also done away with. All parts are made to gauge, and are accordingly interchangeable; and by the adoption of the principle of subdivision of labour, the efficiency and capacity of the factory have been enormously increased as compared with that of an establishment worked upon less advanced principles. It is not too much to say that, if they carry out their programme, the new Company will put a fresh aspect upon the gas-meter trade, since they appear bent upon inaugurating reforms in this most important industry, from which the gas-consuming public can hardly fail to derive much advantage.

PRESERVATIVE PAINTS.

(*Concluded from p.* 777.)

Mr. Wood admits that the production of a paint which is capable of resisting all the destructive agencies already named is a difficult matter. The field is an enormous one; and but little positive knowledge has yet been obtained respecting it, although the investigators and their experiments have been legion, and the literature of the subject fills volumes. This is mainly because time is an essential factor in test of a paint; and if an experimenter is required to wait five or ten years to determine the merits of a paint, or what effect a slight modification of the proportions has upon any one or more of the eight destructive agencies we have considered, a lifetime would easily be spent before a conclusion could be drawn.

Fortunately, to an extent, for engineers, paints for structural purposes are not required to last for a lifetime, but only to keep the structure sound from one periodical overhauling to the next, which is usually no great interval. At the same time, the paint should be as durable as art can make it, for obvious reasons. Mr. Wood's list of acceptable preservative paints comprises the natural and artificial asphalts, with their compounds; iron oxide paints; zinc and lead oxides and carbonates and other metallic paints; carbon paints—all of which he discusses *seriatim*. We shall summarize the information given by his paper upon these matters. As to natural and artificial asphaltic coatings, Mr. Wood states that, "with proper care in their preparation, in order to eliminate the ammonia and organic matter subject to decomposition and the formation of corrosive acids, and when applied hot to clean, dry surfaces free from mill scale, and warmed to any degree under that of boiling water, they are not only cheap in cost, but seldom need renewal, and form one of the best of protective coatings." Upon iron oxide paints, Mr. Wood is decidedly unorthodox—declaring that such paint, as he knows it, is anything but protective to ironwork; and he cites Mr. Emil Gerber as another heretic in this regard. These observations are depreciative in value by the omission of all reference to paint made from natural oxide, which does not appear to occur in the United States, since both Mr. Wood and Mr. Gerber write only of such paint when made from artificial sesquioxide by different methods.

As to zinc oxide paints, Mr. Wood states that they are most unsatisfactory by reason of their tendency to peel off from metallic surfaces, as already mentioned. When mixed with red lead, in the proportions of one-quarter to one-third of the zinc to three-quarters to two-thirds of red lead, ground together in raw linseed oil, the result is improved, but the paint sets slowly. White lead paint forms a very effective coating for ironwork, if it is protected from atmospheric influences. Mr. Wood also speaks favourably of sublimed lead paints; and he describes red lead as perhaps the oldest mineral pigment known. He declares that there is no other pigment used as a protective covering for all kinds of surfaces that gives such uniformly satisfactory results as red lead. One ounce of lamp-black added to every pound of red lead in powder, mixed together dry before the oil is added, changes the colour to a deep chocolate, and prevents the red lead from taking its initial set with linseed oil so quickly as when the lead is mixed with oil alone. This compound will remain in paste form for thirty days without hardening.

Mention is made of the use of manganese dioxide ore (pyrolusite) as a preservative paint. This application of the material is patented in England, and paint made from it is credited with the power of forming a film of magnetic oxide on iron surfaces. The natural colour of this pigment runs from dark steel gray to black. The formation of magnetic oxide upon the surface of iron and steel by the action of manganese is of extensive industrial application; articles being plunged into a bath of melted nitre containing a small amount of the peroxide, which imparts to them a permanent non-corroding coating of a deep bronze colour. The formation of the magnetic oxide film by the agency of paint, however, is a very obscure phenomenon. Personally, Mr. Wood appears to prefer what he calls carbon paints. He holds as a matter of opinion that the waterproof anti-corrosive paint of the future will be made from asphalt oils—oils produced by the distillation of natural asphalt—as the medium for some of the carbon group of pigments; the drying element being furnished by some strong metallic salt, with which he includes iron oxide. Amorphous graphite makes a good paint, although lamp-black is almost as great a favourite with Mr. Wood; and if one must have bulk in a pigment, he seems to hold that gypsum will answer the purpose more harmlessly than any other inert substance.

And now, what is the lesson to be drawn from these exhaustive observations upon pigments and paints intended for the preservation of structural ironwork? How and with what shall the gasholder, the viaduct, or the pier be painted? In this part of the world, at any rate, oxide of iron paint, specified to be made from the natural oxide, is generally employed for such work; and there is nothing in Mr. Wood's article to disparage this kind of paint. Tar paints and black varnishes, we also know; and very good these are for many uses. But it can be safely averred that the black colour is against them for a great variety of applications; and the same hue will militate against the universal adoption of carbon paints. Oxide of iron paint is preferred to tar or to lamp-black largely for its colour; and, when made from the proper material, it is quite deserving of adoption for its preservative qualities. That such a paint exerts an actively beneficial effect upon the metallic surfaces covered by it, we do not believe; but it is credible that its feebly oxidizing action upon the oil, keeps the mass in a proper condition for protecting the iron (if originally free from corrosion) from atmospheric and other external influences detrimental to its durability. The best natural oxide for paint making is probably that found in certain deposits where the oxide exists in natural combination with silica, and where neither carbonate of lime nor alumina is in excess of 5 per cent.—the proportion of ferric oxide being not less than 40 per cent. nor above 53 per cent., with not a trace of sulphur or acid. With such a material, the oxide forms the basis of attachment to the iron or steel surface, and duly oxidizes the medium; while the silica in combination with the small proportion of lime, alumina, and borates present in the paint as mixed with boiled linseed oil, tends to form a kind of enamel glaze upon the hardening surface of the applied paint. Paint which is nearly all oxide of iron can be made by roasting hematite ore, and grinding the product with oil. But the trials that were made in America with paint so made were anything but satisfactory. The fact is that too much oxide is not good for the oil, which is then oxidized too quickly and rendered natureless, so that the paint eventually powders off.

Of course, there are paints and paints; but there certainly is still good reason for the belief that standard articles of trade—such as red oxide of iron or red lead paint, when bought of respectable firms with a reputation at stake upon every consignment, will as a rule be found to justify their commercial and technical eminence. Such paint as we have in mind, well laid upon iron or steel previously made clean and dry, will last as long as can be expected of any covering composed of materials one at least of which—the vehicle or medium—is by its nature perishable when exposed to air and moisture.

Holophane Globes.—Application has been made by MM. Psaroudaki and Blondel to amend the specification of their patent No. 19,185 of 1893, for improvements in the diffusion and distribution of light by means of holophane globes. An abstract of the specification was given in the Journal for Oct. 2 last year (p. 651); and the proposed amendments are set forth in the Official Journal of the Commissioners of Patents for the 2nd inst. (p. 1039).

TECHNICAL TERMINOLOGY.

One of the most interesting of the many scientific and technical periodical publications of America is the *Engineering Magazine*, which is conducted in so catholic a spirit that followers of almost every branch of the profession from which it takes its title can usually depend upon finding something worthy their attention in every number. In the current issue, for example, there appears a brief but pointed article upon the subject of engineering terminology, fortified by references to certain terms put in circulation and used by gas engineers and their coadjutors among mechanicians. This is a subject that always appeals to us with peculiar attractiveness, as it is one of the responsibilities of the Journal to observe and hold up a high standard of purity and simplicity as regards the phraseology of gas engineering. There must, of necessity, be a difference between the technical and the ordinary colloquial or literary use of words, inasmuch as in the realm of technics, which exists within the circle of everyday life, a special kind of verbal currency is indispensable. All technicians and specialists have to agree, by common consent, to attach peculiar meanings to certain terms. Some of these are never heard out of their company; while others have quite different significations in popular parlance. We cannot stop to explain to one another what we mean by these expressions; it is sufficient that those who use them in a particular sense know what they are about, and are confident of being understood. At the same time, this specialized employment of words, particularly of words which already mean something else, is a matter that must be carefully watched if technical language is not to become mere jargon. When educated men talk "shop," in "shoppy" terms, they owe it to the common language of their race, that the supreme rules of composition, grammar, and spelling shall be observed; and that the risk of ambiguity which is inseparable from the employment of common phraseology to express some special meaning, shall be reduced as far as possible. It was for this reason that, when the list of papers to be read at a recent gas managers' congress appeared with one communication bearing the title "washing," we drew attention to the term as being vague to the verge of ambiguity, with the result that it was afterwards corrected.

It is easy to see how errors of this kind come about. As the article to which we have referred observes, "there seems to be a tendency, when a new term is wanted for a thing or operation in practical mechanics, to seize upon the name which has been used in the shop where the thing or operation originated, regardless of its mechanical or scientific fitness to express all that it should." And there is more reason than might be suspected at the first glance into the matter, for this subservience to shop terminology. The common people are the greatest makers of language. As one of the most scholarly of living poets has admitted, the unlettered workman or peasant, when he talks at all, talks better than scholars or literary persons, because his words go so much closer to the realities of the subjects with which the speaker has to deal. Literature and scholarship are not life, but work in the factory or on the farm is life stripped of all conventionalities. Hence the worker usually talks as directly as he hammers or digs. So it frequently happens that the handworker hits as if by instinct upon the most telling term for a new process or operation. Sometimes, however, a man with a smattering of culture undertakes to name a thing; and then the result is apt to be confusing. Our American contemporary seizes upon this aspect of hap-hazard technical terminology; and the first example cited in point is a term in regard to which we have, with contrition, to confess that we and our readers have often sinned. This is no other than the now familiar term "producer gas." This is employed, as the accusing article states, to signify gas made in so-called "gas producers," for use in gas-engines and so forth; the intention being to distinguish this kind of gas from ordinary illuminating gas. "Now, the term 'producer gas' has in it nothing which, to one not previously instructed in its nature and uses, conveys the slightest notion of what it is, except the idea that it is some sort of gas artificially produced. But this is true of most gases; so, in reading about the increasing use and efficiency of gas-engines which use this gas, the lay reader—after vain search for light on the nature of the difference between this gas and illuminating gas—is forced to content himself with half-knowledge. The term 'gas producer' is equally open to criticism; it really defines nothing." This is perfectly true; and the indictment might be drawn even more strongly, by referring to the aggravating circumstance that there is good reason to believe that not infrequently those who talk about producer gas are not free from intent to deceive, inasmuch as they may have in mind one variety of this product, whereas those whom they address may, to their knowledge, have learnt to think of it as something quite different. One man talks about producer gas, meaning all the time the product of the imperfect combustion in a mixed current of air and steam of anthracite coal; his hearers may only know of such gas as made in a similar way from coke. In all such cases, however, the point is clear, that the use of the term in this way implies the knowledge, to a degree that may be pardonably regarded as excessive, of the technical process and its antecedents and circumstances.

Our contemporary goes on to allege—in this regard following the lead of another publication, the *American Machinist*—that, "in the art of using gas in heat-engines, there has been a singular outcrop of such insignificant terminology." Let us pause awhile to enjoy the full flavour of the incidental use of the good old word "insignificant" in its original meaning of devoid of significance. How sadly the language has been impoverished by the degradation of such words as this, with which might be cited "impertinent," "indifferent," and "advertisement," until to the uninstructed ear they convey so much lower a meaning than that originally expressed in them! To return to the point, which is that one of the terms applied to the gas-engine is that of "impulse-engine"—the complaint is made that such a term not only fails to express the facts relating to the combustion and expansion of gas in engine-cylinders, but that as so used, it conveys to most readers an entirely erroneous idea. The article runs on as follows: "To invent a new word, or even a new application of a standard word, is to incur a great responsibility in any event; and in the case of an incorrect application of the word, it may cause serious trouble and misunderstanding. Someone has begun the practice, and now it is quite a common one, of speaking of the gas and oil engines of the day as 'impulse' engines. The idea intended to be conveyed, of course, is that power developed by the engine and taken from the driving-shaft for practical uses, is first imparted to the piston suddenly, and all at once, at the instant that the explosion occurs. The use of the word 'impulse' in this connection—meaning by it a sudden application of force—is incorrect, misleading, and libellous. In speaking of the ignition and rapid combustion of the charge as an explosion, we are probably contributively culpable. The expression suggests not only an unsteadiness of revolution in the engine much greater than actually occurs, but also strains upon bearings, connections, and frame that are never encountered." It is then argued that gas-engines, so far from being driven by "impulse," are instead more truly expansive engines than any steam-engine that ever existed, because in them expansion takes place from the very beginning of the stroke, while in the steam-engine only after the cut-off is the work of expansion done.

The error in question must be regarded as confined to the land of its origin; for nobody in England has ever poisoned the technical literature of the gas-engine by calling it an impulse-engine. If any formula intended for use as a descriptive title of such motors has ever had even a limited circulation in lecture-rooms, it is that which classifies gas and oil motors as "internal combustion engines." So far from the term impulse having been applied, with us, to the work done in the cylinder of a gas-engine by the charge, we may claim for the Journal the distinction of having put the question some time ago of when the advent of an "impulse" gas-engine—a gas-engine, that is, driven by impulse, like the steam-turbine—might be looked for.

To return to the first subject, of the misleading character of the term "producer gas," and even of "gas producers"—we have confessed and expressed contrition; and now it remains to be asked, how is a repetition of the inaccuracy to be avoided? Frankly, we do not know. Whoever may be responsible for the initial error, the fact remains that, for industrial purposes, combustible gases are classified as coal gas, water gas (carburetted or otherwise), producer gas, and generator gas. If an illuminating or a fuel gas is not one of these, it must be another, or a mixture of two or more of them. In one sense, it might be possible to speak of more than one of them as coal gas; but convention has fixed what this term shall be understood to mean. Producer gas is at times spoken of by some proprietary name—as "Dowson" gas; just as what technicians know as generator gas is occasionally called Siemens gas. The truth of the matter is that a sufficiently precise meaning in the technology of gas manufacture has become attached to the word producer; so that it is rather late to impeach the term in the supposed interest of the "lay reader." This individual must "get up" the accepted terminology of the gas industry, as he must do that of any other, if he desires to confer upon fairly equal terms with its actual practitioners. Let a lawsuit affecting gas producers or producer gas once get into Court, and although it will be necessary to start by instructing the Judge in the proper technical meaning of these terms, he will not need to be told twice. As with the Court, so with the man of business—the circumstance of there being any number of other meanings to a word does not affect the particular one that may happen to be in question.

The *Engineering Magazine* concludes its article upon this subject with an observation which must have escaped the writer by inadvertence. It is to the effect that "a literary and scientific bureau of experts, to which new technical terms might be referred for approval, before their use could be regarded as authorized, would be very useful. The work of such a bureau might profitably be extended to the revision of terms already in use. The number of words now used in the Arts as technical terms is great. Different words are used in different English-speaking countries to signify the same thing; and even in the same country in different localities things are called by different names. Many an American reader perusing an English technical paper will find terms entirely unfamiliar to him, which, when he has ascertained their meaning, he discovers to be used to indicate familiar things or processes. Difficulty and confusion are thus created, that might be easily avoided by the authoritative action of some competent body in the adoption or

exclusion of technical terms." With all respect to our contemporary, this is nonsense. The English-speaking world—albeit only the proportion of the whole which speaks English on occasion in technical senses—is not going to put itself into leading strings. The dreadful fate that has overtaken our American cousins through their misplaced confidence in "authority" in the matter of spelling, would of itself be enough to frighten Englishmen from such a course. The only authority that can be recognized in these matters is the general body of educated public opinion, as signified through the usual channels of contemporary literature and journalism. Every editor of every journal is, in effect, a professor belonging to the world-wide faculty of the cultivation and improvement of language as a medium for the expression of thought. It is part of his duty—a duty, unfortunately, not always perfectly realized or performed—to watch for the slip-shod diction, the ungrammatical or obscure sentence, the ambiguous term, the misleading or imperfect appellative, which will creep into the writings of the most careful author, as they are the besetting weaknesses of the half-educated and careless, and to keep them out of circulation. Only in this way can the language be kept even passably clear. Happily, much may be effected by this agency, as experience abundantly proves. But there exist in the technical and general press a number of periodical publications of a low class, the conductors of which seem not to care how often they offend against the canons of the language which they know only imperfectly and are only able to use more or less badly. Self-respecting readers, however, do not waste time on such trashy productions. Fortunately, these journals never originate anything—not even a wrongly-applied technical term; so that their power for mischief in this respect is small.

Incandescent Gas Lighting in Streets.—The experiments in connection with the lighting of the public streets of Siegen by means of Auer incandescent lights have proved so successful that it has been decided to adopt the light on a large scale.

Railway Carriage Lighting by Gas.—All the carriages which now leave the South-Eastern Railway works at Ashford are fitted up for gas in place of the old oil-lamps; and the Company are making extensive use of gas with a view to adopting it as the sole illuminant on their system. Some 800 carriages are already provided with it—the gas being manufactured at the Company's works in London; while, in order to meet the increased requirements in this direction, they are having large works erected at Rotherhithe. Each coach carries a pair of gasholders underneath, capable of containing a supply for 25 hours. They are replenished at different depôts on the line.

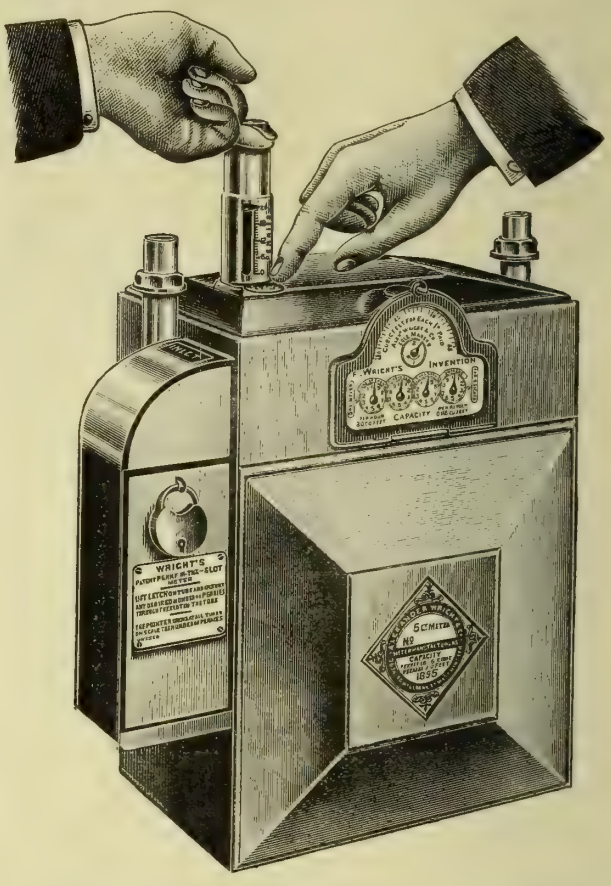
An Improved Asphalte.—A new kind of asphalte has been brought out by Mr. J. Wetherill, the former Borough Surveyor of Keighley. The present mode of preparing asphalte is by softening the pitch with creosote oil or coal tar, so that when cold it shall be tough, and not brittle in any way. It is found to melt with the heat of the sun in summer on a clear day, and to run out of the joints of the paving on the surface of the road, filling up the channels and gulleys. In cold weather and frost, it becomes very brittle, and crushes with the vibration of the traffic passing over the road, and is afterwards removed by the scavengers. Mr. Wetherill's asphalte, which is said to avoid these defects, is made in the same way, with the exception that less oil or tar is used, and lime is added; thus hardening it in summer and softening it in winter. It is claimed for it that it will change as the weather changes from hot to cold, and will always keep a tough and reliable joint impervious to wet and frost.

Corporation Extravagance—Under the title of "A Citizens' Auditor's Notes," Mr. S. Norbury Williams has been criticizing in a trenchant yet withal good-humoured style, in the *Manchester City News*, the items of expenditure in connection with the opening of the Thirlmere Water-Works on the 12th and 13th of October last year. The expenses for the two days amounted to £1368 15s. 9d.; the cost of providing the dinner for 330 persons on the second day being £325 15s. 5d. Mr. Williams characterizes all this as "a scandalous piece of unnecessary waste in these hard times, when the rates are always increasing, and are likely to rise shortly to the biggest figure they have ever reached in Manchester." He says that, if there were six men of backbone in the Council, these outrageous items of waste would be stopped. But there are not. To move in the matter would mean being boycotted; and this councillors cannot endure. Consequently, aristocrats and "labour" members alike acquiesce in these spendthrift outlays; and there is not a pin to choose between them. Mr. Williams has searched the Treasurer's abstracts of receipts and payments, with the aid of one of the oldest of the financial officials, in order to find an entry of the £1368; but they gave up the search as a puzzle. However, the riddle was solved on turning to the water-works ledger; for there they found that all the items he had been criticizing had been "lumped in" with a number of others in the water-works capital account as follows: "Thirlmere Works—Aqueducts, pipes, &c., £68,804 14s. 1d." Mr. Williams rightly regards this as a piece of concealment worthy of strong condemnation. It seems that Manchester spent rather heavily last year on luxuries. The Queen's visit cost £5467; the cleaning and furbishing of the Albert and John Bright statues, £630; and opening the Thirlmere works, £1368—a total of £7465.

TECHNICAL RECORD.

WRIGHT'S PREPAYMENT METER.

In our "Essays" columns to-day, an article will be found on the subject of the above-named meter. In order to make the description as complete as possible, we give below a perspective view of the meter, and on next page two diagrams showing the working parts of the prepayment attachment.

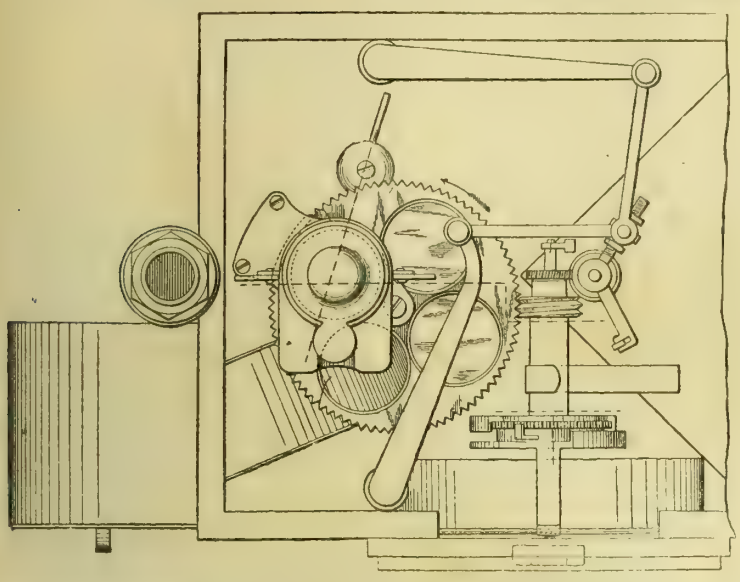


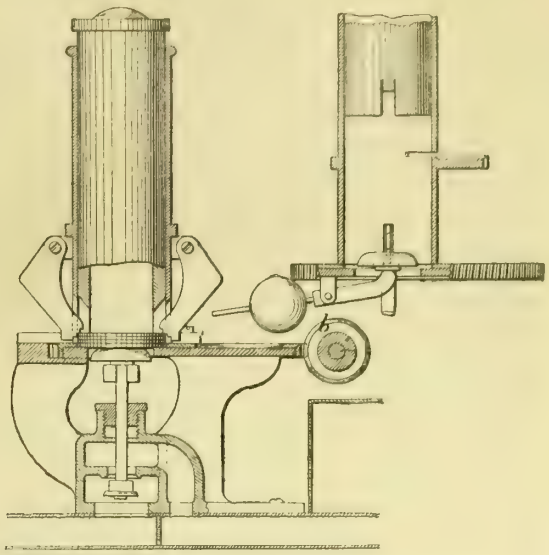
THE PROPERTIES OF LIQUID ETHANE AND PROPANE.

The following article on the above subject was contributed to *Nature* by Mr. A. E. Tutton.

A comprehensive study of the properties of these primary hydrocarbons in the liquefied condition has been made by Dr. Hainlen in the laboratory of Professor Lothar Meyer at Tübingen; and an account of his work will be found in *Liebig's Annalen*. Owing to the greater ease with which it undergoes liquefaction, propane was first investigated. The hydrocarbon was obtained in a state of purity by means of the admirable method of preparation discovered in the same laboratory in the year 1883 by Köhnlein, which consists in heating propyl iodide with aluminium chloride in a sealed tube to 130°. After subjection to this temperature for twenty hours, the tube was allowed to cool, and subsequently placed in a freezing mixture. While immersed in the latter, it was found practicable to open it without danger or loss—the accumulated gas being readily transferred to a gasholder over water.

In order to determine the boiling-point of propane, the purified gas was first condensed to the liquid state in a U-tube surrounded by solid carbon dioxide. It was then transferred to the special boiling-point apparatus by evaporation and recondensation; the last traces of impurities being eliminated by this process of repeated distillation. The special apparatus consisted of a glass tube closed at the lower end, furnished with a side tube for the entrance of the gas, and with a stopper at the open end perforated for the passage of an exit-tube and a thermometer. The upper half of the cylinder was surrounded by solid carbon dioxide, and the lower portion was protected by a mantle of badly-conducting felt. Upon the entrance of the gas, the air was expelled by the exit-tube; and the gas which condensed in the upper portion of the cylinder collected in the lower portion. When the protecting mantle was removed, the relatively warm air soon promoted ebullition; and the escaping vapour was as rapidly recondensed in the cooled upper portion of the cylinder, and fell back into the lower. If the hand were brought into the proximity of the cylinder, the boiling became most vigorous. At first propane usually boils irregularly—quiescent intervals being succeeded by almost explosive ebullition. But after a short time the formation of vapour becomes perfectly regular; and a mercury thermometer dipping in the liquid registers a temperature of − 38°. After comparison of the latter with an air thermometer, the correct temperature of the boiling-point of propane is found to be − 37° at 760 mm. pressure.





Propane may safely be sealed in strong glass tubes after condensation by means of solid carbon dioxide, and thus preserved in the liquid state. It is a perfectly colourless liquid, but much more viscous than liquid carbon dioxide. The critical temperature was determined by use of such a tube half filled with the liquid. The tube was immersed alongside a thermometer in a bath of liquid paraffin, furnished with a suitable stirrer. Upon heating the apparatus to 101°, the liquid meniscus commenced to become hazy, and the distinction between gas and liquid became less and less pronounced, until at 110° all trace of it had disappeared. Upon cooling, the well-known nebulosity was observed at 102°; and this temperature is considered to be a close approximation to the critical temperature of propane.

The vapour pressures of propane for different temperatures up to 12·5° were determined by enclosing a quantity of the liquefied hydrocarbon in one limb of a U-tube, and dried air in the other limb; the two being separated by means of a short column of mercury. The closed apparatus was then cooled to various temperatures in suitable baths, and the vapour pressures calculated from the amount of compression of the air-column. The vapour pressures for temperatures superior to the ordinary were determined by use of the Cailletet apparatus and spring manometer. The following table represents a summary of the results:—

Temperature.	Pressure in Atmospheres.	Temperature.	Pressure in Atmospheres.
Deg.		Deg.	
− 33	1·8	+ 1·0	5·1
− 19	2·7	+ 5·5	5·9
− 15	3·1	+ 12·5	7·1
− 11	3·6	+ 22·0	9·0
− 5	4·1	+ 53·0	17·0
− 2	4·8	+ 85·0	35·0
		+ 102·0	48·5

The critical pressure of propane corresponding to the critical temperature of 102° is consequently 48·5 atmospheres.

Dr. Hainlen has also determined the density of liquid propane at several temperatures. It is 0·536 at 0°, 0·524 at 6·2°, 0·520 at 11·5°, and 0·515 at 15·9°, compared with water at 4°.

An investigation of the properties of liquid ethane upon similar lines naturally presented greater difficulties, on account of the further removal of its boiling-point from the ordinary temperature. The pure gas cannot be so conveniently prepared by the method of Köhnlein, as the sealed tubes frequently explode with great force. It was therefore obtained by the well-known method of Gladstone and Tribe from ethyl iodide and the zinc-copper couple. A mixture of ether and solid carbon dioxide is insufficient to effect liquefaction of the gas; but liquid ethylene was found to bring about the necessary reduction of temperature, which latter was measured by a copper-silver thermo-element. Liquid ethane in the pure state is perfectly colourless.

The boiling-point of ethane was determined as in the case of propane; the upper part of the apparatus, however, being surrounded by the liquid ethylene instead of solid carbon dioxide. The ethylene was prevented from vaporizing rapidly by allowing the extremely cold vapour produced by the evaporation to pass through an outer cylinder, and thus to act as a protective cold bath. The ethane was first cooled by means of ether and solid carbon dioxide before admission into the boiling-point apparatus, after which it was found to be rapidly condensed by the colder ethylene. One end of the thermo-element was immersed in the accumulated liquid instead of a thermometer. The temperature of the liquid when in regular ebullition, produced by removing the cap protecting the lower half of the cylinder, was found to be − 89·5° at 735 mm. pressure.

Liquid ethane cannot be sealed in a glass tube without considerable danger. Hence the determinations of vapour pressure and density were effected by the use of a modified Cailletet compressing apparatus and spring manometer. The various temperatures were obtained by surrounding the narrow thick-walled glass tube in which the liquid was produced by suitable baths. The critical temperature at which the curious cloudy appearance was observed, just before the complete disappearance of the liquid meniscus, was found to be 34·5°, and the corresponding critical pressure 50 atmospheres. The meniscus becomes hazy at 32°, and only disappears completely at 40°; so that the critical temperature, as in the case of propane, does not appear to be so sharp as with many other liquids of low boiling-point. The following table represents the vapour pressures for a few intervals of temperature:—

Temperature.	Pressure in Atmospheres.	Temperature.	Pressure in Atmospheres.
− 31°	11·0	0°	23·3
− 20°	14·5	+ 15·0°	32·3
− 11°	18·3	+ 34·5°	50·0

Professor Dewar in 1884 determined the critical temperature and pressure of ethane, and gave them as 35° and 45·2 atmospheres. M. Cailletet had previously stated that at + 4° the gas exerted a pressure of 46 atmospheres. Professor Dewar's numbers are now found to be in close accordance with Dr. Hainlen's results; and the other statement of M. Cailletet must therefore be taken as founded upon an error. The density of liquid ethane was found to be 0·446 at 0° and 0·396 at + 10·5°.

It may be interesting to compare the facts now established with reference to ethane and propane with those previously well ascertained for marsh gas and for normal butane:—

—	Boiling-Point.	Critical Temperature.	Critical Pressure.	Density in Liquid State.
	Degrees.	Degrees.	Atmo.	
Methane (CH_4)	−164 (Olszewski)	− 81·8 (Olszewski)	54·9	0·415 at − 164°
	−160 (Wroblewsk)	− 95·9 (Dewar)	50·0	
Ethane (C_2H_6)	− 89·5 at 735 mm.	+ 34·5	50·0	0·446 at 0°
Propane (C_3H_8)	− 37·0 at 760 mm.	+102·0	48·5	0·536 at 0°
n-Butane (C_4H_{10})	+ 1·0	..	..	0·630 at 0° (Ronalds, 1865)

If the above boiling-points are represented graphically along with those of the higher normal paraffins, molecular weight or the number of carbon atoms being taken as abscissæ and boiling-point as ordinates, a perfectly regular curve is obtained, slightly concave towards the axis of abscissæ, which very clearly indicates the dependence of the boiling-point upon the molecular weight.

The German Patent for the Incandescent Gas-Light.—The German Incandescent Gas-Light Company a short time ago instituted a number of lawsuits against persons who, as they alleged, were infringing their patent. The first of the cases—an action brought against Herr Fritz Trendel in respect of the "Diamond" light—has lately been decided in the Company's favour by one of the Berlin Courts. The defendant has been forbidden, on pain of a penalty of 1000 marks for each infringement, to manufacture, sell, circulate, or use any burners for the incandescent gas-light, where a firm body, wholly or partly in or over the mouth of the burner, is applied for the purpose of preventing explosions in the flame at that place (thereby obviating noise by the flame), and on which a capsule is arranged round the firm body, the lower end of the tubular incandescent body being so drawn over it that the right position in the hottest zone of the flame is ensured. By this decision, a most important point has been established as far as Germany is concerned—viz., that, in addition to the patent covering the mantle, it applies also to the burner itself. The Company therefore believe that the other actions will be decided in their favour. It appears that the German Patent Office are going to investigate the question of the incandescent bodies; and the Company consider that, as matters stand at present, the proceedings taken in this connection will likewise terminate favourably.

REGISTER OF PATENTS.

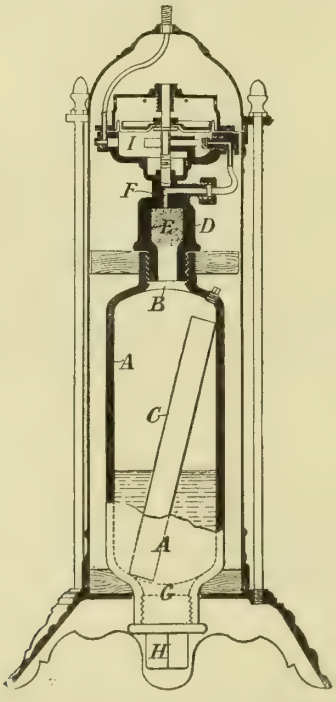
Gas Motor Engines Working with Slow Combustion.—Abel, C. D.; communicated from the Gasmotoren Fabrik Deutz, of Koeln-Deutz, Germany. No. 21,829; Nov. 12, 1894.

This invention refers to the working of two-stroke slow-combustion-cycle gas motor engines, whereby compressed air or inert gas only is introduced into the cylinder during the first part of the outstroke, after which combustible mixture under pressure is admitted, and gradually burnt during its inflow; the hot combustion gases being made to expand from the time when such inflow is cut off to the end of the outstroke, and being afterwards expelled during the instroke.

The rear end of the engine cylinder is provided with an inlet-valve for the combustible mixture of gas and air under pressure; the gas being forced in by a pump worked by the engine-shaft, while the air enters from a reservoir for compressed air charged by a pump worked by the engine, or otherwise—the air being made to mix with the gas on entering through the valve. A second air-admission valve is provided, also communicating with the reservoir under pressure, through which the preliminary charge of air is introduced during the first part of the outstroke. These valves are operated by a countershaft, driven at the same speed as the engine-shaft, and having cams acting on levers connected to the valves, and so arranged that the cam for the admission of air under pressure alone opens the corresponding valve at, or slightly before, the commencement of the outstroke, and allows it to close shortly afterwards. On the other hand, the cam for the admission of combustible mixture opens the valve after the piston has performed a certain portion of its outstroke, and allows it to close after a further portion of the stroke has been performed. The countershaft has another cam, acting on the discharge-valve of the engine, so as to open it at the commencement of the return stroke.

Lamp for Burning Acetylene Gas.—Gearing, E. G., of Harrogate. No. 22,183; Nov. 16, 1894.

This invention refers to apparatus to be employed in generating acetylene gas from calcic carbide, and burning it in a portable lamp.



A is the generating vessel (of steel or iron), cylindrical in form, with hemispherical ends, and conveniently (though not necessarily) about 4 inches in diameter and 16 inches in height. It is constructed with an opening B at the top, through which water can be introduced, as also sticks or pieces of prepared carbide C. The opening is fitted with a screw-plug D, containing a small chamber E filled with asbestos, and with a small hole F through its top. There is a supplementary opening (normally closed by a plug), through which the vessel A can, when necessary, be supplied with water without removing the screw-plug D. In the bottom of the generating vessel also, there is a hole G, furnished with an appropriate closing device, such as a screw-plug H, by removing which the interior of the generating vessel can be cleared of the material remaining as a product of the decomposition which occurs in the process of generating the gas. Above the small chamber E is a reducing-valve I, which is screwed into the chamber E, and with which the small hole F communicates; and above the reducing-valve there is arranged the burner (which is not shown, but may have the usual fittings), a tap or cock being interposed.

For generating gas in this lamp, the carbide is prepared as follows: The patentee takes calcic carbide, produced by the direct action of lime on carbon in the electric furnace, and makes it into "cartridges," sticks, or pieces of convenient size, which are coated on the surface with a film of soluble substance—such as gelatine, glue, or soluble varnish—to protect them from the action of the moisture in the atmosphere. It is preferable, says the patentee, to cast the molten carbide direct from the hearth of the furnace into sticks or blocks of convenient size, as he finds it then less liable to be affected by air than if crushed and rammed into cartridge form. Approximately 1 lb. of calcic carbide will form a stick about 1¼ inches diameter and 12 inches long; and when decomposed by water, it will yield 5 cubic feet of acetylene, which, in a cylinder 16 inches long by 4 inches in diameter, will develop an initial pressure of about 800 lbs. on the square inch. As the water in the generating vessel dissolves the protective coating from the surface of the carbide, the generating process commences; and the acetylene liberated is compressed in the generating vessel under the pressure created by its evolution. With such a lamp as is above referred to, which will maintain its flame for many hours, a light has been obtained of some 45 candles when only consuming about one cubic foot of gas per hour.

Burners for Gas Stoves and Fires.—Wright, G. E., of Birmingham. No. 22,983; Nov. 27, 1894.

According to this invention, the body of the burner is made in longitudinal halves bolted together. There are in it two parallel channels, separated by a diaphragm or partition having in it a series of rectangular recesses, open at one side, and resembling generally in shape the "key pattern." The open sides of the several recesses are in communication alternately with one or other of the two parallel channels separated by the diaphragm. In these recesses, the gas-jets (arranged in line) are placed so that alternate jets open into one of the parallel channels, and the intermediate jets open into the other parallel channel. The gas-supply pipes are situated respectively at the open ends of a divided supply channel parallel to, and cast with, the inner channels. One of the outer channels opens into one of the inner channels, and feeds the combustible gaseous mixture to the jets in connection with it; while the other outer supply channel feeds the intermediate jets in communication with the other inner channel. By opening one of the pipes at the middle of the burner, alternating jets of the series may be supplied with the gaseous mixture; and by opening the other pipe, the intermediate jets of the series are supplied. By opening both pipes, the whole row of jets may be put into operation. In this way independent control over the two series of jets of the Bunsen burner is obtained.

Effecting the Noiseless Exhaust of Gas and Other Engines.—Lake, H. H., communicated from C. Löper, of Lichtenberg, Germany. No. 25,140; Dec. 27, 1894.

This apparatus for the noiseless discharge of waste gases from gas and other engines has for its characteristic features a conical chamber, tapering in the direction opposite to that in which the waste gases pass; the chamber (packed or not outwardly with a soft material) having at its larger extremity the discharge-pipe leading into the atmosphere, and provided in its interior with a pipe, secured against undesired alteration of position, the outlet-passage of which is stopped with a porous substance impeding the outflow of the waste gases. The sound-deadening device consists of a pipe enlarged at one extremity so as to form a box, while at the side is arranged a conical chamber held in place in a tubular piece fixed to the pipe, and which contains in its interior a pipe passing through the whole of its length and into a box-shaped part. A shorter pipe leads back from the box toward the tubular piece fixed to the pipe.

Incandescent Gas-Lamps.—Denayrouze, L., of Neuilly, France. No. 4494; March 2, 1895.

The claims for this invention are: (1) The intimate mixture of air and gas, and its supply to the burner at no sensible pressure, by means of a mixer in form of a fan. (2) The arrangement of air supply by tubes surrounded by annular passages for gas. (3) For driving the fan, the electric motor described. (4) The command of the gas supply to the lamp from a distance by means of an electrically opened valve. (5) The command of the kindling of the lamp from a distance by means of an electrically opened valve, causing a lighting spark. (6) The general construction and arrangement of lamp described with reference to the drawings.

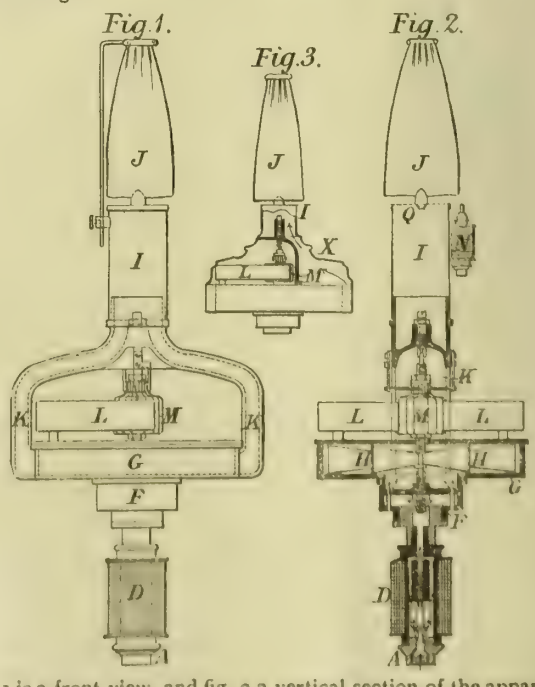


Fig. 1 is a front view, and fig. 2 a vertical section of the apparatus.

The gas enters at A through a valve attached to the moveable iron core of a solenoid D. Above the moveable core is a fixed one, having a central screw, which forms an adjustable stop for the moveable core when it rises to open the valve. The gas ascends four grooves in the sides of the fixed core to a chamber F, in the bottom of which are fixed tubes, which pass up through somewhat larger holes in the cover, so that around each tube there is an annular outlet from the chamber F to a chamber G containing a fan H, from which chamber two passages K

conduct the mixture of gas and air to the passage I, terminating in a wire-gauze outlet Q, under the incandescence mantle J.

The electric motor comprises a permanent magnet L fixed on the fan chamber G, and having pole-faces, between which revolves the armature M, which is fixed on the axis of the fan. Two insulated brushes supply current to the commutator.

On putting the apparatus in circuit with a suitable source of electricity, the moveable core in D is attracted upwards, opening the valve, and causing the fan to revolve. The gas, as it ascends to the fan chamber, draws in air; and thorough mixture being made by the fan, the mixed gas and air pass up to the burner.

Instead of ascending by the passages K, the mixed gas and air may pass through a chamber X (fig. 3) to the burner.

For kindling the burner, a solenoid N may be provided connected to one terminal of the source of electricity.

Coin-Freed Gas-Meters.—Lake, H. H.; communicated from L. Haas, of Mainz, Germany. No. 7660; April 16, 1895.

This invention in coin-freed gas-meters is based upon the principle that an inserted coin acts as an abutment for mechanism actuated by weight or spring power; the coin being carried to its point of action either by its own weight or under an additional pressure. The mechanism actuated by weight or spring power is, when no coin is present, forced into that position which causes the closing of the gas conduit; and, on the other hand, when a coin is inserted, the mechanism is, under pressure exerted upon the coin—which pressure may also force the coin to its point of action—moved into the opening position. The time during which the coin remains at the point of action is so fixed that the coin is supported by a moveable member connected to the counting mechanism of the meter—the moveable member either carrying the coin gradually away as the counting mechanism advances, or causing the coin to drop after a certain time elapses.

Two constructional forms of the invention are described in the specification, which differ from one another in the means by which the coin is held in position, as well as in the means by which the pressure is exerted upon the coin. This automatic device is especially suitable for the direct actuating of the gas valves or cocks, because it operates under direct weight-pressure, and because the coin does not act by its weight, but is used as a resistible intermediate piece, which during its operation forms part of the apparatus.

The coin dropped through a slot of the slide-casing into a slide is, by pulling a handle of the slide, carried over the coin-channel, provided with openings for inspection; and it falls into a channel, which may be charged with a certain number of coins. By means of a pin fixed laterally to the slide, the lever (having a weight) is simultaneously turned upward on its pivot to such an extent that the coin inserted is enabled to fall in front of the lower striking-surface of the lever, and to present itself opposite the lower extremity of the channel. The coin thereby also arrives opposite the lower striking-surface of the valve-lever, which is in the position corresponding to the closure of the valve. By releasing the handle, the weight falls so that the lever will, by the aid of the coin, turn the lever and open the valve. During this movement, the lever presses the coin downward completely into the rounded striking-surface of the lever, and against a pin of a disc turned by the counting mechanism of the meter, and which pin now serves as a lower support for the coin. As soon as the pin slides from below the coin, the latter will drop down and the valve-lever be free to fall.

To ensure the falling down of the coin at a given moment, the following arrangement is made, which serves at the same time to prevent any further coins that may be stored in the coin-channel from dropping away unintentionally: At the periphery of the disc, the pins are arranged at uniform distances apart, in such a manner as to strike against the lower end of the valve-lever, and to finally turn the lever aside owing to the movement of the disc; thus still further lifting the valve, without, however, increasing or decreasing the delivery of gas. The coin follows this return movement of the lever until it finds, besides the pin which forms the first point of support, a second point of support by a pin fixed to the casing—the latter pin projecting over the periphery of the disc. As soon as the pin on the disc has approached the pin in the casing to a sufficient extent, the coin turning to the left hand drops down, and gradually takes up a position by sliding down along a fixed guide, and is finally (on the further turning movement of the wheel) thrown out.

When falling down from the pins on the disc and the pin in the casing, the coin drops first between one of the former pins and the upper edge of the fixed guide, so that the coin, when in this position, can serve as a support for any other coins that may follow, and is not removed from its position until the adjacent pin on the disc has passed by the lower edge of the lever, and this latter has fallen back, and thereby caught hold of the next following coin between itself and a projection.

Whereas in this gas-meter the valve is initially opened by the pressure transferred from the coin, at the end of the one period the counting mechanism itself will effect the holding of the valve in the open position, in order to thus liberate the coin from pressure, and allow of the free passage of the next coin. This free passage would not be possible if the coin were to force its way into its place. The forcing-in takes place in conformity with the construction in which the coin is passed from above to the point of operation, under a pressure sufficient to overcome the pressure of the valve-lever, to force the coin along the latter, and thus to open the valve.

The coin here slides through a channel downward, and arrives in the coin-channel after the plate (which closes the entrance opening of the channel by its own weight) has been raised thereby, so that the weight which is guided vertically, and which grips with a projection extending through a slot into the coin-channel, and underneath the plate, is lifted by the handle. The coin-channel may thus receive a certain number of coins, the lowermost of which, forced down by the weight, is pressed between the disc rotated by the counting mechanism on the one hand, and the extremity of the valve-lever on the other.

The disc is provided with pins fixed at smaller distances than the diameter of the coin used, and of such dimensions that the penetration of the coin effects in every position of the disc a sufficient return motion of the lever for producing an entire opening of the valve, and so that coins of too small a diameter are dropped. During the rotation, each coin slides between two pins of the disc, is passed round therewith, and is finally withdrawn from underneath the lever, which latter then places itself immediately against the next coin.

Valve-Gear for Gas-Generators.—Cutler, S., of Millwall. No. 10,224; May 23, 1895.

These improvements relate to the manipulation of the valves controlling the outlets of water-gas generators, where it is usual to pass the steam sometimes upwards, and at other times downwards, through the fuel. To accomplish this, gas-outlets are provided at both the top and bottom of the generator controlled by valves; and it is to a novel way of operating these valves that the invention particularly refers.

The valves employed are of the "outside rack-and-pinion" type, in which the sluice is raised by rotating, by means of the hand-wheel, a pinion geared into a rack attached to the head of the sluice. On an extension of the pinion-shaft is placed a mitre-wheel (or other suitable gear), which engages similar gear upon a vertical shaft. This vertical shaft may be continuous and directly coupled, or may sometimes more conveniently be made in two portions geared together with spur-wheels. In this manner the two valves are opened and closed simultaneously, as will be readily understood.

When the sluices of the valves are of different weights, a weight is placed upon the lighter valve, or the heavier valve is counterweighted by a suspended weight connected to the head of the sluice. The requisite travel for sluice-valves of different sizes is obtained by making either the racks, mitre-wheels, or spur-wheels of a correspondingly variable pitch or diameter.

APPLICATIONS FOR LETTERS PATENT.

18,719.—Exley, J. H., "Generating acetylene gas." Oct. 7.

18,815.—Hawkyard, J., and Braddock, J., "Prepayment gas-meters." Oct. 8.

18,824.—Kaestner, C., "Automatic gas-generating acetylene lamp." Oct. 8.

18,877.—Dvorkovitz, P., "Means or apparatus for distilling; applicable also for enriching gases by hydrocarbons." Oct. 8.

18,890.—Readman, J. B., "Obtaining cyanides." Oct. 9.

18,899.—Gardner, L., "Gas-engines—a device for reducing the compression while starting." Oct. 9.

18,908.—Lanchester, F. W., "Gas and oil motor engines." Oct. 9.

18,931.—Webber, W., "Prepayment apparatus for attachment to gas, electricity, or other fluid meters." Oct. 9.

18,933.—Eydman, F. H., "Bunsen burners applicable for heating and lighting, but more especially in connection with incandescent gas-lamp devices." Oct. 9.

18,940.—Höltje, F., "Automatically regulating the flow of liquids." Oct. 9.

18,945.—Lönholdt, F., "Gas heating and cooking apparatus." Oct. 9.

18,963.—Paget, A., "Manufacture or treatment of incandescence hoods or mantles for gas and other burners." Oct. 9.

18,964.—Paget, A., "Glass chimneys for gas and other lamps." Oct. 9.

18,965.—Paget, A., "Incandescence bodies or hoods for illuminating purposes." Oct. 9.

18,966.—Edwards, F., "Utilizing radiant heat." Oct. 9.

18,995—Southall, J., "Operating the valves of gas and oil engines." Oct. 10.

19,032.—Kindermann, P., Blumenthal, J., and Walch, F., "Incandescent lamps for burning gasified paraffin, volatile hydrocarbons, and the like." Oct. 10.

19,037.—Wolf, T. A. de, "Disposal of refuse and the like, and manufacture of gas." Oct. 10.

19,046.—Schneller, L., "Gas-engines." Oct. 10.

19,049.—Webber, W., "Prepayment fluid-meters." Oct. 10.

19,102.—Barrett, W. G., "Incandescent gas-burners." Oct. 11.

19,110.—Bowman, G. F., "Gas and oil stoves applicable for heating and ventilating purposes." Oct. 11.

19,138.—Vogel, J. L. F., "Alkaline cyanides." Oct. 11.

19,142.—Grove, J., "Oil or gas engines." Oct. 11.

19,183.—Shillito, T. R., "Automatically regulating the mixture of gas and air for incandescent gas lighting and for heating purposes, and for suppressing the noise made by the inrush of air when incandescent gas-lights are turned low." A communication from C. M. Römpler and H. Axmann. Oct 12.

19,197.—Webber, W., "Prepayment gas-meters." Oct. 12.

19,201.—Downing, G. C., "Manufacture of alkaline cyanides, ferro-cyanides, and their derivatives." A communication from J. R. Moïse. Oct. 12.

19,202.—Crocker, S. H., "Mantles for incandescent light." Oct. 12.

Street Lighting in Liverpool.—The Special Lighting Committee of the Liverpool Corporation have decided that the lowering of the gas in the street-lamps on moonlight evenings between Oct. 15 and March 1 should be discontinued.

Ceara Gas Company, Limited.—The Directors of this Company report that the rental for private lighting for the year ending June 30 last shows a large increase over 1894; and, but for the low rate of exchange ruling during the past year, the result would have been most satisfactory. The profit is £3413, which, added to the balance brought forward (£666), gives a total of £4079. Deducting the interim dividend paid in April last (£1611), there remains £2468 available for division. The Directors recommend the payment of a dividend for the six months of 5 per cent. on the preference shares (less tax) and of 4 per cent. on the ordinary shares (tax free), together £1911; making, with the interim dividend already paid, 10 per cent. on the preference shares and 7 per cent. on the ordinary shares for the year. The balance carried forward will be £557. The Directors mention that the whole of the debentures (£7500) offered to the shareholders in June were applied for.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Oil-Gas Experiments at Bradford.

SIR,—Mr. Wright's personal attacks upon me in your last two issues demand a reply. I must emphatically protest against the way in which he alters and misquotes our reports and statements. Repeatedly, in his letters, Mr. Wright charges us with statements which we have never made, so that he may contradict them.

On p. 737, col. 2, line 72 of the JOURNAL, Mr. Wright states "Dr. Dvorkovitz had not adopted the candles used by Mr. C. Wood;" but on p. 740, col. 1, line 6, he contradicts this by stating: "I do not remember that Mr. Wood ever calculated his costs at per candle." On p. 783, col. 1, line 91, Mr. Wright speaks of taking me "literally," and of "calculating the costs in thousand candles," &c. Mr. Wright knows that I never calculated costs in "candles" or "thousand candles." Why will he still try to obscure his blunder by these oft-repeated contradictions?

On p. 738, col. 1, line 63, Mr. Wright deliberately misquotes our estimate of 0·42d. per *candle thousand* (see p. 680, line 4), which he alters to 0·42d. per *thousand candles*. We never gave any estimate of 0·42d. per "thousand candles" or per "thousand foot-candles." On p. 738, col. 1, line 68, Mr. Wright says: "If, however, he insists that I do take him literally, then his costs must be inevitably multiplied five times." Therefore taking Mr. Wright "literally," on Oct. 2 he still affirms that our estimate of 0·42d. per *candle thousand* should be multiplied five times!

On p. 739, col. 1, line 85, Mr. Wright says: "Mr. Charles Wood insists, and has always insisted, on the very high values for this oil-gas tar." This is untrue; and I challenge Mr. Wright to give a single instance where I have "insisted" upon any enriching value for them. Again, on p. 738, col. 2, line 5, Mr. Wright says: "If Mr. Wood feels that he must still insist upon his ability to extract 350,000 feet-candles from a gallon of oil, . . . (*vide* report of March 28)," &c. I have never *insisted* upon, or even mentioned, 350,000 feet-candles, or ever claimed that the whole bulk of the tar is worth 35,000 candles per gallon. Mr. Wright knows very well that the report of March 28, which he professes to quote, does not claim for the bye-products 350,000, or even 350, candles per gallon. In our report of Jan. 23, we said that some of the preliminary tests of the bye-products indicated 35,000 foot-candles per gallon. But we added that "it is necessary to experiment much further with them before we can even approximately say what their enriching value will be," and that "it is necessary to make tests of several weeks', or even months', duration to thoroughly determine the value of the process, and especially of the bye-products obtained in working it." (See JOURNAL, Vol. LXV., p. 329.) Since Jan. 23, we have simply taken the bye-products at the prices offered to the Corporation for them, without mentioning any enriching values.

Mr. Wright's quotation on p. 738, col. 2, line 43, that "Mr. Wood asserts that, out of 500,000 tons [of cannel] offered, none came up to my estimate of 23 candles, at the price I take of 13s. per ton." This is another case of misrepresentation. (See my letter, p. 542.) Mr. Wright knows very well that all his quotations of the illuminating power of gas refer to experiments at the Thornton Road works, and have no bearing whatever upon the quality of gas made from superior coal at the other works. The absurdity of Mr. Wright's cannel enrichment calculations we have already sufficiently exposed in our previous letter. Mr. Wright's remarks upon the evidence of the 33 days' test prove nothing, as the conditions of working in February and July were quite different. I agree with Mr. Wright that "a little goodwill would have explained the affair;" and I only regret that he did not show some of it at the right time.

I am sorry that Mr. Wright does *not* "put the affair of the calculations in its true light." His version of the circumstances under which my letters were sent on April 5 is untrue. No "orders" (as Mr. Wright politely puts it) were given to me by the Committee; but my suggestion that I should write for an explanation was agreed to. In his anxiety to excuse himself, Mr. Wright complains of the way in which I addressed him. Did he think, after he had made a silly blunder, which led some members of the Gas Committee to charge me with falsifying the report, that I must wait for the orders of the Committee, or anyone else, before asking him to correct his mistake? Did he expect to shield himself behind this flimsy excuse of privacy? Mr. Wright overreaches himself. I have sent you his letters of April 6 and 13; and as all the correspondence between us is now published, I will leave your readers to draw their own conclusions.

It will be seen that, in his letter dated April 1, Mr. Wright, in replying to the second query, says that 0·42d. per *candle-thousand* is "incorrect," and that 8½ farthings per candle-thousand is "correct." It will also be seen that, in dividing by 5 in each case, Mr. Wright also is a "man who has taken 1000 feet-candles and candle-thousand as equivalent terms." In a private report to the Committee, we were quite justified in using the terms "foot-candles" and "candle-thousand" in the sense that the members understood them; but Mr. Wright's use of these terms, with a different meaning, only misled them. I now think that he did not then understand the meaning of a "candle-thousand." He succeeded in deluding for a time members of our Committee; but does he suppose that gas engineers and your other readers are "so dense as not to see through that rubbish"?

On p. 738, col. 1, line 83, Mr. Wright complains that our estimate of March 28 did not include an offer made for the bye-products *five months later!* The concluding paragraph of Mr. Wright's letter of Oct. 9 is absolutely untrue.

Mr. Wright's letter of April 13, which purports to be a reply to mine of April 5, *I now see for the first time*. This letter is such a palpable evasion of the question in dispute—viz., the value per candle-thousand (see my letter of April 5, on p. 784)—that I will not discuss it except to point out his unwarranted assumption that "a *candle* is the light given by the burning of 120 grains of sperm." After committing himself to this statement, no one will be surprised that Mr. Wright "declines to discuss candles" with me. Such is Mr. Wright's method of "discussing"!

As Mr. Frank Wright now publishes a portion of his letter of April 2 (see JOURNAL for Oct. 8, p. 734), I must briefly refer to it. Why does he not publish his statement about our estimate of 0·42d. *per candle-thousand?* In a report dated April 9, sent in reply to my letter of April 5, Mr. Frank Wright says: "I have carefully perused the pamphlets issued on the 23rd of January and the 28th of March" (our reports on the experiments). He then gives long quotations from these reports, in which he coolly substitutes "*thousand candles*" for *candle-thousand* in our estimate of 0·42d. He concludes thus:

> In seeking to make both ends meet, by disregarding this most essential factor due to the consumption of gas taken as the standard for comparison with the photometer tests, Mr. Wood is not bettering his case, as he pleads most unwonted ignorance on a subject that every gas manager should be thoroughly at home with. Mr. Wood further asks my definition of a candle-thousand unit. I reply: The light equivalent to 1000 standard sperm candles, each consuming at the rate of 120 grains of spermaceti for an hour. *It is apparent that it will take a "candle-thousand" or 1000 "foot-candles" to enrich every 1000 cubic feet to the extent of a candle; and, upon Mr. Wood's figures, we arrive at the basis of cost at 2·1 pence.*

The italics are mine; and I would specially emphasize this sentence. No wonder the Committee were misled by such an astounding blunder.

It will now be seen, I think, that I do not "stand alone as the man who has taken 1000 feet-candles and candle-thousand as equivalent terms," but have the support of Mr. Frank Wright in the sentence just quoted, and the support of Mr. Lewis T. Wright in his letter dated April 1. (See JOURNAL for Oct. 15, p. 784.)

Mr. L. T. Wright's reference to pp. 50-51 of Mr. Newbigging's "Handbook" is characteristic. There is not a single word on these pages about foot-candles or candle-thousands.

Mr. Wright infers that I "mistake generosity for a blunder." I could substitute another word for "blunder;" but it would not be "generosity." Mr. Wright's "generosity" is on a par with his anxiety to avoid references to the calculations when he came to Bradford in July. When he did find that his and Mr. F. Wright's statements had led the Committee to believe that our estimate per candle-thousand was five times too low, why did he not honourably correct his mistake? Why did he not adhere to his first use of the term "candle-thousands," instead of *generously* "taking them per 200 candles, or cost of enriching 1000 cubic feet by 1 candle per 5 cubic feet"?

Was it "generosity" that prompted Mr. Wright to tell the Committee (see JOURNAL, p. 593, col. 1, line 75): "I have nothing to withdraw; but allow me to explain. If you take this paragraph literally, as it was presented to the Committee, Mr. Wood is five times wrong; but to let Mr. Wood down gently, I am willing to believe that Mr. Wood did not intend to convey the impression he did convey." Mr. Wright knew very well that the impression I "intended to convey," and *did convey*, to every member of the Gas Committee was, that the cost was 0·42d. per candle-thousand, or per candle of enrichment per 1000 cubic feet.

Bradford, Oct. 17, 1895. CHAS. WOOD.

SIR,—The conversion by Mr. Wood, in his letter of the 2nd of October (*ante*, p. 733), of the words of my letter to him of the 13th of April, 1895 (*ante*, p. 783), "If your Committee, or any member of the same, have thought that 'A's' answer to the second query brought out the candles five times too high, and the cost five times too low," into "if the Committee thought the cost per candle-thousand was brought out five times too low," is a serious misquotation, employed as it is in support of his unfounded contention that I was privately discussing a report of his, and that I had to go to a former one to find his use of the term 1000 foot-candles. The correspondence clearly shows that I was not discussing any report of his, but a letter that asks for the cost per 1000 foot-candles under a difference of opinion between "A" and "B." In that letter, "A" takes 1000 foot-candles as the product of 1000 cubic feet by 1 candle of illuminating power, which is stated (as almost everyone knows, and as "B" knew) in candles per 5 cubic feet; and further "A" treats a candle-thousand as the equivalent of 1000 foot-candles. "B" takes the same product, when divided by five, as representing those units. I have already shown that Mr. C. Wood, in his very first letter to me of the 5th of April (*ante*, p. 784), has made that admission.

The attitude of Messrs. Newbigging—who, after being associated with me in a perfectly friendly and cordial manner, go outside the matter on which they are engaged to report, and without notice to me, in order to give currency to a wretched story devoid of foundation; who, when it appears probable that I have a reply, deprecate the use of personalities, while making most liberal use of that poor weapon themselves; and who, when asked to explain a few of their own contradictory statements, excuse themselves on the score of not wishing to tire readers—is one that I shall not characterize, as I do not desire to deprive them of their monopoly in the use of personalities. To make an ill-founded complaint against anyone is, I suppose, a way of amusing readers; to have it refuted is to tire them.

1, Victoria Street, S.W., Oct. 18, 1895. LEWIS T. WRIGHT.

A Gas Company's Investment and Extensions.—An application was made, on behalf of the Tamworth Gas Company, at the Borough Court, last Wednesday, for a certificate to enable the Directors to use £445 which had been invested in Consols, with the accruing dividends, in payment for recent extensions. The application was granted.

Stratford-on-Avon Corporation Gas Committee.—Last Wednesday, a Local Government Board inquiry was held by Mr. E. P. Burd relative to an application by the Corporation for a Provisional Order to alter the Borough Act of 1879, so as to remove the limits imposed upon the amounts which might be paid for the purchase or redemption of gas annuities issued under the Act. The Town Clerk (Mr. R. Lunn) explained that the application was to the effect that the limit of 25 years should be struck out, and that the Corporation should have liberty to purchase the annuities upon any terms which they might think to the advantage of the ratepayers. There was no opposition.

LEGAL INTELLIGENCE.

Charge of Attempting to Steal Gas.

At the County of London Sessions last Tuesday, before Sir P. H. Edlin, Q.C., Roger Weeks pleaded "Guilty" to an indictment for having attempted to steal gas, the property of the Wandsworth and Putney Gas Company (*see ante*, p. 639). Mr. Besley, Q.C. (with him Mr. Layman), for the Company, said there was a second indictment, which charged the accused with having actually stolen gas; but he would not go on with that. Defendant lived in Earlsfield Road, Wandsworth, and it was found that a pipe had been connected to the main, so that gas could be used without passing through the meter. The Company had prosecuted as a warning to others, not with any desire that the man should be sent to prison. Mr. Drake, for defendant, said it had been stated that there was a falling off in the consumption of gas on the premises; but this was accounted for by the circumstances that Weeks formerly had in the house an office he had now ceased to use, having retired from business, and that the pipes were frozen last winter, and for some time the gas could not be burnt. Defendant was a retired builder, and bore a very high character. He was sentenced to pay a fine of £15.

A Water Company's Supply Used for Irrigation.

At the Tunstall Stipendiary's Court last Thursday, Joseph Colclough, farmer, of Ravenscliffe, was summoned at the instance of the Staffordshire Potteries Water Company for wilfully and negligently allowing water belonging to the Company to be wasted on Oct. 2. The case for the prosecution was that, at one o'clock in the morning of the day mentioned, an inspector tested the mains at Goldenhill, and found a great waste of water. He traced the course of the flow to the defendant's farm, where he discovered that the water was running from two taps into a broken tub and an iron cistern. The water was conveyed by a broken piece of spouting to the tubs, which emptied into a sewer, and apparently went to waste. The sewer, however, went a distance of 20 yards only; and at the end of it was a gutter, from which trenches were dug to various parts of the field. The water from the taps was running down those channels, and irrigating the field. The rate at which the water was running was upwards of 100 gallons an hour. On behalf of defendant, it was stated that the taps were not running when he went to bed. The Stipendiary pointed out that it was rather curious that the drain from the taps should run into the field in the way it did. He fined defendant 40s. and costs—£3 16s. in all.

The Toronto Gas Consumers' Company and their Reserve.

In May last, a special case was stated before Mr. Justice Ferguson, at Osgoode Hall, Toronto, bearing upon the proceedings of the Toronto Consumers' Gas Company in regard to their reserve fund. The plaintiffs were Mr. J. T. Johnston and the Toronto Type Foundry Company; and they sued on behalf of themselves and the other consumers of gas in the city. The following is an outline of the case, as given recently in the *Toronto Empire*: The defendants were incorporated in 1848. In 1887, being desirous of increasing their capital stock, they presented a petition to the Legislative Assembly of Ontario for authority to do so; and thereupon an Act was passed in that year, entitled "An Act further to Extend the Powers of the Consumers' Gas Company of Toronto," which came into force on the 23rd of April, 1887. It was alleged by the plaintiffs that, at the time of the passing of this Act, the defendants had a surplus of profits on hand, which was to have formed the nucleus of the "rest," or reserve fund, which at that time amounted to $394,310. The plaintiffs alleged that the defendants then sold the increased capital stock at a premium, and thereby realized a large sum, which, as they urged, should have been added to the reserve fund, and invested in some one or more of the securities mentioned in the 4th section of the Act; but, instead of so investing it, the defendants spent it for plant and material. The plaintiffs also charged that the defendants made large profits in their business since 1887, amounting to about $250,000, which should have been applied in forming the special surplus account to be used in the reduction of the price of gas to the plaintiffs, and also that the interest which would have been gained if the reserve fund had been invested should also have been applied in reducing the price. The plaintiffs also alleged a further sale of new stock by the defendants in October, 1893, which realized a premium of $83,040, which sum the defendants, as the plaintiffs feared, would, unless enjoined, use in the purchase and construction of plant, as also such fresh profit as might accrue from time to time. The plaintiffs claimed a return of sums which they said had been overpaid by them to the defendants as the price of gas consumed; and they asked for an account of the receipts and disbursements of the defendants since March 23, 1887, a mandatory order directing the defendants to comply with the provisions of the Act of 1887, a declaration of right, a declaration that the defendants were trustees, &c., and an order restraining them from misapplying the $83,040. The Company, by their defence, raised the question of the proper construction of the statutes relating to their reserve fund, &c., and they said they had reduced the price of gas. They also demurred to the statement of claim on the grounds that the plaintiffs had no *locus standi* to bring the action. The first question put to the Court was whether the plaintiffs had a right to maintain the action as constituted. This was answered in the affirmative. The second was whether the defendants were obliged to include in the reserve fund which the Act of 1887 directed them to have—(1) The moneys which they had standing to the credit of the profit and loss account, (2) to the credit of the contingent account at the time of the passing thereof, and (3) all the money received from the premiums on the sale of stock authorized by the Act to be sold until the fund amounted to 50 per cent. of the paid-up capital. The answer of the Court to this question was also in the affirmative. The third question was whether it was *ultra vires* on the part of the Company to invest or use the reserve fund, or any portion of it, in the purchase or construction of their plant or buildings, or in their business generally. The Court said it was. Then, was it *ultra vires* of the Company to invest the premiums on the sale of stock, or any part thereof, in the erection of buildings until the reserve fund had been found equal to one-half of the paid-up capital? This was answered in the affirmative. The reply to the fifth question—Did the defendants establish, maintain, invest, and use the reserve fund in accordance with the provisions of the Act?—was answered in the negative. No answer was necessary to the sixth question. The seventh question was: Has the plant and buildings renewal fund ever been created or maintained within the meaning of the Act? The answer was: It does not appear that this fund has been created or maintained as required by the 6th section of the Act. The next questions were After providing for all usual and ordinary repairs and renewals, was it *ultra vires* of the Company to invest or use the surplus of the plant and buildings renewal fund in their general business, or was the fund to be kept separate from the other moneys of the Company uninvested? If the usual and ordinary repairs and renewals did not amount to as much as the 5 per cent. referred to in the Act, should the full 5 per cent. be carried to the credit of the plant and buildings renewal fund, or only sufficient to cover the usual and ordinary repairs? These questions were answered as follows: There is no objection to the investment of any portion of this fund, remaining unemployed, in such securities as would be readily available in case the funds should be required; but there is no obligation resting upon the Company so to invest. The final question was whether, in addition to keeping the plant and buildings in repair by means of this fund, the Company had the right to write off sums of money from profits by "depreciation in plant?" The answer was in the negative. The judgment was therefore in favour of the plaintiffs; and it directed the taking of several accounts, comprehending the whole business of the defendants done since the passing of the Act of 1887, and including the surplus profits then in their hands. For the purpose of taking these accounts, a reference was directed to the Master-in-Ordinary. The plaintiffs are to be paid their costs to the present time by the defendants. Further directions and subsequent costs are reserved. The Company intend to appeal.

Horse v. Steam Traction for Conveying Coal to Gas-Works.—During a Local Government Board inquiry at Maidstone last Wednesday, in respect of certain proposed new regulations for traction-engine traffic in the county of Kent, the National Traction-Engine Owners' and Users' Association strongly protested against the alterations contemplated, on the ground that the industry would be so seriously crippled as to threaten its destruction altogether; while it would especially act against many of the gas companies who had their coal conveyed to the works by means of traction-engines. Mr. W. Arnold, one of the witnesses, said he might cite the Ticehurst Gas-Works as an illustration. The carriage of coals to these works by traction-engines, as compared with horse cartage, resulted in a saving of from 3s. 6d. to 4s. a ton. The Inspector said this seemed a very important statement. He was assured that it was correct, and that the difference would be more in some places; but if the alterations in the regulations were sanctioned, the traffic could not be carried on in many districts.

Gas Affairs at Stoke-on-Trent.—The Executive Gas Committee reported to the Stoke-on-Trent Town Council last Thursday that they had ordered a remittance of £890 to the Council; making a total of £2890 paid over out of the year's profits towards the reduction of the rates. They recommended that two purifiers should be put down at the gas-works, according to plans and specifications prepared by the Manager. In moving the adoption of the report, Mr. Geen, the Chairman of the Committee, stated that the cost of the purifiers would be from £800 to £1000, and that they would be paid for out of revenue. The report was adopted. In accordance with notice, Alderman Boulton moved an instruction to the Gas Committee to consider the advisability or otherwise of reducing the price of gas. In seconding, Mr. Greatbach said that the Stoke consumers were paying 25 per cent. more for their gas than their neighbours; and the Corporation were paying 13s. per lamp more for public lighting than Hanley. Mr. Geen proposed, as an amendment, that it be an instruction to the Committee not to reduce the price of gas until they were satisfied that the annual profits from the undertaking were sufficient to enable them to pay the Council 5 per cent. upon the amount of capital employed. The amendment was carried by 18 votes to 2.

Serious Accident to a Warehouse and Gas-Mains at Halifax.—An extraordinary accident occurred at Halifax last Wednesday evening. At the corner of Horton Street and Church Street stands a large warehouse, four storeys high, with a frontage of some 80 yards to Church Street. Overhanging the building was a massive cornice and parapet; and a few minutes after six o'clock, the portion in Church Street, from one end of the building to the other, fell with a tremendous crash, completely covering the whole thoroughfare. A horse and brougham, with the coachman (William Holroyd), were standing beneath. Holroyd's head was crushed in, and death was instantaneous; the horse was killed; and the brougham was completely smashed. Soon after the accident, a strong smell of gas was perceived in the street; and workmen from the gas-works concluded that the vibration caused by the heavy fall of masonry had damaged the mains, and caused the gas to escape. It was therefore considered dangerous to move about with lights, for fear the quickly accumulating gas should explode. Several times it did ignite; and some difficulty was experienced in extinguishing the flames. The gas continued to accumulate in Church Street; and the police requested the tenants of the three adjoining houses to leave their dwellings, lest an explosion should occur. The tenants acted upon the advice; and the wisdom of this step was apparent later in the evening, for the gas in one of the houses exploded with a loud report, and the kitchen in the basement was soon in flames. The fire brigade were summoned; and they prevented the flames from spreading to the adjoining property, and ultimately extinguished them.

MISCELLANEOUS NEWS.

THE GAS QUESTION IN LIVERPOOL.

The Special Lighting Committee's Memorandum—Newspaper Correspondence.

The controversy which has been going on in Liverpool in regard to the price and quality of gas—resulting, as already recorded in our columns, in the passing by the City Council of a resolution to take steps to "establish and maintain a competitive gas supply," and in the Town Clerk being instructed to retain the services of "an eminent gas engineer in London" to report upon the matter—has given rise to some newspaper correspondence which it may be of interest to reproduce, in conjunction with other documents bearing upon the question.

It will be remembered that, towards the end of last month, a report was presented to the Special Lighting Committee of the Council, by the Gas Examiner (Mr. C. R. Bellamy), giving the results of tests he had made of the illuminating power of gas in various towns. It was preceded by a memorandum, signed by the Chairman of the Committee (Mr. F. Smith), recording the circumstances which led to the making of the tests. It appears that at a meeting of the Committee and a deputation from the Directors of the Gas Company, which took place on the 28th of June last, the Directors demurred to accept as reliable the value ascribed to gas in other towns, as shown by official and parliamentary returns. As a consequence, no certain comparison could be made between the Liverpool gas and other gas, and discussed, until the respective values were definitely ascertained. The Committee accordingly authorized Mr. Bellamy to proceed to the various towns having the principal gas undertakings of the country, and test the illuminating power with the same instrument as is at present, and for the last twelve months has been, used for testing in Liverpool. The tests were made with three different burners; and they demonstrated to the members of the Committee who witnessed them that the use of a burner suitable to the gas is absolutely necessary before the consumer can ever hope to obtain anything like the best light for the money he expends. They found that the average loss of light due to the use of the ordinary fishtail burner amounted to about 34 per cent. Taking Liverpool, Glasgow, and Sheffield, as being capable of easy comparison, the following figures were given:—

Town.	Illuminating Power.	Price of Gas. s. d.	Cost of Coal per Ton. s. d.	Value of Residuals per Cent. on Cost of Coal.
Liverpool.	20·11	3 4 / 3 0	20 7·40	32·04
Glasgow .	20·87	2 6	9 9·10	45·62
Sheffield .	20·40	1 10 / 2 5	8 6·82	101·15

It was explained that "the two prices of gas in Sheffield represent the maximum and minimum charges—the actual charge being according to a sliding-scale based upon the amount of gas consumed; while the two prices in Liverpool represent the charges for the first and second halves of 1894, or an average for the year of 3s. 2d., as compared with 2s. 5d., the highest charge in Sheffield, though the lighting value according to the actual test is practically identical in both towns." The Committee went on to point out that "the coal, &c., consumption for gas manufacture in Liverpool is over 300,000 tons per annum;" and they remarked that, "if Liverpool used material as cheap as that used by either Glasgow or Sheffield, the saving to the ratepayers who are gas consumers would be very great. A saving of £150,000 per annum on coal would represent a reduction of about 1s. per 1000 cubic feet to consumers of gas." The memorandum closed with an expression of the confident hope that attention rightly directed to this subject by the Council and the Directors of the Company would result in some action bringing about a very substantial reduction in the price of gas for both lighting and cooking purposes, "especially bearing in mind the large purchasing power of Liverpool, its close proximity to the Lancashire coal-fields, and the large number of important consumers." The first step in the direction of attaining the desired end was taken by the Corporation, who assumed the hostile attitude referred to in the opening paragraph of this article.

At a meeting of the Special Lighting Committee on Monday last week, the following letter, addressed to the Town Clerk (Mr. Harcourt E. Clare) by Mr. P. F. Garnett, the Secretary of the Gas Company, was read: "I am instructed by the Directors to inform you that, in accordance with my letter of the 26th ult., a thorough investigation has been made into the subject-matter of the Special Lighting Committee's memorandum of the 23rd of September, 1895, with the result that it has been found to contain many very erroneous and misleading statements, and that the comparisons drawn to the prejudice and disparagement of the Liverpool Gas Company are absolutely unfair and unwarranted. But inasmuch as the City Council has now assumed a distinctly hostile attitude, by passing a resolution to apply for statutory powers to establish and maintain a competitive gas supply, the Directors consider that the proper place for entering into details will be a Committee-room of the House of Parliament; and they regard with much satisfaction the prospect of having an opportunity to submit their whole administration of the Company's affairs to the impartial judgment of that tribunal. In view of the altered relative position of the Corporation and the Gas Company, the Directors feel that it would be useless to have any further interviews with the Lighting Committee." Though this communication was of great importance, it was not published; and the result was, as pointed out by a local newspaper, that adverse criticisms were made by parties who must have been aware of the true position, but who "carefully refrained from allowing the ratepayers to know the other side of the question as stated on behalf of the Gas Company."

In the paragraph on p. 774 last week, it was mentioned that a correspondent of one of the Liverpool papers advised the Corporation to acquire the Company's undertaking. The correspondent in question was Mr G. H. Ball; and his letter (which appeared in the *Liverpool Courier*) was as follows: "Since I wrote the letter to the *Courier* of Feb. 21, 1894, *in re* the Corporation and the Gas Company, the shares of the Company and those of nearly all the other gas companies in the kingdom have gone up very much in value, owing to the fact that more recent experience has proved that the increased use of the electric light has had very little material influence upon the consumption of gas in all parts of the world. In many places—Paris, Vienna, Berlin, &c.—the improved gas-burners, with more brilliant and less costly light, have displaced the electric light to a great extent. As the chief grievance against the Gas Company by the Corporation is that of extravagant management, for which there may be some justification, there is a practical and easy remedy. Let the Corporation guarantee the shareholders the statutory dividends, and take over the Company's undertaking holus-bolus, as was done in Glasgow with great success. The management could then be done by a Committee of the Corporation open to public criticism, as is the case in Glasgow, Manchester, Leeds, and other towns. By obtaining a relaxation of the Act of Parliament, so as to enable the Corporation to reduce the minimum illuminating power from 20 candles, as it is at present, to 18 candles, which has been found in Leeds by testing to be sufficient for all practical purposes, a considerable reduction in the cost of production could be made; and I am quite satisfied that, under economical management, gas could be supplied at 2s. 3d. per 1000 cubic feet, or perhaps less, after paying dividends, &c."

The foregoing letter was answered by the Chairman of the Special Lighting Committee (Mr. F. Smith). The following are the principal portions of the reply: "Mr. Ball says that Paris, Vienna, and Berlin have improved burners that have displaced the electric light; and I cannot but think that, if the Gas Company here had done what they could, the Liverpool consumer would to-day have a burner which probably would save one-third of the gas bill while improving his light. Such a burner, certified by the Corporation test, will, it is hoped, be forthcoming. Everyone who has considered the matter will agree with Mr. Ball that, while electric lighting is most desirable in many cases, it is not sure to displace gas; and therefore it becomes necessary for Liverpool to have the right to supply gas, at any rate in the portions of the extended city as yet undeveloped. It would have been useful if Mr. Ball, from his wide Continental experience, had given us the terms upon which the gas undertakings of the places he names are carried on. It is said they manage these things better in France; and I understand that in Paris a very large sum is annually paid by the gas undertakers to the Municipality for their privileges, and that thereout the beautification of the city is largely made. This form of benefit is perhaps not the best; but it is infinitely better than nothing at all, and dear gas into the bargain. Mr. Ball, referring to Liverpool gas, says he is quite satisfied that, under economical management, gas could be supplied at 2s. 3d. per 1000 cubic feet, or perhaps less. I certainly think it is to be regretted that he did not propound and discuss this view at the last meeting of the Gas Company, or when the gas engineers of the kingdom held their meeting here. Mr. Ball, who for some years was a hard-working public man of experience, also suggests, as what he calls a practical and easy remedy, that the ratepayers of Liverpool should pay equivalent to £400 for each £100 ten per cent. share, though the market price to-day is 239 to 241. If this were the only remedy, sorry indeed would be the plight of the gas consumer. There is a much more drastic remedy in the hands of the people; and, wild and visionary as it may appear to-day, it does not portend greater changes than have been already accomplished in Liverpool. The attentive dealing with the subject is only in the bud; but, under the kindly and discreet, but firm, nurture of the ratepayers, it will, I trust, bring forth much fruit. I want to see hundreds of poorer homes in the city supplied with cheap coke, which should form an economical fuel; and, as they cannot afford electric light, gas on the best terms—say, at 1s. 6d. per 1000 cubic feet, and not, as at present, at 3s. 4d., cash in advance, while the richer neighbours pay 2s. 10d. at the end of the quarter. The friends of the Company say this is a party question; but the question is one the magnitude of which far exceeds any party question ever raised in our city."

Another correspondent—Mr. Thomas Scott—took up the question; commencing his letter as follows: "Account for it as we may, there seems no doubt at all that the average Englishman hates a monopoly. Only those who profit thereby can be found to say a word in its favour; and this is equally as true of the Liverpool gas monopoly as of any other. When a monopoly is of the nature that provides 10 per cent. per annum profit under all circumstances—that is, when the 10 per cent. is absolutely safe, no matter whether the business be ill or well done—it is one with which the owners may well be satisfied; and it is idle to expect that they will desire change. They are willing that it shall go on for ever. It has been urged that the 10 per cent. return is really a fallacy; but that I deny. Truly, anyone buying gas shares now would have to pay a price which would only leave 3 or 4 per cent. interest. That, however, is a matter between buyer and seller, and does not make the gas supply any cheaper to the public, who from first to last have paid 10 per cent. on the original stock; and if the buyer only gets a reduced interest, it is because he has thought it worth while to pay perhaps £250 for every £100 worth that he has bought. Then, also, most men think that a monopoly paying 10 per cent. dividend, and which has lasted fifty years, has lasted long enough at the expense of the public, even to satisfy those who undertook the original risk."

As this seemed to be the idea entertained by Mr. F. Smith, Mr. Ball made it the basis of his reply to both gentlemen. Thinking it would be interesting to the public to have a little information as to the real state of the case, Mr. Ball inquired into the early history of the Company, in order to make himself fully acquainted with all the facts. These he set forth as follows:—

"I find that originally there were two Gas Companies in Liverpool One was called the Liverpool Gaslight Company, founded as far back as 1816. The stock at that time issued was nominally a 10 per cent stock; but, as a matter of fact, the very first issue was sold at a premium. In 1845, the same Company sold £25,000 of 10 per cent. stock, which realized £45,344; and in 1848, they sold a further amount of £25,000 of 10 per cent stock, which realized £40,163. On two occasions (1841 and 1846), for some reason, I presume, according to the Money Market at the time, they allotted some stock at par. Then in 1848 they amalgamated with the Liverpool Oil-Gas Company; and

from that time it has continued as the Liverpool United Gaslight Company. I find that even with the Liverpool Oil-Gas Company the great bulk of their shares were sold, and realized a very large premium. In 1834 and 1838, £70,000 of 10 per cent. stock realized a premium; in 1841 and 1843, £17,000 of 10 per cent. stock was sold for £24,345; and in 1844 to 1847, £40,000 of nominal 10 per cent. stock realized £73,677. In 1848, when these Companies were amalgamated, it was under an Act of Parliament, which contained certain obligations on the part of the Company, and certain privileges. The last Act in reference to the Company was passed in 1886; and from that time the Company have issued nominal stock at 7 per cent., but it must be sold by public auction, so as to realize the utmost capital that the public are prepared to invest at the price. But prior to that, even so far back as 1882, 7 per cent. stock was issued, known as 'B' stock, at a very large premium. For instance, in January, 1883, £75,000 nominal 7 per cent. stock was sold for £94,082; in 1884, £75,000 was sold for £98,341; in 1885, £50,000 of 7 per cent. stock was sold for £75,163; in 1888, £8100 of stock was sold for £12,414; and again in 1888, £41,900 of stock was sold for £64,214; in 1891, £38,100 of stock was sold for £55,253; in 1892, £50,000 of stock was sold for £75,040; in December, 1894 (the last sale that was made), £40,000 nominal 7 per cent. stock actually realized £67,647.

"The whole of these premiums I have quoted—the whole premiums paid upon these values—have not gone into the hands of any speculative shareholders or any individuals whatever, but have been used as capital in carrying on and extending the Company's undertaking; and the popular idea that the Company's shareholders are obtaining such large dividends as mentioned by Mr. Alderman Fred. Smith and his friend Mr. Thomas Scott is altogether erroneous, and evidently shows that these gentlemen either do not understand the question they are speaking and writing about, or it would seem they meant to mislead the public. What I wish the public to understand is this—that, upon the faith and strength of an English Act of Parliament, investors have been induced to pay such high prices as I have mentioned for their stock in the Company. The amount actually realized in dividends upon the whole of the capital stock is small as compared with the nominal dividends of 7 and 10 per cent. As a practical illustration of this, I mention the very last sale that took place—in December, 1894. The Company were then anxious to obtain £65,000 of capital to extend their new works. In order to obtain that sum, the Directors resolved to offer £40,000 nominal 7 per cent. stock by auction. It was sold in the Law Association Room, and realized £67,647, which, at 7 per cent. on the £40,000, will yield a dividend of £4 2s. 9d. per cent. to the shareholder upon his investment. Of course, no one in his senses would think of investing his money in an ordinary trading concern for such a low rate of interest, especially with the knowledge that, under any circumstances, whatever the amount of profits obtained by the Company, he was not allowed by Act of Parliament to receive more than £4 2s. 9d. per cent. upon his investments—the surplus profits must be used on the reduction of the price of gas. On the other hand, it would have been very foolish of him to invest for such a small interest unless he considered that, though he was not allowed to receive more than £4 2s. 9d., he was in some way protected against getting less than £4 2s. 9d. per cent. So the Act empowers the Company, in order to secure uniformity of dividends in accordance with this limitation, to raise, if necessary, the price of gas as high as 4s. 6d. per 1000 cubic feet as a maximum charge; and it is the limit of fluctuation between the price of 2s. 10d. at present and 4s. 6d. per 1000 feet that affords security to the investor for the permanence of his dividends. This has been explained over and over again by the Chairman of the Company at meetings. I have already explained it through the Press myself for some years past; but, notwithstanding this, the public are deluded by such statements as have been made by the gentlemen in question.

"Mr. F. Smith was pleased to refer to me in his letter as a large shareholder in the Company. I may as well inform Mr. Smith and the general public that the actual capital which I have in the Company, and which has gone to the Company, and not to any speculator, does not quite pay me 5 per cent. per annum; and at the last auction sale I offered as much as £168 per share, which would not have paid me £4 5s. per cent., and I was unable to get any. The gas consumers get the advantage of all this, for the simple reason that, had the Company not realized such a high price for their shares which brought them in the necessary capital, they would have had to have issued shares at a lower price, which would have necessitated the realization of a greater amount of profit to pay the statutory dividend, which profit would have had to be made up by raising the price of gas to the consumers. But owing to the favourable conditions upon which the Directors were able to dispose of their stock, the gas consumers get a considerable advantage in having the gas at a lower price. It is not my intention to defend the action or management of the Company's Directors. I have no doubt they will be able to give some explanation themselves as to the charges made against them by Mr. Smith and others. I am now simply speaking from a shareholder's point of view, in order that their interests may be safeguarded from any such insidious attacks as have been made.

"Reference has been made also as to the extravagance of the Company in connection with their works; and the question has been raised as to what the probable value of the whole of the Company's offices, works, and undertaking is as a going concern. From inquiries I have made as to the charge for renewals, enlargements, old plant, mains, &c., I am satisfied that if we were to start *de novo*—that is, supposing the Company did not exist, and that it was decided to put down plant, mains, and break up the streets for a new concern—it would cost considerably more than now stands in the capital account of the Company.

"In my recent letter, I mentioned that if the Corporation took over the whole of the Company as a going concern, and guaranteed the statutory dividends, which amount to the rates mentioned above, it would enable the Corporation to take over the concern without any outlay of capital at all more than has already been made. It simplifies the transaction, and would bring about a change in the mode of management, which I think at present is not sufficiently made public; and by the relaxation of the Act of Parliament which now fixes the minimum illuminating power at 20 candles, so as to enable the Corporation to reduce it to 18 candles, which in some other towns has proved satisfactory, the Corporation could supply gas at a much lower price. Moreover, if they thought it advisable to continue the working of the electric light, it would enable them to work under better conditions by a combination of departments, as in Glasgow and Manchester, and make it more economical and satisfactory to the public.

"As a practical illustration of Mr. Smith's inability to act as a guide to the public in these matters, I refer to his *ad captandum* remark 'that he wanted to see hundreds of poorer homes in the city supplied with cheap coke, which should form an economical fuel.' I think I need hardly remind you that the Gas Company is carried on chiefly to supply gas; and it is the duty of the Directors to obtain the best price for their residuals, in order to keep down the price of the gas to the public. It must be apparent to the simplest mind that the lower the price at which the Company sell their coke, tar, and ammonia, the higher the price it would be necessary to charge to the consumers for gas. If Mr. Smith thinks the terms I have suggested upon which the Corporation could take over the Company are not satisfactory, I may tell him for his information that the shareholders would no doubt be exceedingly pleased to sell upon the same terms, and at the same ratio of value to the net profits earned, as he considers he has so successfully arranged with the Electric Supply Company."

With regard to the "eminent gas engineer in London" alluded to in the opening paragraph of this article, more definite information was furnished by the following announcement in the *Liverpool Courier* last Wednesday: "The Finance Committee of the Liverpool Corporation have adopted a resolution authorizing the Town Clerk to give a general retainer to Mr. George Livesey, Gas Engineer, and to engage him, at a cost of not exceeding 100 guineas, to consider and report on some scheme to supply Liverpool with gas independently of the present Gas Company." Mr. Livesey replied to this statement as follows:—

The Editor of the *Liverpool Courier*. *Oct.* 18, 1895.

Sir,—The statement in your issue of the 16th inst. is quite correct so far as the offer by the Town Clerk of a retainer in this matter is concerned. I should, however, feel obliged if you would permit me to say that I replied, expressing my appreciation of the confidence of the Finance Committee of the Corporation; but that my connection with the South Metropolitan Gas Company was an absolute bar to my taking a hostile position towards any gas company. I could not, therefore, accept the retainer.

May I also be allowed to say that an independent gas supply is utterly out of the question? It is more than thirty years since Parliament sanctioned a competing gas company; and it has never authorized—and it is not at all likely that it ever will authorize—any corporation to introduce an independent supply in competition with a company. The best plan for dealing with the question will be for the Corporation to open friendly negotiations with the Gas Company, with a view to a reduction of the illuminating power of the gas. The present high quality costs the consumers more than it is worth. It is the cause of the high price paid for coal; and with a lower quality, at a correspondingly lower price of gas, the consumers would get better value for their money.

(Signed) GEORGE LIVESEY.

South Metropolitan Gas Company,
709A, *Old Kent Road, S.E.*

THE RIGHT OF GAS SHAREHOLDERS TO VOTE ON ELECTRICITY SUPPLY QUESTIONS.

The important point as to the disability of shareholders in gas companies taking part in the discussion of, or voting upon, the subject of the supply of electricity at meetings of urban district councils and kindred governing bodies, was a topic of much discussion at the meeting of the Reigate Town Council last week. Several electrical supply companies had given notice to the Council that it was their intention to apply to the Board of Trade for a Provisional Order to authorize them to furnish electric light within certain areas of the borough. A special meeting of the Council was accordingly held to determine whether a private company should be allowed to do the work, or whether the Corporation should apply for a Licence and carry out an installation. All went smoothly until Alderman F. Budgen, a Director of the Gas Company, rose to speak; when Mr. Viall asked the Town Clerk (Dr. Grece) to give his legal opinion as to whether a gas shareholder could take part in the discussion of, or vote upon, any motion relating to electric lighting. In reply, the Town Clerk read the opinion of Mr. G. Humphreys, of the Temple, which, he said, had appeared in the JOURNAL OF GAS LIGHTING for April 10, 1894, respecting a similar point which had been raised at the Monmouth Town Council. Many of our readers will doubtless recollect that Mr. Humphreys considered that members of the Town Council who were also shareholders in the Monmouth Gas and Water Company were not pecuniarily interested, either directly or indirectly, within the meaning of the Municipal Corporations Act, 1882. He (Mr. Humphreys) thought, therefore, that the Mayor of Monmouth was bound to treat them in all respects in the same way as the ordinary members of the Council; and that the fact that they were Directors of the Company did not preclude them from taking part in the discussion of, or from voting upon, the scheme for electric lighting. The Town Clerk, having read this extract, said his views entirely coincided with the opinion given by Mr. Humphreys; and the Mayor was about to rule that Alderman Budgen might speak, when Mr. Viall handed in an extract from an opinion of Mr. R. S. (now Mr. Justice) Wright in regard to electric lighting, which was cited in respect to a similar question raised at the Wells Town Council early last year. He also produced one of Sir R. E. Webster, Q.C., M.P. Mr. Justice Wright said:

The question turns on the construction of section 22, sub-section 3, of the Municipal Corporations Act, 1882. In my opinion, those members of the Council who are shareholders in the Gas Company have a direct pecuniary interest in the question whether or not the Council shall give their consent to the application by the Electric Light Company for a Licence under 45 & 46 Vict., cap. 56, sec. 3; and such members are not entitled to vote on the question, or to take part in the discussion of it. No penalty is

attached to a breach of section 22, sub-section 3; and all that can be done in order to prevent such members from voting will be to get some member of the Council to draw the attention of the Mayor to the facts that the votes in question ought not to be received, and will be invalid. (See Rule 10 of Schedule II. to the Municipal Corporations Act, 1882).

(Signed) R. S. WRIGHT.

The Town Clerk, having read the foregoing opinions, said he would not place his ruling in opposition to such authorities. Had he not seen Mr. Justice Wright's opinion, he should have accepted that of Mr. Humphreys—that a pecuniary interest had not been made out. After a good deal of discussion, in which, however, none of the gas shareholders took part, it was resolved that Counsel's opinion should be taken "as to the legality or otherwise of gas shareholders voting on the electrical supply question."

[This matter is dealt with in our editorial columns.—ED. J. G. L.]

THE DVORKOVITZ OIL-GAS CONTROVERSY AT BRADFORD.

As might have been anticipated, the "paper war" over this subject has not been allowed to die down all at once; and the Bradford local papers have contained further references to the matter. Among the contributions that need noticing here, is a reply by Mr. J. E. Gresty to the letter by Mr. W. W. Shaw, the substance of which appeared in last week's JOURNAL (p. 789).

After some introductory remarks, dealing mainly with his denial of the alleged infringement of the Peebles patents by the Huddersfield oxy-oil plant, Mr. Gresty gives further particulars as to his Company's (the Northern Counties Hydro-Oxygen Gas Company's) offer to the Bradford Corporation. Concerning this, he remarks: "The offer made by my Company was an alternative one. One was that my Company should construct a plant at their own expense, and take all risks; and that one-half of the saving thereby effected should belong to the Corporation, and the other half to my Company. It was proposed that this plant should be constructed at the Valley Road works; and, as previously explained, we estimated that one-half of the saving would be £1562 10s. per annum. I am prepared for present purposes to accept Mr. Shaw's statement that, if oxy-oil were adopted at the whole of the Bradford gas-works, the yearly saving to the Corporation would be £9375; and one-half would be £4687 10s. The intention was to apply it to one works only; and it is to be observed that the whole risk would be my Company's, who could only make a profit if it proved a success, as we had every confidence it would be. The Corporation would have been a great gainer without risk or cost. I am quite aware that, when it had proved a success, it is probable the Corporation would not deal with its other works on the half-profit system, but would fall back upon the alternative scheme of a royalty. It is clear that the division of profits cannot in any way be treated as a royalty for the purpose of comparing cost with the Dvorkovitz process; and for comparison we must deal with our alternative proposal. This was that we would put down a plant at our own cost; and if it proved successful, it should be taken over by the Bradford Corporation at cost, and be then subject to the payment of a royalty which, for enriching the whole output of the Bradford borough 2 candles, would not amount to more than £450 per annum. In making our calculation of profit, we had an ample margin not only for this royalty, but for interest on outlay upon plant, depreciation, and cost of oxygen; and we were satisfied the Bradford Corporation could rely upon at least a net profit which would, on Mr. Shaw's figures, amount to not less than £9375, if the whole output were enriched to the extent of 2 candles."

In comparing the oxy-oil and the Dvorkovitz processes, Mr. Gresty points out again that his statement was based upon a calculation from figures in Mr. Wood's report, which Mr. Shaw quoted in his letter of Sept. 20.* It is there stated that 55 tons 1 cwt. 3 qrs. of oil were used to enrich 41,125,000 cubic feet of gas to the extent of 2·16 candles. At the present time, the whole output of Bradford is above 1,600,000,000 cubic feet; so that, in the same proportion, 2095 tons of oil would be required to enrich the total output. The question is, says Mr. Gresty, in round numbers—Say 55 tons enrich 42,000,000 cubic feet of gas 2 candles, what will enrich 1,500,000,000 cubic feet? Is it not rather that Mr. Shaw relies on his imagination, and cannot, or dare not, realize what the facts are?

Concluding his letter, Mr. Gresty says: "I gather from Mr. Shaw's last letter that he has now reduced the value of the bye-products to 3½d. per gallon. It is somewhat amusing to find out how the values of these bye-products have been reduced. Not very long ago I was told that Dr. Dvorkovitz said they were worth 1s. per gallon; after which they were stated to be worth 6d. per gallon; then they were reduced to 4d.; and now to 3½d. Possibly, in course of time they may come down to Mr. Wright's figure of 1·71d., which, I believe, is not very far from being correct. Mr. Shaw, in his letter, states that they are prepared to buy these products at 3½d. per gallon; but Mr. Shaw does not detail the exact terms upon which he is prepared to purchase, nor for what length of time his contract will hold good. As Mr. Shaw must know, the attempt to which he refers, as having been made in Paris forty years ago, to mingle oxygen with gas, bore no similarity whatever to the oxy-oil process. He might with equal relevance have referred to the large numbers of oil processes which have been attempted before the Dvorkovitz process was thought of."

Water-Works for Castlebar.—Mr. C. P. Cotton, the Chief Engineering Inspector of the Local Government Board for Ireland, held an inquiry at Castlebar last week, with reference to an application by the Sanitary Authority for a loan of £8500, for the purpose of constructing water works for the town. The proposed works contemplate the provision of 15 gallons of water per head per day for 4000 persons. The application was not opposed.

* See JOURNAL for Oct. 1, p. 681.

FLETCHER, RUSSELL, AND CO.'S NEW LONDON PREMISES.

It is a gratifying and promising feature in connection with the gas industry that the manufacturers of gas appliances for domestic purposes have, during the past few years, found it necessary, in order to cope with the constantly increasing demand for their goods, to extend their productive power, and provide additional room to display the growing variety of patterns they have to show their customers. It is not many years ago that the first-named partner in the firm of Messrs. Fletcher, Russell, and Co., Limited (whose works are at Warrington and Manchester), was contented with a small London establishment in Upper Thames Street; but, with the progress of time and business, three changes to larger premises have had to be made. The last move (which has recently taken place) is to 134, Queen Victoria Street. This is an extensive building at the corner of Peter's Hill; and it consists of four floors, each of an area of about 87 feet by 25 feet, with a basement of equal dimensions. Entering the ground floor, one is struck by the admirable disposition of the goods which has been effected by the Manager (Mr. C. Clare). On one side is placed a whole series of the firm's well-known cooking-ranges for ordinary use—from the large double oven down to the small "Savoy" oven, the height of which with burner and stand measures only 16½ inches. Among them is a specimen of the new "Kensington" range, which has been specially designed for use with prepayment meters, and which combines the essential qualities of being simple, strong, and easy to clean, with all parts interchangeable. Down the centre of the room are numerous gas-fires, of both old and new types. The latest productions of the firm in this particular line are the "Register" fires, which may be seen in operation. These fires contain improvements which will commend them very strongly to favour. In devising them, the firm have had an eye to the production of a fire which shall have the resemblance of an ordinary coal fire, with, of course, the absence of the surrounding dirt; and they have succeeded. In these new stoves, the canopy is raised above the top of the incandescent fuel, exposing the upper surface, and also the back of the fire; and so utilizing the additional direct radiant heat, and doing away with the objectionable "boxed-in" appearance of gas-fires as hitherto made. Another feature is the moveable fire-clay flap at the back, which is actuated like the flap of the ordinary register fire grate. On first lighting, when all is cold, a full free way is provided for the escape of the products of combustion; but as soon as the draught is established, it can be partially closed, reducing the outlet to the minimum required, and so obviating any waste of heat. The fires (which are fitted with non-lighting-back burners) are made in several styles, which all lend themselves to a variety of adornment suitable for any class of room. In the decoration of their fires, Messrs. Fletcher, Russell, and Co. have introduced a new idea in the use of their "Chimatto" porcelain enamel. Instead of the ordinary plain enamel, a very pretty effect is obtained by mottled colours. Some important improvements have also been achieved in the syphon and condensing types of gas-stove. On the same floor may be seen specimens of the smaller domestic gas appliances manufactured by the firm; and also a large assortment of their laboratory goods, including the new gas-furnaces (fitted with the powerful "Cyclone" burner) for workshop and trade processes. Many applications are now made for large kitchen apparatus for hospitals, infirmaries, hotels, and clubs; and descending into the basement stock room, some huge ranges, ovens, carving-tables, and hot closets for such institutions are on view. A section of the basement has been set apart for a kitchen; and this will shortly be fitted up with apparatus capable of cooking for 1000 people. Adjoining the kitchen, a bath is to be fixed with a water-heater in operation, and also a testing-table for laboratory goods. The first floor of the building has been assigned to the display of the handsome mantels and overmantels, with iron frames and tiled panels, for which the Manchester department of the firm is famed, and which are alike suitable for gas-fires or coal-grates. In connection with the adaptation of ordinary fireplaces for gas-fires, the firm have introduced a novel idea. Instead of the unsightly plain sheet of iron hitherto employed for filling in the opening in which the coal grate has been, they now affix artistically designed tiles to the plates; and this has a very pleasing effect. On the floor above will be found further examples of the firm's ironwork, including lavatories, with gas water-heaters; and the top floor is mainly utilized for storage. The whole building is most conveniently arranged for the purposes to which it is devoted; and it is well worth visiting.

GAS-WORKS IMPROVEMENTS AT FALKIRK.

The Starting of the Peebles Oil-Gas Plant.

Soon after the Falkirk Corporation Gas Commissioners acquired the undertaking of the Falkirk Joint-Stock Gas Company, in February last, they resolved upon a large scheme of renovation. The suggestion was made that a consulting engineer should be asked to report upon the condition of the works and the necessary operations to bring them into a state in which they could be worked with profit. Their Manager (Mr. P. B. Watson), however, placed before them a scheme of improvement, which the Commissioners, after considering with the help of visits to other works, adopted. The scheme consisted, shortly stated, of the introduction of Hislop's regenerative system of firing for the retorts, and of the Peebles oil-gas process for enrichment. Having resolved to proceed with the work, the contract for the regenerative retort-bench was let to Mr. C. M. Hamilton, of Glasgow. Mr. Watson kept the oil-gas installation in his own hands; procuring the necessary castings, and employing his own workmen to build in the retorts. The works are now all completed, and in working order; and on Tuesday last, a company assembled to celebrate the starting of the new plant. The regenerative retort-bench had been in use for about three weeks; and the ceremony resolved itself into the turning on of the oil to the Peebles plant, which was done by Provost Griffiths. In connection with the erection of the retort bench, opportunity was taken to shift it to one side of the house—the old bench having been

in the centre—and to overhaul the retort-house. The walls have been renewed where necessary, and a new roof erected, which is supported in the centre and at one side by pillars. The retort-bench is a single one. At present a portion of the old bench opposite it has been left standing, and has been utilized for the oil-gas retorts. By-and-bye it is intended to remove the old bench entirely, and to place the oil-retorts in line with the new bench. Then the side of the retort-house facing the bench will be open; and as it is intended to bring a railway into the works, alongside the open side, there will be an ample coal-store along the whole front of the bench. The bench erected consists of eight ovens, in settings of eights—making 64 retorts in all. They are ⌂ shaped, 9 feet in length, and 22 in. by 14 in. inside diameter. The pit for the Hislop regenerator plant is 5 feet deep. A heat of 2300° is attained; and three-hour charges are worked. The oil-gas plant consists of a store-tank below ground, outside the works and on the opposite side of the retort-house from the coke-heap, which will reduce to *nil* the risk of any oil which might be spilt being set fire to by hot cinders. From the store-tank, the oil is pumped to an elevated cistern, from which it enters the manufacturing plant in the usual way. An elevated iron gangway has been erected about 6 feet in front of the retort-bench; and upon it are the taps which supply the oil direct to the ascension-pipes, by which the oil enters the retorts. There are eighteen retorts, of circular form, 22 inches in diameter, contracting to 15 inches at the mouthpiece, 8 feet long, and laid at a slope of 9 inches. The usual plan for the introduction of the oil gas into the coal gas is after the coal gas has been scrubbed and washed, and before it enters the purifiers. Mr. Watson sends his oil gas through the oil-condenser, and then through a special meter; and he afterwards brings it back and introduces it into the foul main, so that it has to travel with the coal gas through the condenser, scrubber, and washer before it reaches the purifier.

The company first inspected the works, and then assembled in front of the oil retort-bench. Provost Griffiths, Mr. R. F. Hislop, of Paisley, son of the patentee of the regenerative system, and the agent for the process, ascended to the elevated gangway. Mr. Hislop said they had met to inaugurate the important extensions which had been made upon the works by the introduction of a system of regenerative heating and of an oil-gas process. He had been asked, as representing his father, to perform the very pleasant duty he had now to discharge. The works to be inaugurated, he might say, would not only be a credit to them, but, he hoped, would be such as would abundantly justify their decision to adopt them. The action of the Commissioners had been very highly spoken of throughout the country; for they no sooner got the works into their possession than they set about, in the most business-like manner, to attain all that was possible by them. He had no doubt their action would be beneficial to the community. His duty now was to present Provost Griffiths, on behalf of the Patentees and the Contractors, with a key, as a small souvenir of the occasion; and he did so with the very greatest pleasure. Provost Griffiths, having accepted the key (which was of silver, and bore a suitable inscription), by it turned on the oil to the first retort. He then said he had to thank Mr. Hislop for the very kind way in which he had performed that interesting ceremony. Doubtless the regenerative system they had adopted would contribute very largely to the future success of the works, as well as to the prosperity of the town and locality. The old plant was in such a condition as to make it perfectly hopeless that any success would be attained by any effort of theirs; and therefore the best thing they could do was to set their minds to obtaining the highest possible results with the least possible expenditure of money. They had the necessary reports presented to them as to the alterations to be effected; and they had the results before them that day. While the production would be increased very largely by the system they had adopted, they would have, in addition, a great saving of labour. That had, however, not been effected without large outlay of capital; but they believed that the time was not far distant when the plant would recoup them. He thanked the Contractors for their kindness to himself, and for the way in which they had done their work. He trusted that the success which had attended them that day would continue for many years, until they were compelled to remove to larger premises.

Thereafter the company were driven from the works to the Crown Hotel, where a banquet was held. Provost Griffiths presided, and Bailie Weir was croupier. Mr. Hislop proposed the toast of "Success to the Gas Undertaking." He said his father was Manager of the old gas-works at Falkirk 38 years ago; and after holding the post for about four years, he gave it up. He, however, acted for many years as their Consulting Engineer. Subsequently he valued the works of the Falkirk Gaslight Company and of the Falkirk Joint-Stock Company, with a view to amalgamation. That amalgamation fell through; but he afterwards acted as Arbitrator in the amalgamation which took place. The gas undertaking was now under the Corporation, where, he was sure, it would rest; and under their careful management, and that of Mr. Watson, it was bound to prosper. The system of retorts now inaugurated was as complete as it was possible to make them. The settings had saved the Corporation of Paisley over £3000 a year; and they were being largely adopted, not only in this country, but abroad. He had no doubt they would return their entire cost within eighteen months. Corporations and gas companies must be abreast of the times; and he had no doubt they were now in that position. Provost Griffiths, in acknowledging the toast, said the gas undertaking was of very considerable value to the town of Falkirk. He supposed he need not go into the history of the purchase—let them take the undertaking as it is now. When they acquired the works, the gas was considered to be very high priced. The Committee were very anxious about this matter; and they spent many hours with a view to being able to effect a reduction. They had plans and reports before them; and they visited other towns to ascertain what was known in them of these two processes. They were favourably impressed that a regenerative system was the right one; but there were so many of them, that the difficulty with him was to make up his mind which was the best. They adopted this one; and the result had, he thought, in their short experience, justified them in adopting it. They had been able to take 5d. per 1000 cubic feet off the price of gas; while in the outlying districts, there was a further sum of 5d. which they did not now charge, so that the people outside the town were getting a reduction equivalent to 10d. per 1000 cubic feet. When they considered that the consumption of gas outside the town was one-third of the entire production, the reduction over the whole quantity was more than 5d. That reduction had, to some extent, discounted the saving which there would be by the new system. The cost of labour was very much reduced. Under the old system, for the week ending Aug. 29, there were 44 retorts at work, with 8 fires and 11 stokers; the make of gas was 695,800 cubic feet; wages amounted to £15 12s.; and the cost of stokers' wages per 1000 cubic feet was 5·37d. With the new system, in the week ending Sept. 6, there were 24 retorts at work, with 3 fires and 9 stokers; the make of gas was 1,512,000 cubic feet; wages amounted to £12 6s. 6d.; and the cost of stokers' wages per 1000 cubic feet was 2·03d.—showing a saving of 3·34d. per 1000 cubic feet. With the old settings, they were making 8400 cubic feet of gas per ton of coal carbonized; while they were now making 9000 cubic feet—an increase of 600 cubic feet per ton of coal. A thousand cubic feet of gas cost 1s. per ton for coal; so that 600 cubic feet extra was equivalent to a reduction of 7·22d. The estimated saving from coke per year with the new settings would be about 403 tons. The old system required coke from two retorts to heat six retorts in one oven; but by the new system the coke from two retorts heated eight retorts in one oven. These 403 tons of coke, at 7s. 6d., were equal to £151 2s. 6d. per year, or 0·5d. per 1000 cubic feet of gas—making a total saving of 11·06d. per 1000 cubic feet. Some people could not understand where they were going to spend such a large sum of money. He thought it was a business-like thing to do, to attack the old system and destroy it, and enter upon a new one. The enrichment of the gas by the oil process, which they saw him inaugurate by the simple turning of a tap, he thought would be of considerable value to them. They expected by this system to be able to give light which would satisfy the most fastidious person in the burgh; and they hoped to be able further to reduce the price of gas. Bailie Hamilton proposed "The Gas Manager." Mr. Watson, in acknowledgment, said it was not out of the labour of the men they would effect a saving, but out of the regenerative setting. He estimated that with the oil and coal they would get about 10,000 cubic feet of gas per mouthpiece, as compared with about 8000 feet under the old system. Mr. Beveridge, Parliamentary Solicitor for the burgh, proposed "The Town and Trade of Falkirk;" and a number of other toasts were given.

EXTENSION OF THE STRETFORD GAS-WORKS.

The extraordinarily rapid development, during the last two or three years, of the Manchester suburban districts of Stretford and Sale (the gas supply of which is covered by the Stretford Gas Company) has quite overtaken what were previously the adequate resources of the Company; and considerable extensions of their existing plant have thus been rendered absolutely necessary. To meet these increased requirements, the Company are now—under the direction of Mr. Benjamin Haines, the General Manager—carrying out an extensive reorganization and enlargement of their existing plant, which, when completed, will far more than double their present production. The scheme includes the erection of a large new retort-house, with retort-settings on the regenerative principle; the increase of the scrubbing and purifying plant; and the enlargement of the existing holders by putting on additional lifts. At present, only a portion of this scheme is being carried out; but it is anticipated that before the heaviest pressure of the winter demand comes upon the works, the additional plant completed will quite double the existing output of gas. It will bring the production up to about 40,000,000 cubic feet. The completion of the remaining portion of the scheme will be put in hand next summer. With the largely increased demand upon the gas-works, and the considerable enlargement of the requisite plant, much heavier and more responsible duties have necessarily fallen upon Mr. Haines; and, in order that he may have relief from some of these duties, it was decided, upon the resignation of Mr. Hughes, the late Assistant-Engineer, that Mr. H. Kendrick should be appointed as Engineer to the gas-works (as intimated in the JOURNAL a fortnight since), with full charge of the carbonizing.

THE COVENTRY CORPORATION GAS UNDERTAKING.

Paving and Gas Profits.

At the Meeting of the Coventry City Council on the 8th inst., the question of the appropriation of the profits of the gas undertaking was discussed on a motion by Mr. James to the effect that the Finance Committee should be instructed, in preparing the estimates for the forthcoming district rate, to include a sum equal to one-third of the gas profits for the year ending the 25th of March last, to be expended in repaving the footpaths in the centre of the city. The mover of the resolution remarked that some time ago he had a similar motion, asking the Council to repave certain streets. This had been done in some cases; but since 1891 they really had not had any money to spare for improving the footpaths without coming upon the ratepayers rather heavily. He was pleased to say that at the present time they had a very large sum coming from the profits of the gas-works. The original sum was £5600; but there had been £864 paid into the sinking fund—with which he did not propose to deal. He purposed taking one-third of the net amount of the sum the Gas Committee handed over to the district rate, which would be one-third of about £4736. He felt that, in making this proposition, he was really assisting Alderman Tomson, the local Chancellor of the Exchequer, in the preparation of his budget. Mr. Band seconded the motion. Alderman Tomson thanked Mr. James for his kind advice, but said he was certainly sorry to inform him he intended moving an amendment to his resolution. In the first place, he thought it an unbusinesslike way of dealing with the matter. He was in sympathy with the desire to improve the footpaths of the city; but he thought

the question ought to be approached in the regular way. Let it be a reference from the Council to the General Works Committee. If the Committee were rather lax, it was quite open to the Council to pass a resolution to stimulate them. This would be the effect of the amendment he intended to propose. He did not like any "fancy" way of dealing with the gas profits. Those profits belonged to the Corporation, and ought to be dealt with as a matter of business, like any other portion of their income. Mr. James's motion would not pledge the Council or the General Works Committee to improve the footpaths; it would simply pledge the Finance Committee to set aside money for the purpose. His (Alderman Tomson's) plan would be rather quicker in operation than Mr. James's. Another objection was that they had spent a lot of this money already; and there was very little left to deal with. The proper way, in his opinion, would be for the Council—if the time had come when the footpaths of the city needed looking to—to instruct the General Works Committee to draw up a plan or statement as to what footpaths they considered were in need of repair, what kind of repair, and in what order they should be done. If that was the feeling of the Committee and the Council, he would take care that, in the estimates, a sufficient sum was put year by year until the Council were satisfied with the state of the footpaths. His amendment would simply be—"That the state of the pavements in the centre of the city be referred to the General Works Committee, with a view to their improvement." Alderman Gulson seconded the amendment; remarking that it seemed to him a very unbusinesslike way of dealing with any part of the gas profits to appropriate them to certain things. He had before expressed his opinion that the Council were not doing their duty in appropriating so large a proportion of the gas profits to the consumers, and so little to the wants of the ratepayers. When they acquired the gas undertaking, the argument in favour of the step was that it would bring them in a very large revenue, as it did in other towns—Birmingham and Leicester for instance—that would be in aid of the rates. In Coventry, they had from time to time reduced the price of gas, and given the profits to consumers to an extent that was not at all needed in their interest, and was very deleterious to the interest of the ratepayers. He hoped the time was not far distant when the ratepayers themselves would see this was not fair dealing with them when they undertook the responsibilities of a great business. He trusted this part of the policy of the Gas Committee would be changed. Mr. Andrews (the Chairman of the Gas Committee) opposed the motion, though he could hardly say he approved of the amendment. He was rather sorry Alderman Gulson had introduced the question of the ratepayers *versus* the gas consumers. In so doing, he thought he had gone a little out of his depth, because the policy in Coventry was exactly similar to that pursued in Birmingham—a gradual reduction made in the price of gas, and a substantial sum given to the ratepayers. It was very convenient, no doubt, for the Gas Committee to make a surplus profit on the year's trading, and then for Mr. James to dispose of it so nicely. He trusted the Council would not agree to the resolution, but leave it to be dealt with by the Finance Committee in the ordinary way. Mr. James said he would be very pleased if the Finance Committee would deal with it; only he thought an instruction from the Council would assist them, and make them open their hearts more generously. If Alderman Tomson thought his was the better plan, and assured them that he would introduce the matter and make provision for it, he (Mr. James) would be willing to accept it, and withdraw his proposition. This was assented to by the seconder; and the amendment was then put as a substantive motion, and carried.

ELECTRIC LIGHTING NOTES.

The greater part of last Wednesday's sitting of the St. Pancras Vestry was devoted to a discussion on the cost of the electric light, the recently-introduced high voltage, and kindred subjects. Mr. Cox thought the lighting rate should be reduced; but Mr. M'Gregor maintained that, now electricity had been taken up, a higher rate would be required to meet the Vestry's difficulties in that direction. Mr. Hodgson said they had been told that the electric light would cost nothing; and with the new installation, it ought to cost less than that. During the last two years, the light had cost £9367 19s.; while the 561 gas-lamps displaced would only have cost £3309 18s. The electric light had therefore cost the ratepayer £6058 1s. more than the former gas-lamps would have done. During these two years, the Lighting Committee had made no profit; and there was an estimated deficiency of £788. Mr. Menzies said the previous speaker had forgotten to mention that the debit balance two years ago was between £3000 and £4000; while it was only £788 this year. He readily admitted that the electric light cost two-and-a-half times or even three times as much as gas; but against this must be placed the fact that it gave nine times the light of gas. The 95 arc lamps were of an average power of 600 candles—making 57,000-candle power; and the 561 gas-lamps displaced had only 12 or 14 candle power, or a total of about 7000 against 57,000 candles. Therefore the ratepayers were getting far better value for their money; while the cost of working was gradually being reduced. All beginnings were expensive; but in the end the new light would beat gas by a long chalk. After this little duel, the report of the Electricity Committee came up; and several applications for current were received. Mr. Hodgson asked if these were to be run at 220 volts. On receiving an affirmative answer, he moved that, as the Vestry had fixed the standard pressure at 110 volts, they could not grant these requests for current at 220 volts, not having complied with sub-section B of the Act. The first installation was carried out in 1890 by Professor Robinson, under the direction of the Vestry; and it was designed to supply current at 110 volts. Later on, another station, also for the same voltage, was erected. The Vestry had therefore laid it down that the standard voltage was fixed at 110. But on the 12th ult., a notice was sent out to new and old consumers stating that the supply would be delivered at 220 volts. What authority had Mr. Baynes (the Electricity Engineer) to raise the voltage? Mr. Brown then seconded the motion. Mr. Sweet (the Chairman of the Electricity Committee) said the Vestry were bound to grant these applications. They had the sanction of the Board of Trade to supply at a pressure of even 300 volts; and the Committee had decided to raise it at the new station to 220 volts—to the enormous advantage of distribution. Indeed, if Mr. Baynes had done no other stroke of business for seven years, he would have earned his salary. Mr. M'Gregor pointed out that the question was that the Committee had altered the voltage and erected ventilators without the permission of the Vestry. Eventually, the motion was lost; Mr. Hodgson defiantly threatening to communicate direct with the Board of Trade. Mr. Hodgson inaugurated another lively discussion by moving that the Electricity Committee be instructed to prepare a return of the houses where the public roads and footways had been taken up for the purpose of substituting india-rubber tubing for the braiding to the service-lines from the Vestry's electric mains to the consumers' premises, and the probable cost of executing this work. Mr. Sweet explained that the alteration had been ordered by the Board of Trade. Dr. Smith said the object was to prevent leakage. It was understood that this item alone would cost between £300 and £400; and Mr. Markham thought the Committee were exceeding their duty in not getting the sanction of the Vestry for so large an expenditure. Mr. Hunt said the Vestry had apparently no check on the Electric Light Department, who acted quite independently. Mr. Wettenhall asked whether this was not practically a new scheme. Mr. Sweet replied that it was only making the connections more perfect—a reply which his querist declared he received *cum grano salis*. The return asked for was, in the end, promised.

Last Thursday, the Hampstead Vestry decided that the question of raising a further loan to meet the liabilities incurred in carrying out the electric lighting undertaking in the parish be referred to the Finance Committee. It may be incidentally mentioned that the total indebtedness of Hampstead amounts already to £146,784 at various rates of interest averaging 3⅜ per cent., and that the London County Council are to be asked to lend that sum to the Vestry at 2⅞ per cent., in order to wipe off the 35 different loans. It is therefore problematical whether the ratepayers will view this further proposed electric lighting loan with equanimity. An application was received from a parishioner for permission to light his outside lamp with the electric light; and the Committee recommended that this be granted, "provided he will take the supply of electricity from the Vestry, and sign the usual agreement." Mr. Johnson strenuously objected to this qualifying clause, which he thought was an arbitrary use of the Vestry's powers. But the Chairman of the Committee emphasized the importance of maintaining the "rights" of the Vestry; and the proposed course was adopted after some discussion. The Vestry refused to consider the application of the three Assistant Electrical Engineers at the central station (who now receive the munificent wage of £100 per annum) for an increase of salary. The Chairman reported that the Vestry had now 17,000 lamps connected, and applications for current that would make a total of 20,000 lamps by Christmas. Here Mr. Johnson pertinently inquired what was the percentage of current lost in transit from the central station to the consumer; but the Chairman (Mr. H. Harben, J.P.) declined to allow the question to be put without notice, or to "allow a member to cross-examine an official of the Vestry." Later on, Mr. Johnson found an opportunity of stating that he believed the loss of current to amount to 66 per cent.; and therefore he thought there must be something wrong to allow such gross waste. He also moved that the Electric Lighting Committee should report on the absence from their recommendations of any proposals to extend the public lighting. The Chairman replied that this was the first time he had heard of the alleged waste of current, and that the Committee were doing all they could to obtain a dividend before incurring further expense.

The action of the ratepayer of Wimbledon in circularizing his fellow-ratepayers on the subject of the electric lighting scheme which the District Council have decided to adopt, alluded to last week, has not been altogether fruitless. A representative meeting was held the other day in the Drill Hall; and an almost unanimous resolution was passed to oppose the Council when the official inquiry is held in regard to their application for funds for carrying out the scheme. The Council are called upon not to proceed without making further inquiries. The Chairman of the meeting (Mr. T. C. Summerhays) was quite neutral; he was neither a supporter nor an opponent of the project. The burden of his speech was that he thought the existing oil lighting compared favourably with the gas lighting which preceded it; but there was a desire for a change, and he did not mind, so long as the rates were not increased. "That's the point," cried a voice. Mr. Cooke, the Chairman of the Ratepayers' Association, moved the opposing resolution; and it was seconded by Mr. Ely, who spoke, from personal experience, in support of incandescent gas lighting. Mr. Crickmay, who had voted for the scheme when it was before the Council, now opposed it. Mr. Ansell asked if the electric light was worth the money proposed to be spent upon it, which he put at £40,000 before they had done with it. A luxury like that would, he said, mean an increase of 5d. in the pound in the rates, which at present amount to 1s. 7d. Mr. A. Arnold, J.P., the Chairman of the District Council, justified their action in taking up the electric light question again. The present lighting was, he said, emphatically pronounced to be unsatisfactory; and the choice lay between it and electricity—for they could not entertain gas. Mr. Preece's figures, which had been carefully checked, showed that electricity was the more economical, taking into consideration the better light that would be obtained. But it would not be necessary to spend the £30,000 estimated—in fact, not more than £25,000; and the repayments on this would come to between £1300 and £1400 a year. The Council would provide electric light at about the present charge for gas, and would be able to take it into every quarter of the town, whereas if a company came in they would only take it where there was a chance of making money. Mr. Preece rose to address the meeting; but he was received with impatience, and was eventually obliged to resume his seat.

The formal inauguration of the electric street lighting of Newport (Mon.) took place on Monday afternoon last week; the engines, five in number, at the generating station being started by the Mayor (Mr. J. C. Sanders), in the presence of a numerous company. The Chairman

of the Electricity Committee (Alderman Moses) asserted that, from an engineering and electrical point of view, Newport had almost perfect works, and that the installation was an unqualified success. Subsequently the first electric street-lamp was started by the Mayoress from a table in the Town Hall.

Last Tuesday, the electric supply station of the Stafford Corporation, of which some particulars were given in the JOURNAL for the 1st inst. (p. 687), was formally opened. The assembled company having been admitted into the station by the Chairman of the Gas and Electricity Committee (Mr. W. H. Peach), who explained the origin and growth of the scheme, the Mayor (Mr. C. H. Wright) started the first engine; the second and third being started by Alderman Silvester and the ex-Mayor (Mr. G. Wormal). The light was switched on by the Mayoress. The station was designed by Mr. J. Ferguson Bell, the Gas and Electricity Engineer of the Corporation; and it has cost £20,000.

The quiet town of Reigate has been exercised over the electric lighting question; and, at a special meeting of the Town Council on Monday last week, the Mayor (Alderman W. Brown) introduced the matter by bringing forward an item on the *agenda* to the effect that the Council should consider the expediency of applying to the Board of Trade, pursuant to the Electric Lighting Acts, 1882 and 1888, for a Licence or Provisional Order authorizing the Council to supply electricity within the area of the borough. A letter was read from a resident, who said he had had experience in the working of several installations, and, with every belief in the future development of the electric light, he had yet to learn of a town, with a scattered population, of about the size of Reigate, or Reigate and Redhill combined, in which the light was a dividend-paying investment. He suggested that, before the Council undertook the lighting of the borough by electricity, inquiry should be made as to this, as any loss incurred would mean an increase in the rates. Mr. Powell moved that a Sub-Committee be appointed to investigate the matter, with authority to employ a professional engineer to advise as to cost, &c. Mr. Giles seconded the motion. A long discussion ensued; and, as mentioned elsewhere, it raised the question of the right of shareholders in the Gas Company to join therein or vote on the motion. Eventually, it was carried by 15 votes to 3; and the Sub-Committee was appointed.

A special meeting of the Wakefield City Council was held last Tuesday, to receive the minutes of the Electric Lighting Committee, who recommended the Council to accept tenders for the following electric lighting plant: Supplying and erecting boiler-house plant, engine-house plant, and suitable board and instruments, £10,900; transformers and switch-board, £448; supply and erection of underground work, £3192; supply of arc lamps and posts, £252; supply of meters, £223; erection of an overhead crane, £253. After the matter had been discussed in private, the adoption of the recommendations was duly moved; but an amendment was proposed referring the matter back to the Committee. There were 13 for the motion, 4 for the amendment, and 15 absent; consequently the motion was carried. It is expected that when the sanction of the Local Government Board to a loan to defray the cost of the works has been obtained, the scheme will be at once proceeded with.

Some opposition was raised at the last meeting of the Plymouth Town Council to the proposal of the Works Committee that a deputation should visit other towns and make inquiries respecting the electric light. The contention of the opponents of the project was that the Corporation already had their hands full of schemes, and that the time was inopportune for acting upon a speculative undertaking of this nature. On the other hand, it was said that, if the Corporation did not introduce the electric light into Plymouth, outsiders would do so; and that the element of speculation was more apparent than real, because corporation electric lighting works had paid where they had been established. The resolution in favour of the "picnic," as one gentleman called it, was carried; the suggestion being made that the deputation should also inquire into the advantages of incandescent gas-lamps for public lighting.

A Livesey Washer for Blackburn.—The Blackburn Corporation have had one of Livesey's washers fitted into the bottom of one of their tower scrubbers; the Contractors for the work being Messrs. R. Dempster and Sons, Limited, of Elland.

The Scarborough Gas-Works Purchase Question.—According to the minutes submitted by the Joint Committee of the Parliamentary Bills Sub-Committee and the Finance Committee at the meeting of the Scarborough Town Council on Monday last week, the members have been busily engaged in further considering the question of the purchase of the Gas Company's works. Correspondence has passed between a Special Sub-Committee and their expert adviser (Mr. Corbet Woodall) and the Company. As a result, the Sub-Committee recommended that the undertaking be acquired by the Corporation if it could be purchased for a sum to be named by the Joint Committee. The latter, however, referred the matter back to the Sub-Committee.

Important Concessions to the Gas Consumers at Stockport.—When a Gas Committee find themselves able to hand over, in the shape of reductions, something like £8000 to the gas consumers within a twelvemonth, there is at least evidence of consideration on their part; and that they are in a position to do this implies good management. This is the gratifying condition of things at Stockport. Last March, the Committee reduced the price of gas 2d. per 1000 cubic feet. This meant a loss in revenue of £3456. They have now decided, subject to the approval of the Council, on making further concessions, as follows: 1d. per 1000 cubic feet reduction in the price, 2½ per cent. discount on all accounts paid within a month, and the abolition of meter-rents. The first will mean an annual loss of £1728; the second, one of £1450; and the third, one of about £1000. This last is practically a further reduction of ¾d. per 1000 cubic feet; and it at once does away with a source of grievance. In addition to these concessions, the outside consumers have been allowed an additional 1d. per 1000 cubic feet, which makes the differential rate 5d. as against 6d., the figure at which it has stood for upwards of thirty years. The total loss in revenue consequent upon these alterations will amount to £8084. The Committee and the Gas Engineer (Mr. S. Meunier) are alike to be congratulated on being in a position to make it.

METROPOLIS WATER SUPPLY.

The Future Source of Water—Lord Farrer's Criticism of the Royal Commissioners' Report.

As mentioned in our article on "Water and Sanitary Affairs" last week, the letter by Lord Farrer on the future source of water for London, given in the same issue (p. 794), drew from a correspondent, signing himself "X," a reply which appeared in *The Times* on the 12th inst. This, with a short letter from Lord Farrer, dealing with the points raised by "X" and Mr. George Livesey, alluded to last week, we reproduce below:—

To the Editor of *The Times*.

Sir,—The letter in which Lord Farrer expresses in your columns his dissatisfaction with the report of the Royal Commission that inquired, in 1892, into the London Water Supply, will doubtlessly be read by a vast number of persons who have neither time nor inclination to study the report itself, or the bulky evidence on which that report was based. Will you, therefore, allow one who is conversant with those documents to make some observations on Lord Farrer's letter?

There were two main questions before the Commission: (1) Could an adequate amount of water for the prospective requirements of London be obtained from the Thames and Lea Valleys, with due regard to the claims of the other inhabitants of those river basins? (2) Would the water thus obtained be of satisfactory quality? Both of these questions were answered by the Commission in the affirmative.

As regards the second question, relating to the quality of the water, Lord Farrer, though he expresses his assent in a somewhat grudging fashion, appears to be in agreement with the Commissioners. His only objection to them under this heading is that, seeing that the water, in their (and apparently in his) judgment, is of satisfactory quality, it was inconsistent on their part to insist upon additional precautions being taken to keep sewage out of the rivers, and to secure adequate storage and filtration. This criticism appears to me to be at least somewhat captious; and I fancy that few persons will agree with his Lordship in finding fault with the Commission for having, even if unnecessarily, attempted to strengthen the barriers by which impurity is excluded from the water-mains.

It is, however, against the Commission's answer to the first question—that which relates to the quantity of water—that Lord Farrer directs his chief attack. His objections, shortly put, are three: (1) That the Commissioners limited their consideration of future requirements to the next forty years, and were silent as to what would happen when that period was ended; (2) that the scheme of storage reservoirs at Staines, of which they expressed their general approval, has been found, "on careful examination by the London County Council, to be extravagant in cost and of very doubtful efficiency;" and (3) that the Commissioners did not compare the merits of this scheme with those of any other scheme, such as bringing water from Wales.

As regards the first of these three objections, it must be manifest that it was absolutely necessary for the Commission to fix some limit of time in their inquiry as to future requirements. It was impossible for them to examine into the question whether the Thames and Lea Valleys could provide sufficient water for Londoners for all eternity. Some fixed point or other must necessarily be assumed, or it would be impossible to estimate, even roughly, what the future requirements would be. Whatever period was selected, it would always have been possible for a hostile critic, such as Lord Farrer, to say, "But what is to be done when that period is over?" The Engineer of the London County Council, who appeared as the mouthpiece of the Water Committee of that body—a Committee of which Lord Farrer is ex-Chairman—wished a period of fifty years to be taken. The Commissioners, for reasons set forth in their report (par. 27), preferred to take forty years. Supposing, however, they had assented to the Council's proposal, and taken fifty years as their prospective period, Lord Farrer's objection would have been just as valid as it is now.

What the Commissioners would have reported as to the amount of available water, had they looked fifty instead of forty years ahead, can only be conjectured. An examination, however, of the figures cited by them in their report (par. 182) leads to the pretty sure conclusion that they would have reported much as they did with the forty years' limit. For they state that the average flow of the Thames at Teddington is about 1350 million gallons per day; and, as only 200 millions are required as a minimum for the purposes of the river below Teddington, it is evident that, when the 300 millions, which they think will be required in forty years' time, have been abstracted, there will still remain an average daily amount of 850 million gallons on which to draw for consumption. It becomes, then, simply a question of possible storage; and it is difficult to believe that, seeing the water is there, the storage of it somewhere in the Thames Valley is beyond the power of modern engineers.

As regards the second objection made by Lord Farrer, it would be of much interest to know what were the grounds and the evidence which led the County Council, on careful examination, to the conclusion that the scheme of storage reservoirs at Staines would be "extravagant in cost and of very doubtful efficiency." It may, I suppose, be assumed that the Council accepted this view on the authority of their Chief Engineer. Of that gentleman I would speak with all respect; but it is manifest that an engineer, however professionally distinguished, who has a gigantic water scheme of his own, is not an impartial witness as to the merits or demerits of a rival project. If that engineer thinks the storage scheme extravagant in cost and of very doubtful efficiency, the at least equally distinguished Engineers, Mr. T. Hawksley and Sir F. Bramwell, expressed a contrary opinion; for they found "that the sites proposed for the reservoirs are suitable for their intended purpose, and capable of being constructed at a moderate expense" (par. 86). Doubtlessly before any final adoption of the Staines storage scheme, its cost and efficiency would have to undergo much more complete and detailed examination at the hands of experts than could be expected from the mixed Royal Commission of 1892. But to dismiss a scheme that has approved itself generally to such competent judges as the late Mr. Hawksley and Sir F. Bramwell, not to speak of the Engineers who served on the Commission, in deference to the adverse

judgment of a gentleman with a rival scheme of his own, would be the height of folly.

There remains Lord Farrer's third objection—that the Commissioners did not compare the merits of the scheme of reservoirs at Staines with the merits of such a plan as that of bringing water from Wales. Surely Lord Farrer must be aware that the area of inquiry by a Royal Commission is limited by the terms of the official document under which it is appointed. Has Lord Farrer taken the trouble to read that document, which is prefixed to the Commissioners' report? He can hardly have done so; for otherwise he would have known that any comparison such as he thinks the Commissioners should have instituted was utterly outside the reference to them. They had no more authority or power to examine into the merits of a supply of water from Wales than to investigate, let us say, the finances of the London County Council. Their business was to inquire whether water of adequate quantity and quality could be got within the Thames and Lea watersheds; and they —very properly, in my judgment—limited themselves strictly to the question which had been referred to them.

The following is Lord Farrer's reply:—

To the Editor of *The Times*.

Sir,—Your anonymous correspondent "X" really reduces the discussion to a question between the merits of a scheme for huge storage reservoirs at Staines and a scheme for bringing a fresh supply from Wales. I shall not think my letter wasted if it has the effect of drawing attention to the importance of this question, which, as "X" admits, was not touched by the Royal Commission. In considering this question, it will be important to know whether the Water Companies, who suggested the Staines scheme, are taking any steps towards its accomplishment. It will also be important to consider whether the expense of the Staines scheme, if proceeded with, is to fall on the present sources of income of the Water Companies, or whether fresh rates will have to be imposed for the purpose on the London water consumers.

As regards Mr. Livesey's doubts concerning the future growth of London, we are all of us, of course, very much in the dark; but it is interesting to see how little the very able Commission presided over by the Duke of Richmond foresaw the present size of London. It must also be remembered that the growth we have to consider is not the growth of population in Central London or in County Council London, but of the population contained in the much larger area of the Water Companies—or, rather, in the whole area which is now supplied by water from the valleys of the Thames and Lea. The tendency appears to be for the population of London and its suburbs to grow at the circumference, while it becomes less dense at the centre.

Writing to *The Times* last Thursday, Colonel Makins took up the question asked by Lord Farrer as to meeting the expense of the Staines scheme, if it should be proceeded with. He said: "If either the Companies, or the London County Council, or a Water Trust, or any other competent body, apply to Parliament for powers to raise capital to be expended in providing a further supply of water beyond that for which the present capital powers have been granted, it is obvious that such capital must be granted on such terms as would enable the Companies, or the Council, to raise it; and the security for such capital must in the case of the companies be power to charge for supply of water, and in the case of the Council the general rates, which would, of course, include a charge for water supply." Colonel Makins added that Lord Farrer seemed to contemplate the possibility of the Water Companies being called upon to "make bricks without straw." He said he had not so learned the practice of Parliament. Whatever authority or corporation was entrusted with the responsibility of raising the requisite funds, would be provided with the only means of securing them—viz., the power to charge for the supply of water. Anything less would, in his opinion, be injustice; anything more, unnecessary. Lord Farrer thought Colonel Makins had not answered his question; for, in a letter published last Friday, he said: "What I want to know from the Water Companies, with respect to the scheme they have themselves proposed for large reservoirs at Staines, is whether they are prepared to make those reservoirs with capital raised upon the credit of the rates they now have power to charge, or whether, when they come to Parliament (as they are bound to do) for powers to make those reservoirs, they intend to ask for some new rating or charging powers in addition to those which they already possess."

The London County Council and the Water Question.

At the Meeting of the London County Council last Tuesday—Sir A. Arnold in the chair—the question of the water supply of the Metropolis was under discussion, on the presentation of the following report by the Parliamentary Committee:—

On the 9th of July, we reported to the Council that, in view of the dissolution of Parliament, we had instructed the Agent to take steps to suspend the Bills for the purchase of the Water Companies' undertakings until next session. The proceedings as to the Lambeth and Southwark and Vauxhall Bills and the decisions of the Select Committee have been reported by us to the Council. At the dissolution, the position was, briefly stated, as follows: The case of the Council was closed, and that for the Water Companies and the Local Authorities was within a few hours of completion. Agreements had been entered into, as regards the Lambeth and Southwark and Vauxhall Bills, with the County Council of Surrey, on their own behalf, and as representing the Corporations of Richmond and Kingston, the Urban District Council of Surbiton, the Parish Council of Mitcham, the Urban District Council of Wimbledon, the Rural District Council of Epsom, the Rural District Council of Croydon, and the Parish Council of Long Ditton, and also with the Corporation of Croydon, the other principal Local Authority concerned. So that, as regards the Southwark and Vauxhall case, all the Local Authorities are satisfied. As regards the Lambeth case, the Local Authorities of about [illegible] ths of the area are also satisfied, but the Beckenham Local Board (about [illegible] th of the area), which is partly supplied by the Lambeth Company and partly by the Kent Company, have not at present agreed, as their object is to secure for themselves a supply of the Kent water in substitution for that supplied from the Lambeth Company's works. The other [illegible] were [illegible] and reading. The eight Bills having been suspended, we have had to consider what course should be adopted in regard to them; and, after discussion, we have decided to recommend—"That, desiring that the supply of water in the Metropolis and the surrounding districts should be in the hands of a public authority, and with a view to a complete agreement with all parties concerned over the entire area supplied, the Council do invite Her Majesty's Government either to deal with the question themselves or to appoint a Royal Commission to do so."

Colonel Hughes, M.P., moved the adoption of the recommendation; explaining that he did so in place of Mr. M'Kinnon Wood, the Chairman of the Committee, who was in the minority when it was before them. He argued that, if only the Government would take up this matter, an enormous saving of time and money would be effected.

Mr. J. Stuart, M.P., moved, as an amendment, that the Bills be proceeded with. He maintained that all that was proposed by the Committee had been already done. In all that was necessary for legislation, this matter had been fought out and placed before the public, and was now in the position in which it ought to be dealt with by Parliament. It was on this ground that he asked the Council to go on with the policy they had hitherto pursued.

Mr. M'Kinnon Wood formally seconded the amendment.

The Earl of Onslow thought that, knowing there had been a narrow escape from a very serious calamity at the East-end, there were not many on the Council but would agree with him that the time had come when they could not any longer allow the water supply of London to remain in private hands. He believed they were now almost unanimously agreed that the undertakings of the Water Companies must be purchased. But the whole matter was enshrouded in great difficulty. He did not consider the County Council were the body to be the Water Authority. It would be work of the greatest delicacy to adjust the negotiations and relations between the Council and the authorities of the several districts now served by the Companies. The best course he considered to adopt in the position in which they found themselves was to appeal to the Government, who could themselves immediately take the matter up, or refer it to a Royal Commission. If the latter course were adopted, the Commission should devote themselves to considering the following matters: (1) What shall be the Water Authority for the whole area? (2) What shall be the terms that shall be referred to the Arbitrators? (3) The question of additional supply. If they went on with the Bills of last year, they would have to pay £60,000,000 or £70,000,000 for the property of the Companies. What he asked the Council to do was just for a moment to abandon the attitude they sometimes assumed, and show a little modesty in their assurance that they were the best body to decide this question. The suggestions of a properly constituted Royal Commission would bear more weight in the present House of Commons than those emanating from the Progressive party of the Council.

Sir J. Hutton supported the amendment. He observed that what they wanted in this matter now was not a Royal Commission, but an Act of Parliament.

Mr. Westacott expressed the belief that, if the recommendation were adopted, it would hasten the time when the water-works would be acquired.

Lord Farrer said that, under present circumstances, if the Council proceeded with the Purchase Bills, they would in all probability have to pay the Companies an extravagant sum. He had always thought that the true policy would have been to have brought together all the Local Authorities, and made them agree with the Council, instead of being at daggers drawn; and when they had them with them, to face the Companies. This, however, had not been done; and the Council were at loggerheads with them all. There were many considerations which made him feel that, by going on with the Purchase Bills, they might be throwing upon London very great expense. He did not think he would vote for a reference to a Royal Commission. The last Commission had not inspired him with such confidence as to make him desire another. But, at any rate, going on with the Purchase Bills was the worst course they could adopt. It would be better for them to continue their examination of the Welsh scheme, and see whether the Companies would bring forward their plan for reservoirs at Staines. Let them be prepared on every occasion to fight the Companies, and insist on their doing their duty. But the worst and most dangerous course was to proceed with the Purchase Bills of last session.

Mr. W. H. Dickinson strenuously opposed the recommendation; expressing surprise and disappointment at the opposition which Lord Farrer now presented to the Purchase Bills.

Mr. Dickinson's speech was listened to with great impatience, and amidst constant cries of "Divide."

Ultimately, on the closure being carried, the amendment was put; and, on a show of hands, it was declared carried. A division was then taken, when there voted: For the amendment, 53; against, 54—majority, 1. The result was received with loud cheers by the Moderate members; and the debate was adjourned.

The consideration of a long report by the Water Committee with reference to an inspection of water areas in Wales which had been carried out by several members of the Committee during the recess, was postponed.

COMPLETION OF THE NEW WATER SUPPLY FOR COVENTRY.

A Description of the Works.

The new water-works of the Coventry Corporation at Whitley are now finished; and the citizens are in possession of a supply of water which will suffice for many years to come. The new scheme was adopted, and the work commenced, under the advice of the late Mr T. Hawksley; and, on his death in September, 1893, he was succeeded in the position of Consulting Engineer by his son, Mr. C. Hawksley. A short general description of the new pumping-station appeared in the Journal for Sept. 24 (p. 640); but some additional particulars as to the machinery and reservoirs have been furnished by the Engineers. The station is situated on land which belonged to the Corporation prior to the passing of their Water Act of 1889; and it comprises an engine and boiler house, coal-shed, well, borehole, and driftways, cottage, and weighing offices. Two engines of the rotative single cylinder, expansive type (the cylinders 27 inches diameter and 5-feet stroke) are supplied with steam from three Cornish boilers, each 24 feet long and 6 feet in

diameter. The well is of elliptical section, 14 feet by 9 feet in the clear, and about 150 feet deep, measured from the level of the engine-house floor. From the bottom of the well, a boring 24 inches diameter extends to a further depth of 100 feet; and driftings for collecting and conveying water to the well are driven at two levels thereat. Two pumps of the single-bucket description have been placed in the well, and are 13¾ inches in diameter by 4 ft. 3 in. stroke. Each pump lifts its water into a cistern, of which there are two, placed at the top of the well, and from which the water is forced by means of ram-pumps, having 17 inches diameter rams, and strokes of 2 ft. 6 in. The pumps are intended to make 16 complete strokes per minute; and at this speed, they should each deliver into the main pipes leading into the Barker's Butts service reservoirs 561,600 gallons of water per 24 hours, or, allowing for actual stoppages, say 500,000 gallons per diem—thus affording, when both engines are working 24 hours, a supply of a millio. gallons per diem. The water is delivered by the pumps into a main pipe 14 inches diameter, extending from the pumping-station to the junction of Fleet Street with Hill Street, where the main pipe becomes 18 inches diameter, and is continued to the Barker's Butts reservoirs. The total length of the main pipe is nearly four miles. The reservoirs are constructed of brick, and are each 160 ft. 6 in. long, by 147 feet wide, by 12 ft. 6 in. depth of water, with a capacity of 1,500,000 gallons. The total capacity of the two reservoirs is therefore 3 million gallons. Each reservoir is furnished with a recorder house and instrument for recording upon diagrams the water-level at every minute of the day. The lowest level to which water can be reduced in the well by pumping is 85 feet above Ordnance datum; and the top water in Barker's Butts reservoirs is 384 feet above Ordnance datum. The power or work done in each pump when pumping from the bottom of the well to the top of the water-level in the Barker's Butts reservoirs is nearly 40-horse power. The total cost of the works, including the new reservoirs, is stated to be about £65,000, though the accounts are not yet finally adjusted. The works were opened on the 9th inst.; the ceremony of starting the engines being performed by the Mayor (Alderman Loudon), at the request of the Chairman of the Water Committee (Alderman Read). On the invitation of his Worship, a large company afterwards sat down to luncheon in St. Mary's Hall.

THE GODALMING TOWN COUNCIL AND THE WATER-WORKS.

A Provisional Agreement to Purchase.

Negotiations between a Special Committee of the Godalming Town Council and the Directors of the Local Water Company have resulted in an agreement by which the Corporation have been recommended to buy, and the shareholders to sell, the water-works for £37,500, subject to the mortgages of £5500, and to all the existing contracts between the consumers and the Company. According to a report which was laid before the Town Council by the Special Committee a short time since, the Company was registered in the year 1878. In 1882, a profit was first made on the revenue account; and the Company declared their first dividend in the following year. In 1885 and in 1893 and 1895, the droughts occasioned great difficulties of supply; but these difficulties seemed to have been due to a deficiency of mechanical power rather than of material, and to the fact that, by taking customers so far afield as in Bramley and Shackleford, instead of confining themselves to the limits of the borough, the Directors crippled the whole of their area. These difficulties will necessitate a further expenditure on additional machinery or storage of some kind or other. The last report of the Company shows a balance of £1000 available for dividend, exclusive of mortgage debentures. Assuming, therefore, that the Corporation bought the works for £38,500, and that a loan at 4 per cent. was borrowed for the purpose, and that 50 years were allowed for repayment, the annual instalment of principal and interest required would be £1787; leaving a deficiency of £787 to be made up out of the rates. It was, however, very probable, said the report, that the mortgage debentures—amounting to £5500—would also have to be paid off on the winding up of the Company. In that case the money would also have to be borrowed, and an extra sum of £110 a year would have to be found to pay off the £5500—making £897 to be supplied out of the rates. Should additional works have to be constructed, and a further sum of £4000 borrowed, this would add an additional £92; making a total deficiency of £989 to be supplied out of the rates. Against this, the expected increase in the earning capacity of the undertaking must be taken into consideration; and a probable saving in working expenses. The Committee, in a supplementary report, also showed the actual amounts required upon the supposition that £48,000 was borrowed at 4, 3½, and 3 per cent. respectively, with interest only payable during the first five years; and the capital and interest by equal instalments during the next 55 years—making the total period 60 years. The Committee also reported that the Council had paid the Company £208 for water in the past two years, and that in future a very considerable quantity of water would be required for flushing tanks forming part of the new drainage scheme. The Committee recommended that the Company's undertaking be purchased on the terms already stated, and that they should be empowered to carry out all requisite formalities, and, if necessary, promote an Act of Parliament. The discussion on the proposals was of considerable length; and the recommendations were carried by the casting vote of the Mayor (Mr. W. Pullman). The shareholders of the Company, at an extraordinary general meeting held last Tuesday, confirmed the proposed transfer on the above-mentioned terms.

A New Retort-House at the Leeds Gas-Works.—The Leeds Corporation Gas Committee have decided to build an additional retort-house at the Meadow Lane works. Last winter all the retorts at the different stations were in use; and the Committee think it advisable to be prepared to add another house in case the demand during the next few months should make it requisite.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Falkirk Gas Commissioners have not yet been nine months in possession of the gas undertaking, yet in that short space of time they have revolutionized the gas manufacture in the town. No one would have expected the Company, as they existed, to have expended the money necessary to renovate the works. But, of course, had they obtained parliamentary powers, they would, without doubt, have made their works equal to all requirements. There was more reason to fear that the Corporation, on taking over the gas undertaking at a large price, would, in their inexperience of the conduct of such a business, grudge expenditure, and so lead to a continuance of the unsatisfactory condition of the works. This, however, has not been the case. The Commissioners have shown a remarkably business-like capacity; and they have been excellently advised by their Manager (Mr. P. B. Watson). The money which has been expended has been judiciously laid out; the Commissioners having been led to introduce two of the most profitable systems which exist at present. They showed the excellence of their judgment in the selection of the right processes; and they have also displayed wisdom in the re-arrangement of the works, which will now be much simpler in design, and therefore easier worked. The Commissioners have accomplished all this with the assistance of their own Manager only, and without calling in a consulting engineer This shows an amount of confidence in Mr. Watson on the part of the Commissioners which it is delightful to observe—more particularly when it is remembered that, at the time of his appointment, there appeared to be an unnecessary severity on the part of some towards him. It looked then as if the Commissioners would be apt to meddle too much with the management; but this has not resulted, with the consequence that there is mutual happiness. The proceedings on Tuesday last, when the new plant was brought into use, were of a most harmonious description.* The Commissioners have done right in putting the works in order at the beginning of their occupation of them, rather than attempting to go on with worn out and antiquated plant. With the saving of 11d. per 1000 cubic feet which is estimated to be derived from the working of the Hislop regenerative plant, they will at once begin to earn profit; and, if they choose, they should soon be in a position to reduce their capital. I observe that nothing was said about saving by the Peebles oil-gas process. In other places where it has been adopted, reductions to the amount of about 5d. per 1000 cubic feet have been effected. If at Falkirk they can do the same by the Peebles system, there will be, with the two processes, a saving of 1s. 4d. per 1000 cubic feet. That would be a splendid result, and would justify the action of the Commissioners in the fullest manner.

There is a feature about Tuesday's proceedings which strikes me as peculiar. Mr. Storey, who was the originator of the gas transfer, was not present. He recently resigned his membership of the Town Council and Gas Commission, and could not have attended in an official capacity; but there were others there whose connection with the gas undertaking was simply their connection with the transfer—notably Mr. A. Gardner, the Sheriff-Clerk Depute at Falkirk, who was Clerk in the arbitration, and Mr. T. Wilson, of Coatbridge, who was one of the valuers of the stock taken over by the Commissioners from the Gas Company. Mr. Storey's absence must therefore surely be accounted for upon some ground other than that of mere accident. What that ground is, I do not know; but it looks as if there had been serious difference of opinion between Mr. Storey and his colleagues

The Commissioners, at a meeting on Monday, had before them an application by the Eastern District Committee of the Stirling County Council asking the terms upon which the mains would be extended, and gas supplied to about 150 additional lamps in the Larbert Special Lighting District. There is a healthy appearance about this; because it means probably about three miles of new mains in a populous district, and the certainty of a considerable demand for private lighting along the route. The subject is under consideration of the Manager. Provost Griffiths, who is an able public representative, referred to this application on Tuesday; and said that the county authorities would get the gas they wanted for public lighting at a price fixed upon the same principle as they charged for the public lighting within the burgh. Nothing could be fairer than that.

At the meeting of the Rothesay Town Council on Monday, the report of Mr. J. Ballantyne, the Gas Manager, showed that in the month of September there was an increase in the consumption of gas in the burgh, as compared with the same month of last year, of 14 per cent.; and that there are now 307 gas-cookers in use, compared with 262 at this time last year. With a business growing like this, the works are rapidly becoming much too small; and the Town Council have now obtained the sanction of the Dean of Guild Court for the alterations which they propose to make upon the buildings they have acquired for new works. Plans for the works, which have been prepared by Mr. A. Gillespie, of Glasgow, were before the Council, and were approved; the Committee being instructed to advertise for offers for the whole of the work. One of the members asked if there would be any smoke from the chimney at the new works; and Mr. Ballantyne assured them there would not. Another asked if there would be any smell, to which Mr. Ballantyne replied that there must always be a smell, but that it would be much less than at present. A third member, who interested himself in the purifiers, elicited the information that in the new works, instead of having to change the purifiers every three or four days as at present, they would go for about three weeks in the winter season.

The Directors of the Coatbridge Gas Company, at a meeting on Tuesday of last week, reduced the price of gas from 3s. 4d. to 2s. 11d. per 1000 cubic feet, from and after Jan. 1 next. The gas supplied by the Company is of 23 to 25 candle power; and the price is thus extremely moderate. Coatbridge is very favourably situated for coal supply, which is a great help to the production of cheap gas; the other most favourable element tending in that direction being the good management of Mr. T. Wilson. Many gas managers will envy the Company's position, when they learn that the Directors have just

* A report of these proceedings will be found on p. 834.—Ed. J. G. L.

concluded contracts for a six months' supply of coal at the average price of 6s. 2d. per ton.

An action relating to the accuracy of a gas-meter was heard in the Hawick Sheriff Court on Wednesday. The Hawick Gaslight Company sued W. Oliver, cashier, for £1 14s., as the price of 13,600 cubic feet of gas consumed since September, 1894. The defence was that the quantity of gas charged for had not been consumed. The Company led evidence to show that the defender's meter, when taken out and tested, was found to be perfectly accurate; also that there was a strong smell of gas, and that Mrs. Oliver was warned that there was something wrong with the gas-pipes in the house. For the defender, evidence was given to the effect that they only burned gas for a fortnight during the period charged for. The Sheriff could not, of course, take such evidence into account, but said he had to abide by the reading of the meter. There had unfortunately, he added, been something wrong with the pipes in the house, with which, however, the Gas Company had nothing to do. He gave decree for the sum sued for, with expenses.

The Paisley Gas Corporation have been considering a report by their Manager (Mr. George R. Hislop) upon experiments made by him with Welsbach incandescent gas-burners, and inquiries he had made into the question of their suitability for public lighting. As a result, they have instructed that the lamps in front of the Municipal Buildings be fitted up, as an experiment, with Welsbach burners consuming 3½ cubic feet per hour. A movement is on foot in the Corporation for the abolition of meter-hire charges; notice of motion having been given for the appointment of a Committee to inquire and report as to the best arrangement for the purchase by the Corporation of all gas-meters not at the present time owned by them, as a preliminary to dealing with meter-rents.

The Perth Gas Commission met on Thursday night, to consider as to the filling up of the vacancy in the gas managership. They had first considered the subject in Committee, when it had been moved (1) that they advertise for a manager at a salary of £300; (2) that Mr. Easson, the present Assistant Manager, be appointed at a salary of £200; and (3) that the post be advertised at a salary of £250. The second motion had been withdrawn; and on a division, it had been agreed, by 11 votes to 6, to recommend in terms of the first motion. Lord Provost Dewar moved the recommendation in the Commission. He pressed upon the members that they must get the best possible man. He had taken some trouble to ascertain the salaries of gas managers over the country; and he did not think that any of them could be moved for less than £300—he meant a man who was capable of looking after the management, construction, and erection of the new works. The late Manager had £365; and they would be offering, in £300, less than Mr. Whimster had thirty or forty years ago. They ought to have a man who was capable of drawing plans and making up specifications. If they employed an outsider, he would charge 7½ per cent. commission; and they would spend on his fee alone forty years of the difference between £250 and £300. That the salary be £250 was moved by Mr. Keiller, who thought it was just as possible to get a competent man for £250 as for £300. He asked how many managers in Scotland had experience in the construction of gas-works. He questioned if there were three or four. One member thought they would get a man for £250 who would be good enough for Perth. Another thought they could get the best man in Scotland for £300. Several of the members spoke in favour of Mr. Easson; and among these Mr. Wright, who said he thought that they should give him an interim appointment for a year, as an opportunity to win his spurs. One remarked that they wanted a man with a college training, who had studied chemistry and engineering; and they would not get such a man for £250. Such is the interest taken in the subject that, out of 23 members present, 22 of them spoke. On a division, 15 voted for the Provost's motion, 6 for a salary of £250, and 2 members declined to vote. The salary offered will therefore be £300. The appointment of a Manager for the gas-works is, as was said, a most important proceeding; and the Commissioners do well to endeavour to secure the services of a good man. They are in a very delicate position, however, with reference to Mr. Easson. Little more than a year ago, it will be remembered, Mr. Easson applied for the post of Manager of the Forfar Corporation Gas-Works; and the Perth Gas Commissioners met hurriedly, and advanced his salary in order to retain his services. No one can say that Mr. Easson has a claim to the post; but he has a strong claim to consideration, whether he gets the position or not. If he does not get it, the Commissioners will be open to the reproach that they served themselves at the expense of his prospects.

Haverfordwest Water Supply.—A special meeting of the members of the Haverfordwest Town Council was held on Monday last week, for the purpose of receiving the report of Mr. F. Beesley, M.Inst.C.E., on a scheme by which it is proposed to take water into the town by gravitation in the place of the present pumping scheme, which has caused much dissatisfaction during the six years of its existence. The report stated that, in company with the Borough Surveyor (Mr. Gibbon), Mr. Beesley visited the source of the springs at Little Newcastle on the 10th and 11th ult., when he found the yield 136,000 gallons in 24 hours, and this after a period of very dry weather. The population of Haverfordwest is about 6200; and, making the usual provision of 20 gallons per head, 124,000 gallons per day would be required. It would therefore be seen that, even during exceptionally dry weather, the springs, after opening out, would yield sufficient for the town for some time to come; and this could be increased in future by constructing a large storage reservoir. He proposed for the present to build an open reservoir at the source, to hold two days' supply. The length of the new main would be about 10 miles; and he estimated the cost at a total of £8500, which, after deducting the present annual expenses of pumping, represented an annual extra outlay for the gravitation scheme of £150 9s. This scheme could consequently be carried out for an additional 2d. in the pound on the present rateable value of the borough—£18,068. The meeting expressed great satisfaction with the report; and it was resolved, on the motion of Mr. R. T. P. Williams, by whom the scheme was first introduced, to adopt it, and at once take the necessary steps for carrying it out.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 19.

Sulphate of Ammonia.—The better demand noticed in the last report continues; but the buying has, for the most part, been to cover sales previously made. Consumers have not responded to any great extent, not believing in any substantial advance in the price of sulphate of ammonia, in face of the low price of nitrate of soda, and other nitrogenous material, for both prompt and forward delivery. They would be interested in the forward position, if at a moderate premium; but makers do not seem inclined to commit themselves far ahead, unless at a substantial advance on prompt prices. For delivery over spring months, a fair quantity was recently sold at up to £9 7s. 6d. per ton f.o.b.; but quotations have advanced to a point beyond the ideas of buyers. Prompt quotations are £9 to £9 2s. 6d., f.o.b. at the ports.

Nitrate of Soda is very quiet in all positions. On spot, the value of fine quality is 7s. 9d. per cwt.; and cargoes of ordinary quality, autumn shipment, may be had at about 7s. 7½d. per cwt.

LONDON, *Oct.* 19.

Tar Products.—Pitch remains steady at prices ranging between 35s. 6d. and 38s., according to port of shipment. The prospect of continuing these prices for the present season appears now to be pretty well assured, although dealers still declare that fuel makers cannot afford to pay present prices, and, if the prices are kept up, large briquette makers will cease operations. Such reports have been circulated before; but fuel makers still go on. Carbolic acid is in excellent request. Although crude does not advance in price, there is a ready market for it; and crystals are dearer in proportion than crude—the first time for many years such a disparity has existed. Benzols have suddenly acquired better values. Whether they will continue to improve is quite a matter for speculation. Anthracene is held firmly at prices quoted below, though a determined and nefarious effort has been made to depress the article, and to discredit the Anthracene Committee. Fortunately, the Committee are strong enough to resist such futile attacks. Values for the week are as follows: Tar, 19s. to 22s. 6d. Pitch, 35s. 6d. to 38s., according to port of shipment. Benzols, 90's, 1s. 3d.; 50's, 1s. 2d. Solvent naphtha, 1s. 2d. Toluol, 1s. 3d. Crude, 30 per cent., naphtha, 5d. Naphthalene salts, 25s. to 40s., according to quality. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d.; 75's, 1s. 9½d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia has steadily gone on improving the last two weeks. It looks as if "bear" operations have now ceased; and sulphate will be allowed to assume its proper position in relation to nitrate of soda. Transactions have taken place during the week at from £8 15s. to £9 2s. 6d.; sellers now demanding £9 5s., less 3½ per cent., at all ports. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Some improvement is beginning to manifest itself in the coal trade here; the demand for house coal necessarily showing more activity with the approach of winter, while the common qualities of round coal are in better request for manufacturing purposes—especially those descriptions suitable for iron-making requirements. Pits here and there are securing sufficient orders to enable them to work practically full time; but four days per week is still about the average, with supplies ample. Prices show no improvement, except that where they were previously cut below current quotations, they have now been levelled up to list rates. At the pit mouth, best Wigan Arley remains at about 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; common house coal, 7s. to 7s. 6d.; and steam and forge coal, which continue very low in price, average 6s. to 6s. 6d. Notwithstanding the increased output of slack, engine fuel moves off fairly well. Prices are well maintained, ranging from 3s. and 3s. 6d. for common, to 4s. 6d. and 5s. per ton for better qualities at the pit mouth. In the shipping trade, there is no improvement to report; business is still coming forward only in very limited weight, with prices quite as low as ever. Common steam coal can be readily bought at about 7s. to 7s. 6d., with better qualities quoted 7s. 9d. to 8s. per ton, delivered at the High Level, Liverpool, or the Garston Docks. It is reported that two Lancashire colliery firms have secured 80,000 tons of the Belfast contract, and that a Yorkshire firm, who last year supplied a large quantity, have not succeeded in securing any portion of the contract this season. The two Lancashire colliery firms above referred to are the Wigan Coal and Iron Company, who have contracted for 30,000 tons; and the Abram Coal Company, who are to have 50,000 tons. There are various statements as to the prices at which these contracts have been placed; but they are too indefinite for repetition beyond the statement that the prices are the lowest ever quoted.

Northern Coal Trade.—The coal trade has now entered upon a period of rather irregular output and shipment; the stormy weather affecting naturally the arrival of steamers, and thus the working of the collieries that depend on the sea for any considerable part of their output. The Northumbrian steam coal trade therefore varies a little from day to day, chiefly in the extent of the demand, but also a little in the price. Generally, best steam coals are quoted at 8s. 6d. per ton f.o.b.; but in cases where there is pressure to get vessels away, 1½d. per ton more may be asked. Second-class steam coals are quiet, at from 7s. 10½d. to 8s. 3d. per ton f.o.b. Small steam coals are quoted 3s. 9d. to 4s. per ton. There is only a moderate business in household coal; and for shipment the price that is quoted varies from 10s. to 10s. 6d. per ton f.o.b. Gas coal is now naturally in greater demand; and the increase must be expected to continue until the end of the year. While the price that is quoted for best Durham gas coals may be given as about 6s. 9d. per ton f.o.b., yet there are some coalowners well sold forward who ask as high as 7s. 3d. for their produce. The local demand for gas coal seems to increase; and there is a desire on the part of many gas companies to enlarge their stocks. Some of the great gas companies are taking advantage of the low freights that have prevailed to get in stocks prior

to the time when higher freights may be concurrent with larger consumption. There is not so much alteration in the coke trade. The demand is steady; and the price is well maintained. Best Durham coke is quoted from 13s. 6d. to 14s. 6d. per ton for export; while the local consumption is large, and the price is about 12s. 9d. to 13s. 3d. per ton, delivered at the local blast furnaces. There is no alteration in the price of gas coke; but with an increased production, some gas companies find it a little more difficult to keep down their stocks.

Scotch Coal Trade.—Over-production is paralyzing the coal market in Scotland. There is a large quantity of coal changing hands; but the supply is more than equal to the demand, and is likely to remain so, with the result that no advance can be got in prices. Ell of the best quality is about the only variety which is in anything like demand equal to output. Other varieties are being stacked; and the market is dull. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 163,482 tons—an increase upon the quantity in the preceding week of 6505 tons, and upon the quantity in the corresponding week of last year of 116,226 tons. For the year to date, the total shipments have amounted to 5,773,551 tons—an increase over the quantity in the same period of last year of 1,912,043 tons, and a decrease on the corresponding period of 1893 of 308,401 tons.

Devonport Water Supply.—Some important works for the improvement of the water supply of Devonport are approaching completion. Considerable additions and alterations have been made to the reservoir at Crownhill, and a new reservoir near the village of Roborough is now nearly finished. This reservoir, which will be called Belliver, is 500 feet above the sea-level, and will have a capacity of 2,000,000 gallons. It is 210 feet in length, 140 feet in breadth, and 11 feet deep. The walls are of concrete, faced with brick; the bottom also being of concrete covered with asphalte. A main has been laid from it to the one at Crownhill, and this will do away with the open leat previously existing, and lessen to this extent the risk of pollution and of the water being frozen in winter. The cost of the Belliver reservoir has been about £8000. A similar amount has been expended on the main, and about £6000 in the additions and alterations to the Crownhill reservoir. The work has been carried out from the plans and under the superintendence of Mr. H. Francis, the Engineer to the Devonport Water Company. The scheme was provided for by Act of Parliament, and additional stock was issued to cover the cost. The capital was subscribed for several times over; the average price obtained for the 4 per cent. stock being a little over 122.

St. Ives Corporation and the Gas-Works.—An inquiry was held at St. Ives (Cornwall), on Thursday, by Colonel A. G. Durnford, R.E., representing the Local Government Board, respecting the application of the Town Council for power to borrow £6000 for the purchase and extension of the gas-works. The Town Clerk (Mr. Boase) said Mr. J. W. Buckley, Gas Engineer, of Falmouth, whom the Corporation had consulted, recommended that the loan should be £6500; and the Corporation asked for a period of not less than 35 years for its repayment. The Corporation bought the plant, &c., for £235; and took possession of the works on Aug. 15, 1894. The land was purchased for £2000. The plant, mains, &c., were very dilapidated and inadequate; and the price of gas hitherto has been prohibitive. The Corporation hoped to give a much better light at a less price. Mr. Buckley stated that two contracts had been entered into for extending the works. One for £2000 included retorts, retort-benches, hydraulic main, scrubber, engine and exhausters, purifiers, meter and governor, and a new gasholder—the last named having a capacity of 39,000 cubic feet. The second contract was for £1000, which included the building of a new retort-house. The Corporation were not absolutely committed to the £6500; but in recent years gas companies and corporations had found it advisable to put in services and fix meters free of cost, and this policy would be an inducement for the consumer to have the gas laid on. The new works would be capable of making 10 million cubic feet of gas per annum. He believed that with judicious management the works would not only be self-supporting, but would hand over a handsome profit to the rates. At the close of the inquiry, Colonel Durnford visited the works.

Common-Sense in the Use of Gas.—This was the title of a lecture delivered by Mr. C. Nickson, the Superintendent of the Manchester Corporation Gas Department, before the Hulme Healthy Homes Society last Thursday. Illustrating the lack of common-sense often exhibited, he quoted a number of typical cases of complaint, in each of which the charge as to deficiency in the quantity or quality of the gas had its origin in neglect on the part of the consumer. The consumers in the city number nearly 85,000; and although it was sometimes said that everybody was complaining of the gas, the complaints sent in to the office only reached about 8000 annually, or 9 per cent. of the whole number of meters in use. It was sometimes said that the official answers to complaints were stereotyped, and so they were, simply because the complaints were stereotyped. Special complaints always received careful attention and a special reply. Proceeding to show how common-sense might be exercised, he referred first to the meters. The size of these, he said, should be regulated by the number of burners and other appliances in use. It was desirable that the meter should be too large rather than too small—a large meter could be turned off according to requirements; whereas a small meter, worked beyond its capacity, was apt to register unfairly, and to be inconvenient in its operations. As to burners, he advised that people should beware of the man who went from house to house hawking burners that were inferior in quality and higher in price than could be obtained at any gas-fitter's for a penny. When good burners were obtained, care must be taken to keep them free from corrosion. With regard to globes, he said that the ordinary globes with narrow bottoms were undesirable, as they created a forced draught, which caused the flame to flicker, curl up, and smoke. Opal, ground glass, and other such globes much reduced the quantity of light; and an excellent form of globe was that which consisted of opal or ground glass in the upper part and clear glass at the bottom. Gas was a good servant; and it would well repay good usage in these and other directions.

New Joint-Stock Companies.—The following new joint-stock companies have lately been registered: The Elstree and Boreham Wood Gas Company, Limited, with a capital of £20,000, in £10 shares, to manufacture and supply gas in the parishes of Elstree, Aldenham, Shenley, and Ridge, in Hertfordshire, and elsewhere. Wright's Gas-Meter Syndicate, Limited, with a capital of £100,000, in £1 shares, "to acquire the interest of F. Wright in patents for all parts of the world, except Great Britain and her colonies and dependencies, but including patents for Canada, for inventions dealing with gas-meters, coin-freed meters, dry gas-meters, &c.; and to carry on the business of prepayment and other gas-meter manufacturers, mechanical engineers, gas engineers, &c., in all its branches." The West Australian Electrical Trunk Power and Lighting Company, Limited, with a capital of £510,000, in £1 shares (10,000 deferred), to carry on, in West Australia and elsewhere, the business of an electric supply company in all its branches; and also those of a gas and water supply and a mining, milling, and smelting company.

Serious Accident at the New Water-Borings for Leamington.—An unfortunate accident has occurred in connection with the water-boring operations of the Leamington Corporation near their supplemental reservoir at Lillington. The Contractor (Mr. Vickers) has sunk a shaft 8 feet in diameter to a depth of 83 feet, having to go but 7 feet farther to finish the first portion of the contract. The ordinary protection of timber was used for casing the well, in sinking which the excavators passed through clay, marl, and sand; the latter being unpleasantly conspicuous, but no danger was feared. Just as the men were leaving work a few days since, the whole well collapsed. Happily no one was in the shaft at the time; but the Contractor's plant is buried, and the Corporation have lost their money. The shaft is so near the reservoir, that it became essential forthwith to fill up the portion not covered with *débris*, in order to make the reservoir secure. The bore never touched the water-bearing rock which the authorities believed to be near at hand. It is intended to sink a second shaft at a greater distance from the reservoir; and special precautions will be taken to cope with running sand, which is prevalent in the locality of the well.

The Price of Gas in the Rochdale Out-Districts.—At the last meeting of the Castleton District Council, the Clerk read a letter from the Deputy Town Clerk of Rochdale with reference to the price of gas. It stated that the Gas Committee would be glad to receive a deputation from the Council; but if the sole object of the deputation was to secure a reduction in the price of gas, it might possibly save trouble to state that the Committee considered the present price of gas very reasonable, and would strongly object to making any change at present. The Chairman (Mr. S. W. O'Neill) said he believed the Council were under a misapprehension at the time they appointed the deputation. Mr. Holt said the Council were certainly under the misapprehension that the price of gas had not been lowered since the reduction in the price of coal; but notwithstanding that, he thought it was quite time an attempt was made to get the charge reduced from 3s. 4d. per 1000 cubic feet. When he could name places where the gas was sold at 2s., 2s. 3d., and 2s. 4d., he thought it was quite time that Rochdale, with its improved apparatus and its close proximity to the coal-fields, should make a reduction. Mr. Ormerod suggested that the Clerk should write to the other Councils supplied by the Rochdale Corporation, asking them to join in a strong deputation to the Gas Committee with a view to getting the price reduced. The Chairman thought this proposal a good one. It was decided that the Clerk should write to other local authorities, asking them to join in the deputation.

Water-Works Improvements at Exeter.—The Water Committee of the Exeter City Council have arrived at the conclusion that the time has come when an increased supply of water is absolutely necessary, and some improvements are required in the filtration system. Upon the Committee's instructions, the Surveyor has reported upon the question. He estimates that the demand for water 30 years hence will be 2,550,000 gallons per day, or an increase of about 750,000 gallons daily on the present maximum demand. The total filtering area required is 70,000 feet; and, there being no land in the vicinity of the reservoirs where filter-beds of this area could be constructed, he suggests that new beds be formed at Pynes, where the Council would have to acquire only one additional area of land. His estimates for the different items are as follows: Filter-beds, &c., Pynes, £5500; engine at Pynes, £850; two boilers, £750; alterations to house, &c., £300; rising main, £4295; taking up and relaying 10-inch main, £325; new engine and boiler at Dane's Castle, £1125; intermediate reservoir, £2600; extensions, £500—total, £16,245. The alterations would bring about a reduction of the cost of working of between £100 and £150 a year; but the main gain would be a plentiful supply of properly filtered water. The Surveyor also suggests direct pumping from Pynes to an intermediate reservoir, and the transference of the whole pumping to Pynes. This, he believes, would result in a saving of 50 per cent. on the present coal bill. In conclusion, he states that it is his opinion that it would be worth while to consider what could be effected by having the principal pumping-station under the same roof as the electric light works, for the purchase of which the Corporation have entered into a conditional agreement. Referring to the use of the city refuse for raising steam, the Surveyor points out that, while it would not be possible to take the refuse to any of the pumping-stations, no such objection could be raised against bringing the water in a closed conduit to be pumped at a place where the sifted refuse could be used. A new 15-inch supply main from Pynes to Exe Street would have to be provided in conjunction with the existing 12-inch main, involving an additional outlay not exceeding £1000. Instead of suggesting the construction of a destructor, he recommends the making of producer gas; but such a scheme as this, he says, would need further consideration. This, however, need not delay the construction of the filters, the laying of the direct main, or the re-arrangement of the machinery for the new supply. The matter came before the City Council last Wednesday, when Mr. Fulford moved that the Committee be authorized to obtain opinions from experts upon the suggestions made by the City Surveyor. If, he remarked, the proposals were adopted, they would involve a total expenditure, with land, &c., of £20,000 or £22,000. The motion was passed.

Rhyl Water Supply.—In consequence of the rapidly-increasing summer and winter population of the Rhyl district, the Urban District Council have decided to take steps to increase the delivery of water from their reservoir. Mr. F. Storr, of Wrexham, who has been consulted, recommends them to lay a new 8-inch main from the bottom of the hill on which the reservoir is situate to the elevated ground just outside Rhyl, with a new 12-inch main from the latter point to the centre of Rhyl; also to construct an elevated tower so that a pressure of 80 feet may at all times be given at Rhyl. It is estimated that a 9-inch main will cost £4750; a 10-inch one, £6110; and the elevated tower, about £2500. With an ever-increasing population, it is also felt that an additional reservoir for storage purposes will have to be built.

Sales of Shares.—Messrs. Grimley and Son recently sold by auction, at Redditch, 60 lots of ten £10 preference shares in the *Redditch Gas Company;* the total amount realized being £7520 15s. 6d.——Last Tuesday, Messrs. Nicholson, Greaves, Barber, and Hastings sold at Sheffield 15 £1 shares in the *Eckington and Mosbro' Gas Company, Limited*, for £2 2s. each.——Last Wednesday, Mr. R. Mack sold by auction £10,000 of 3½ per cent. debenture stock in the *Newcastle and Gateshead Gas Company;* being part of the money authorized to be borrowed under their Act of 1879. There was a large number of bidders; and the whole of the stock was rapidly disposed of. The top price obtained was £116 7s. 6d. per cent.; and the lowest £116—the average being £116 2s. 1½d. The total realized was £11,610 12s. 6d.——Yesterday week, £65 of 7 per cent. new ordinary stock in the *Scarborough Gas Company* was sold by auction at the rate of £167 per cent., and £150 of similar stock realized £164 per cent. These prices were stated by the Auctioneer to be the best ever recorded for this stock.

Northam Water Supply.—Mr. Baldwin Latham, M.Inst.C.E., has forwarded to the Northam District Council the plans and estimate of his scheme for supplying water for Northam, Appledore, and Westward Ho, from Abbotsham, to which reference was made in the JOURNAL for the 1st inst. The scheme, the report said, was decidedly the best that could be devised. There was a gathering-ground of 120 acres, with 40 acres extra; and the reservoir would contain 22 million gallons. About 15 miles of cast-iron main would be required; and there would be storage for a supply of 170,000 gallons per day. The cost of the works would be £18,598; and engineering and other expenses would bring up the amount to £22,300. Assuming there was formidable opposition—which Mr. Latham did not anticipate—and that the whole of the works would cost £25,000, including parliamentary expenses, if this amount were borrowed for sixty years, an annual sum of £903 would be required to pay principal and interest. The cost of working the pumping-engine and for filtration, turncock, &c., would be £150 a year. An alternative scheme was a supply from Yeo Vale by pumping; but that would be the more costly. The matter came before the Council at their last meeting; but the cost of the scheme frightened the members, some of whom seemed to think a supply of water might be found at Appledore for that town. In the result, the question was deferred.

Welsh Water for Wales.—At a meeting of the Water Committee of the Glamorgan County Council last Thursday, the Clerk (Mr. T. M. Franklen) reported that the County Councils of Breconshire, Carmarthenshire, and Monmouthshire had been invited to unite with the Glamorgan Council in considering the question of the water supplies of the four counties; but no replies had then been received. Some conversation took place as to what further action should be taken in the way of forming an area; it being suggested that this should be as large as possible, and in the direction of opposing the London County Council Bill to take water from Wales, if it were to be promoted next session. Mr. R. Middleton and Mr. J. A. B. Williams were appointed Engineers to report on the matter; and the Clerk was instructed to write to the Councils named, informing them of what was intended to be done, and that the preliminary expenses would be paid by Glamorgan. The Clerk was also directed to inquire whether the Engineers should deal with the other counties, and to request the Councils to appoint Committees to confer on the subject with the Glamorgan Committee. The Clerk read letters from the Welsh Members of Parliament, who expressed sympathy with the movement, their approval of a Royal Commission being appointed to protect the water supplies of Wales, and their readiness to attend a meeting to be held soon for the special purpose of considering the question.

The Ilfracombe District Council and the Gas-Works.—On the recommendation of the General Purposes Committee, the Ilfracombe District Council have decided not to proceed further with the proposal to promote a Bill for the compulsory purchase of the Gas Company's undertaking. The Surveyor is, however, to report upon the advisability and cost of supplying the town with electric light.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 822.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	24 – 25*	..	4 4 0
100,000	10	"	7½	Do. 7 p. c.	10	16—17*	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼—7¾	..	4 3 10
40,000	5	"	6½	Do. New	4	5¼—5¾	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	"	"	9	Do. New	100	205—210	−2	4 5 8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	222—227	..	4 16 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	27 Sept.	11¼	British	20	54½—55½	+½	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	+1	4 17 10
51,510	10	"	8½	Do. 7 p. c.	10	18—19	+1½	4 9 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8¾—9¼	+¼	4 6 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	+½	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	26 Oct.	13½	Commercial, Old Stock	100	300—305*	+1¾	4 8 6
165,000	"	"	10½	Do. New do.	100	223—228*	+3¼	4 12 1
160,762	"	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	280—285	..	4 11 3
200,000	"	"	10	Do. 7 p. c. Pref.	100	215—220	..	4 10 11
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25½—26½	+½	4 3 0
354,060	10	"	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100*	294—296	..	4 5 6
100,000	"	"	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	282—287	..	3 9 8
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	167—170	..	3 10 7
1,061,150	"	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	145—150	..	3 0 0
908,000	"	"	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	247—252	−1	4 15 3
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6—6½	+¼	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4 6 2
541,920	20	12 June	5	Monte Video, Limited	20	18—19	..	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	7¼—7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	108—112	..	5 7 1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11½—12½*	+½	5 12 0
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	"	"	12	Do. B do.	100	310—315	..	3 16 2
308,685	"	"	13	Do. C do.	100	325—330	..	3 18 9
800,000	"	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	+1	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	293—298	..	3 7 1
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	223—228*	+4	3 1 5
654,740	"	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	260—265	..	2 16 6
406,200	100	"	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	27 Sept	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 13 4
500,000	100	14 Aug.	12⅜	New River, New Shares	100	385—395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147—152	..	2 12 7
126,500	100	"	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	295—298	..	3 7 1

* Ex div

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*** See Advertisement p. II., centre of JOURNAL.

Cablegrams: "Igniter London." Telegrams: "Holmes Huddersfield."

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Telegraphic Address: "PORTER LINCOLN."

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The Popularization of Good Investments.

THE current *Quarterly* contains an article entitled "The "Triumph of Conservatism," designed to extract the moral of the last General Election, as well as to forecast its results upon the course of practical legislation. It is not for us to discuss the politics of this essay; but we may be permitted to notice that the Reviewer thinks that the present Administration will be bound to devote early attention to certain questions, among which are included employers' liability, old-age pensions, and the purchase of their own houses by the working classes. All these topics of the day have been discussed at some length in our columns, in the light afforded by knowledge of the conduct of a protected branch of trade. The interest of the followers of the gas industry in such questions is immediate and particular, inasmuch as it is in the wide range of experience of gas managers that the most trustworthy teaching is to be found respecting the bearing of labour costs and charges upon the total expense of production. Thus, in the matter of employers' liability for accidents to workmen, the Reviewer has to argue that if a definite liability of this kind were created, "employers would gain instead of lose by being "subjected to a calculable risk instead of, as at present, "to an incalculable risk, enhanced by the costs of law "and the caprice of jurymen." He further observes that "political economy proves that the cost of all permanent "charges on any particular industry is borne in the long run "by the consumer, not by the producer." In gas-works accounts, this fact is visible on the surface, so that there is no need to invoke an insufficiently understood science to prove it. The remark, however, is interesting as showing that what are, in respect of private trading, the presumptions of a theory, are realized in the every-day transactions of a statutory gas undertaking. The inference is therefore that the presumptions in question are just.

With regard to the purchase of their houses by the working classes, this idea of contemporary politics derives its main support from the discredit that has of late years overtaken provident building societies. There can be no doubt that something ought to be done to supplement the Post Office Savings Bank as a means of employing small savings. The enormous increase of the deposits in the Savings Bank, which was noted in the last Budget speech, is satisfactory in more than one respect. But, on the other hand, it has certain drawbacks of which successive Chancellors of the Exchequer will feel the gravity more and more as time passes. It is useless to urge thrift upon the working classes, unless they can be shown at the same time how to use their savings to their own and the general advantage. With this view, we have long urged upon those whom it might concern the duty of rendering municipal loans and gas and water stocks available by the small investor. If Government can do anything to facilitate and popularize this policy, we believe that more will be done in the cause of thrift than can be shown by paper arguments. Now, as in all ages of the world, one of the first duties of the leaders of the people is to extricate the universal from the particular, to exalt the spirit above the letter. So when the ordinary newspaper politician, or even a Quarterly Reviewer, talks about the purchase of dwelling-houses out of savings, he needs to be corrected, and his true meaning expanded so as to embrace facilities and rewards for the exercise of thrift in general. By all means let the workman be encouraged to found a home of his own, from which he cannot be evicted by a grasping landlord; but let him also be provided with opportunities for becoming interested in the prosperity of his own local government, and in the expansion of the great vested interests and statutory undertakings which fill so large a part of his industrial environment.

The Midland Meeting.

THE autumn meeting of the Midland Association of Gas Managers was held in Birmingham on Thursday last—Mr. W. R. Cooper, of Banbury, the Vice-President, in the chair, in the enforced absence of the President, Mr. George Winstanley, of Coventry. Although it was the annual general meeting of the Association, the attendance of members was small. Mr. Cooper was elected President of the Association for the ensuing year; and Mr. Alfred Colson, of Leicester, Vice-President. Two papers were read at the meeting—one by Mr. John Young, of Hanley,

giving "Two Years' Experience of Prepayment Meters," the other being a short statement respecting "An Incident "in Purification," communicated by Mr. W. T. Tew, of Warwick. Discussions followed. Mr. Young's experience has run pretty well upon familiar lines; but it was worth publishing, if only because every District Association of Gas Managers should have an opportunity of putting upon record the view of members regarding such a question of the day. The paper itself is a candid statement of the circumstances of what deserves to be described as another triumph for the automatic prepayment system of gas supply. The first prepayment meter was fixed in Hanley in March, 1893; and by June 30 last the number in use had risen to 1184—the number of ordinary meters standing at the same period at 5837. After this, there can be no question as to the popularity of the new system in this particular community. It is satisfactory to learn, moreover, that the extension of the prepaid branch of the business in Hanley is coexistent with a steady increase in the number of ordinary meters in use. Mr. Young describes several interesting peculiarities in regard to the application of the prepayment system in Hanley. He testifies emphatically to the profitable character of the system; and he makes a good point of the circumstance that the prepayment gas-meter is an excellent means of recovering premises wherein the use of gas has been discontinued. He claims that the system thus assists in "developing capital which has already been expended, "but has become unproductive." It may also be expected that the system will gradually have an effect upon bad debts for gas and the obsolete deposit system. Mr. Tew's paper was an interesting exposure of the unexpected results that may follow the common practice of making the tar-well the general receptacle for all the fluid residuals of gas manufacture.

Permanence for Gas and Water Stocks.

In the course of a recent discussion by the London County Council of the Metropolitan Water Supply, actual and possible, one of the speakers uttered an observation that has a direct bearing upon the question of gas finance which we have lately debated in these columns. Speaking of the capital sum that would be required to buy out the Water Companies, he declared that stock issued by a public authority to represent this amount, whatever it might be, should be made permanent, and the control of the undertakings should be vested in a Trust. This is getting upon all-fours with the idea we have endeavoured to establish as to the right treatment of gas capital. If it is wrong to redeem the capital of a Gas Company, what makes it right to do so for a Corporation Gas Department? As the question stands at present, therefore, it looks very much as though the fairest way to treat all gas capital would be to reduce the amount, as imperceptibly as may be, to something approximating to the actual value; and then to treat the remainder as permanent. Certainly, it appears that the gas undertaking of any and every local authority ought to stand in the local balance-sheet for what it is worth; and this cannot be effected under the present system of municipal finance, which, it may be contended, was not designed to embrace capital applied to industrial or mercantile uses.

Concerning the Retiring Gas-Meter.

Not so long ago, it would have been regarded as the height of eccentricity for a popular author, with pretensions to being esteemed as a person of "light and leading," to confess to a liking for gas-light. Even now, it is no small proof of the possession of that kind of valour commonly called the "courage of one's opinions," by Mr. J. Ashby-Sterry, when this pleasing writer candidly tells the readers of the *Graphic* that he is "in favour of gas-light." Lest there should be any mistake about it, Mr. Ashby-Sterry goes on to declare that he thinks "a good modern gas-"light—it must be good, mind you—very difficult to beat." This is very solacious, if only for the evidence the confession discloses that somebody who is not a gas engineer has become alive to the fact that there is a difference in gas-burners, and that some are more modern than others. After this, who shall doubt that the world moves? Mr. Ashby-Sterry, however, also thinks that "gas would be "delightful were it not for its meter." His grievance is not the common, worn-out suspicion as to the proneness of the gas meter to mendacity. Nothing if not original, Mr. Ashby Sterry is original even in his statement as to what he dislikes so much in the harmless, necessary gas-meter. It is because the whole affair is so mysterious. "A gas-"meter has been a profound mystery to me ever since I "was a small boy; and, now I have arrived at years of "discretion, it is more mysterious than ever. Did you "ever," he asks, "know anyone who could read a gas-"meter, and was able to check the account of the man "who comes to examine it?" Alas! we fear the genial inquirer has reason here. No; we certainly never did foregather with an untechnical person who discovered any acquaintance with the mystery of index-taking; and, what is more, the most painstaking instruction upon the subject, even if it has not run off the mind of the (generally incurious) pupil, has rarely succeeded in causing him to retain the way of it from one day to another. Long years ago, it was rather fashionable for inventors to essay this forlorn hope of teaching the gas consumer to read his own meter; and several more or less ingenious devices with this object as their aim were submitted to public trial. There was the "step-by-step" index, which only showed one figure of each dial at a time through a hole in a covering plate fixed before the index. This was a very jerky affair, and never became popular with the public; while the inspectors hated it, for between the time of a man's first glance at the figures and his second after entering them, the wretched thing might jump round an apparently complete revolution. Then there was the index provided with rings upon the pointers, fondly imagined to show the consumer which figure was to be regarded. But inasmuch as the ring more frequently than not appeared to be "halting "between two opinions," it did not help the consumer much. The clock-faced meter was a later idea; but it had the drawback of being unfamiliar to the inspectors, while the consumers were not more interested in it than they had been in the old-fashioned apparatus. So it has come to pass that reading the meter has been left to the professionals; and there is probably not a single instrument of the kind in use by an ordinary consumer which attempts to curry favour with him by pretending to an exceptional degree of candour in the matter of the index. Mr. Ashby-Sterry broaches another question by asking how it is that the gas-meter "ever appears to be ashamed of "itself." He achieves a new description of the instrument as "a burly, bumptious, rubicund thing—something "between a bullock's heart and a binnacle, with a sus-"picion of a small watchmaker's shop in reduced circum-"stances about it." The seductions of alliteration must have had some influence in the framing of this remarkable description; and we hope Mr. Ashby-Sterry will live to be sorry for using such language about a poor machine that never did him any harm. He is right in his whimsical way, however—as he generally is—in drawing attention to the obscurity of position to which the gas-meter is usually condemned. "It either lurks about in dark corners in the "neighbourhood of the beer cellar, where you crack your "head in trying to look at it, or is put away in a cupboard "at the top of a high room, where it is impossible for you "to reach it." There is a remedy for this, of which the ingenious writer has possibly heard. If he wishes to make friends with his gas-meter—to see how companionable the creature can be when you are all alone with it in the house—let him get one of the "penny-in-the-slot" pattern, and he will not have any reason to complain of its shyness.

How they Pay the "Living Wage" in New York.

A striking example of the consequence of regulating municipal service upon the principle of the "living wage," or, as it might be styled with equal truth, the "Trade "Union rate of wage," is supplied by New York. Our own Progressive parties in municipal bodies have familiarized the British public with the doctrine that public employment ought to set a good example in this respect to private enterprise. Logically, it is only for the employees of a municipal department to form themselves into a Trade Union and agree upon the rate of wages they would like to receive, and communicate the figure to their superiors in office, and the rate in question would have to be paid. In New York, however, even this neat arrangement has been surpassed. The shameful state of the department of street cleaning in that city recently aroused attention; and a "new broom," in the person of Colonel Waring, well known in America as a sanitary engineer, was put in charge of it. He discovered that there was a law in operation requiring the labourers in the employ of

the city to be paid nearly double the ordinary rate of wages; and he consequently represented to the authorities that he could only get half the amount of work done that the funds at his disposal should command. He demonstrated that he could clean the streets properly for the amount appropriated, provided he could obtain authority to pay the rate of wages current in the market, and that he could give the labourers so employed steady work; or he could clean the streets imperfectly, paying the wages fixed by law, and giving somewhat irregular employment. But if the city wished to have the streets kept clean at all times, while he was obliged to pay the legal wages, it would be necessary to have a much larger appropriation. This issue was for a long time carefully avoided by the city authorities, who were responsible for the law, which was suggested by the requirements of the "political "machine." They tried to get rid of Colonel Waring. But the Press and the public liked the clean streets he provided for their use; and the city authorities yielded. They did not yield, however, on the point of the wages of their henchmen, but made an extraordinary grant—illegally, of course—out of the City Treasury to meet the additional expenses of the department. The moral of all this is sufficiently obvious.

The State of the Coal Mining Population.

In the issue of the Journal for Sept. 17, reference was made to some printed statements that appeared about the same time in the *Engineer* respecting the failure of the coal miners' unions in Yorkshire and Derbyshire to keep cheap labour from flooding the pits. It was shown by our contemporary that, in their anxiety to add to the numerical strength of their trade societies, the leaders of the miners' unions had made the great mistake of enrolling, with rights of full membership, any and every man who would take a ticket. Consequently, the stronger the union was made in this way, the more congested the trade became, and the more men there were to compete for the money paid for the getting of coal. On the 18th inst., our contemporary returned to the subject. Referring again to the crisis of 1893, when the various miners' unions, more particularly in Yorkshire and Derbyshire, had sudden and enormous accessions to their ranks, it is observed that "the men "were admitted without question; the leaders in their "innocence imagining that the outside men had in a "moment become converted to the principles of Trade "Unionism. They were mistaken." Of course they were. They had bemused themselves with their own oratory, the burden of which was simply "Join the Union!" And they could not see an inch farther than the ends of their own noses. The members trooped in, in swarms; but it was only, for the most part, to come upon the strike funds. These soon gave out—much sooner than those who had paid into them either expected or liked. But this is the way of such funds. However, in the miners' case, both old and new union men had to come to begging; and the *Engineer* declares that "had it not been for the injudicious "help practically given to the unions by supporting their "men, and thus saving the funds, the rupture would have "come to an end long before it did, and an immense "amount of damage would have been saved to the "country." Now the miners' trade union leaders, with belated caution, have raised the entrance fees, and enacted that no member is to come upon the funds unless he has been a full contributor for at least thirteen weeks. This is all very well; but the mischief has been done. The calling is overmanned, and there are so many registered members of the unions, that the natural increase of population in the pit villages and towns will have to be deported, or some other means must be found for reducing the rigour of the competition between man and man in the same trade. This is a pretty state of things to be laid to the charge of the socialistic-minded agitators who engineered the strike for the "living wage" in Lancashire and Yorkshire.

Mr. C. R. Bellamy on Burning Gas.—Last Wednesday, Mr. C. R. Bellamy, the Superintendent of the Gas Department of the Liverpool Corporation, delivered a lecture at the Stanley Road Board Schools in that city, on "The Best Way to Burn Gas for Lighting Purposes." The address was illustrated by practical tests showing the progress made in the construction of burners since the invention of the first "cock's-comb," more than fifty years ago, down to the incandescent gas-burner. Mr. Bellamy conveyed a vast amount of useful information upon a subject upon which gas consumers, as a rule, are very ignorant. He administered a rebuke to those who complain of their gas-meters and their gas bills every quarter with the regularity of clockwork. He demonstrated how they might examine their meters and fittings, and ascertain whether or not they were receiving proper value for the gas they were paying for. Of the many descriptions of burner in the market, he advocated the use of the governor burner, which he hoped would, in the course of a few weeks, be on sale at a cheap rate in Liverpool with the Corporation's stamp upon it.

Presentation to Alderman Wood.—At the close of the meeting of the Water Committee of the Leicester Corporation last Tuesday, the Chairman (Alderman Wood) was presented by the Committee with a silver vase in recognition of his untiring services during the period of anxiety caused by the drought of last year, his watchful supervision of the new works at Swithland, and his unfailing courtesy and kindness during the whole period of his presidency. The Vice-Chairman (Alderman Coleman) made the presentation, and remarked that the Committee desired in some tangible way to show their gratitude for their Chairman's great services to the town, and his urbanity and geniality in the chair. It was a pleasure to them to bear this testimony to honest service, self-sacrificingly performed. Alderman Wood thanked his colleagues very heartily for their kindly feelings.

Obituary.—With regret we announce the death, on Tuesday last, in his 59th year, of Mr. James Eadington, who for thirty years held the position of Manager of the Blyth and Cowpen Gas Company. Of course, during that lengthy period deceased witnessed a wonderful change in the town of his adoption. The price of gas in Blyth a quarter of a century ago was 4s. 2d. per 1000 cubic feet; and the annual conumption amounted to close upon 6 million cubic feet. In 1894, the consumption had increased to 29,305,000 cubic feet, though the public lighting in the Cowpen and Waterloo districts was by means of electricity. This system, however, has now been discarded; and, to meet the further demands upon their resources, the Gas Company are engaged in very extensive developments of their works. The price of gas has, concurrently with the increase in consumption, fallen to 3s. 5d.——Mr. J. Colthurst, formerly a Director of the Bristol Gas Company, died on the 18th inst., at the advanced age of 85.——Mr. R. Prall, the Solicitor to the Brompton, Chatham, Rochester, &c., Water Company, and to the Higham and District Water Company, died on the 20th inst., in his 66th year. Deceased was Town Clerk of Rochester.

Frank Wright's Prepayment Gas-Meter Corporation, Limited.—In another part of the Journal will be found the prospectus of this Company, which has been registered with a capital of £100,000, in £1 shares, "for the purpose of acquiring, working and selling, or otherwise dealing with the completed patents and applications for patents (or rights relating thereto) and the several future improvements thereon, as set forth in the contracts, of the coin-freed or prepayment gas-meters, invented by Mr. Frank Wright, for the United Kingdom and colonies, Canada alone excepted;" and for generally carrying on business as manufacturers of, and dealers in, coin-freed or prepayment gas-meters, dry and other gas-meters, and all apparatus connected therewith. The Company's Articles of Association have a feature which is certainly unique in the history of joint-stock undertakings; for, instead of the customary seven signatories—usually unknown persons taking one share each—there are no less than 132, who will subscribe for more than £40,000 of the capital required. The subscription list will be opened at ten o'clock on Thursday, and close at or before four on the same day for London, and the following morning for the country.

The Sydney Water-Works.—A description of the Sydney Water-Works appears in the seventh annual report of the New South Wales Metropolitan Board of Water Supply and Sewage. The source of supply is from the Nepean River and two of its tributaries—the Cordeaux and Cataract Rivers. The catchment area is about 354 square miles. Across the Nepean River is built a concrete dam 10 feet high, which is designed to divert a portion of the stream only into the tunnel, and lift it to the level of the crown. The water is then taken by a tunnel, 4½ miles in length, to the Cataract River. Another concrete dam, similar to that on the Nepean, is thrown across this river just below the outlet of the tunnel from the Nepean. The water is thence conveyed by a tunnel for about 1¾ miles, and then by a series of open canals and tunnels, making a total distance from the source of about 40½ miles, to the Prospect reservoir. There are 11⅔ miles of tunnels, and about 28¾ miles of open canal from the off-take to the Prospect reservoir. This reservoir covers an area, when full, of 1261 acres, and has a capacity of 10,812,313,000 gallons. The dam is earth with a clay puddle core, is 7300 feet long, has a maximum height of 84 feet, with slopes of 3 to 1 on the water side, and 2½ to 1 on the outer side, and is 30 feet wide on the top. The water face is covered with heavy bluestone pitching. When quite full, there are 6,744,343,000 gallons available by gravitation. The water is drawn off from the reservoir through a valve-tower into pipes placed in a brick tunnel, and conveyed to the Pipe Head Basin, situated 16¼ miles from Sydney, and thence by a wrought-iron pipe, 6 feet in diameter, to the tank at Pott's Hill, a distance of five miles. This tank holds 100 million gallons, and is designed to tide over any interruption of supply from Prospect reservoir, as well as to prevent fluctuation of pressure.

WATER AND SANITARY AFFAIRS.

The Progressives in the County Council, defeated in their scheme for spoliating the Water Companies, have now called upon the Moderates to "declare a policy" on the subject of the water supply. Of course, this is assuming that some change has to be effected in the present system. It is taken for granted that London is anxious for the Water Companies to be got rid of, and for the supply of water to be placed under some different management. This postulate may be disputed; but there can be no doubt that the Progressives are animated by the strongest possible desire to place the County Council in the position now occupied by the Companies. Their transfer scheme being thrown overboard, they now call upon the Moderates to say what shall be done. The Parliamentary Committee, imbued with the principles of the Moderate party, proposed that the Government should be "invited" to deal with the question, or to appoint a Royal Commission to undertake the task. Were the present Government that of Lord Rosebery, such a proposal might flatter the hopes of the Progressive party. But the case is now altered, and the Progressives lack faith both in Parliament and the Government. They may even be thankful that their Transfer Bills have been, as they say, "wrecked," after six years of toil and trouble. They would never have carried their Bills through the present Parliament; and they are now spared the ignominy of such a failure. Perhaps the Moderates had been wise if they had left the Progressives to hang themselves with their own rope. The defeat of the Progressive tactics had become certain. Now the Moderates find themselves saddled with the responsibility of formulating a policy. That is to say, as they have proposed that an application should be made to the Government to undertake the water question, they are called upon "to "report without delay the lines on which they suggest "that the Government should be asked to legislate." They have already gone so far as to say that the supply of water to London and its environs "should be in the hands of a "public authority." But this is not policy enough for the opposite party. At the meeting of the Council last week, Dr. Collins's amendment to the recommendation of the Parliamentary Committee expressed a desire not merely that the water supply should be in the hands of "a" public authority, but that the authority should be the County Council. This was declared to be the Council's own desire, of which there could be no doubt, if by the "Council" we understand the Progressive party.

That the Progressive majority in the County Council have the least intention of adopting such "lines" of legislation as the Parliamentary Committee may be expected to recommend, is in the highest degree unlikely; and the task set before the Committee is a mere waste of time. Dr. Collins's motion, carried on a division by a majority of nine, is immediately at variance with the intentions of the Moderate party as to the public authority which shall have charge of the supply. The antagonism on this subject is shown by the circumstance that Mr. M'Kinnon Wood, although Chairman of the Parliamentary Committee, not only refused to move the adoption of the Committee's report advising an application to the Government, but has since resigned his post as Chairman of that Committee. The gulf is thus widening; and we see the County Council presenting the appearance of a house divided against itself. As elected by the ratepayers, there is at the present time a majority of one on the Moderate side. In respect to the Aldermen, there is a Progressive majority of seven. Thus the Progressives gain a majority of six—perhaps enlarged to-day, in supplying Mr. Ritchie's place. That six is not a working majority is shown by the vote of a fortnight ago, when Mr. Stuart's amendment to proceed with the Transfer Bills was lost by a majority of one. Even last Tuesday, when Dr. Collins's amendment was put to a show of hands, there was again a majority of one in opposition; the proposal being only saved by the subsequent division. It is perfectly true, as stated by the Earl of Onslow, that, after six years of power, the Progressives have "failed utterly and signally" in their efforts to settle the water question. To ask the Government to take up this question is to confess that Lord Onslow is right. To think of laying down the lines on which the Government is to act, however suggestively this idea may be put, is distinctly Progressive, and none the less absurd. If the Council know what should be done, let them bring in a Bill for the purpose. But what Bill can they possibly prepare? They have had Water Bills—eight of them, and they are all "wrecked." What is to be the future of this question? Mr. Costelloe may enlighten us. He says "the Council are not prepared to take a single step in the "matter until it is fully understood that the London "County Council is to be the Water Authority for "London." But what says the *Daily Chronicle?* It distinctly fears that the water supply will rest where it is "for many a year to come." Even the County Council must bow to the inevitable. Whether, as the Council have to step aside, the Companies can come forward with an acceptable scheme, is another consideration. No man is indispensable; and very possibly, in regard to the water question, London can do fairly well without the County Council.

In the debate at Spring Gardens on Tuesday last, the motion brought forward by Dr. Collins having been carried, a rider was added, of which Sir John Lubbock had given notice, requiring the publication of a memorandum which had been drawn up by the Deputy-Chairman, Mr. W. H. Dickinson, on the subject of the water supply. A copy of this document made its appearance on Friday in the morning papers, generally in a condensed form. The full text is of considerable length; but we give the principal portions in another column. Here, at all events, we meet with a policy and a programme sufficient to satisfy the most exacting Progressive. Why ask the Parliamentary Committee for anything more? Mr. Dickinson proposes for the Legislature to enact that the powers of the Companies "shall absolutely cease and determine in 1931, "and that in that year the Council shall take over their "undertakings, or so much as it requires; paying therefor "the actual value of the plant and materials so taken over." This practically applies tramway law to the Water Companies, though the capital appertaining to the latter was raised without any stipulation by Parliament for an ultimate surrender of the property on the basis of "the actual value" of plant and materials. This extraordinary application of the *ex post facto* principle is described as "not unfair to the "Companies." They would be left in the possession of a valuable property for forty years; and though it would be gradually decreasing in value, the shareholders would be spared a "sudden destruction of their property." As for the capital loss, "a slight reduction in dividends" might provide a reserve fund to meet the contingency. These and sundry other propositions of a like character stud Mr. Dickinson's memorandum; and he suggests their embodiment in a General Bill to be brought into Parliament by the Council. This gentleman calculates that the water-works, as they now exist, "are not worth to the "purchasers more than £10,000,000," though they were valued in 1891 at £37,000,000 of Metropolitan Consolidated Stock. It is well to know, as precisely as possible, what ideas prevail at Spring Gardens on the financial part of the water question; and the Companies may feel obliged to the Deputy-Chairman for having enlightened them on the subject.

Defects of Water Meterage Systems.—At the recent meeting of the New England Water-Works Association a discussion arose upon the supply of water for all purposes by meter. As to the testing of water-meters, it appears to have been the general opinion that meters registering against the consumer are not often met with. As a rule, the effect of wear and hard usage upon a water-meter is found to make it register slow; and several members agreed that durability is more to be desired in such an apparatus than accuracy of measurement. Yet it is evident, from the statements of some speakers, that there is some practical difficulty in balancing serviceability against sensitiveness in these appliances. It was asserted that, in some metered distribution systems, about twice as much water is pumped as the total registration accounts for. This seems to be an important point, as bearing upon the idea entertained by some English water-works engineers that the general adoption of water-meters would tend to reduce unaccounted-for water in British towns. One member of the Association declared that "in one town where every fixture was metered, they could account by this means but for 50 to 60 per cent. of the water consumed." Seeing that several other speakers had stated that they did not pass, for fixing, meters showing an error of more than 1 per cent., this allegation appears to require evidential corroboration. If true, it destroys the only case that can be sustained for the general introduction of water-meters.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 892.)

All attention on the Stock Exchange is centred in the Kaffir Market, and is likely to remain so for some time longer. The past week was highly exciting; and its history might be summed up in a daily record of ups and downs, according as the crowd ran in to sell, or the big men stepped in to stop the rush. As time went on, the kaleidoscopic changes became more rapid; and when on Saturday the settlement commenced, the quick turn became almost bewildering. In this state of things, the other departments could not hope to have a quiet existence; being liable to derangement by the turmoil going on near them. As a matter of fact, they were all flatter; and the Railway and American markets had their own troubles into the bargain to help to depress them. Consols were almost alone in showing a rise. The Money Market was in a somewhat healthier condition, and better rates were obtained. Business in the Gas Market was very slack during the earlier portion of the week; and though it grew more brisk later on, the volume of transactions, on the whole, was below the mark. Movements in price were decidedly irregular; for while very considerable advances were scored by some issues, there were just as many that went the other way. Nearly all of those which retrograded, however, had recently been very liberally moved up; and so a slight reaction in their case was always on the cards. Gaslight "A" showed weakness. Opening at 295½, it slid gradually away, and the closing mark was 293—the lowest of the week. Business was somewhat brisker in the secured issues; and prices were about a good medium. There was more doing in South Metropolitans; and, less support coming in, the "B" failed to maintain the phenomenal point to which it had advanced. In Commercials (the very inadequate quotation of which we lately pointed out), some stock came into the market; and the price took a big jump at once. But even now the new stock, which is in no way inferior to the old, stands ten points lower than it should be in order to be abreast of the old. Business in the Suburbans and Provincials was, of course, very limited; but some changes took place. Brentford new was reinstated, and Brighton rose smartly; but British, which had been going ahead too fast, was set back half a point. The same thing occurred to Continental Union; and Imperial also receded. Among the rest, San Paulo and Buenos Ayres were also lopped of some of their rise. Water was almost stagnant; and the only move was a fall in Lambeth 10 per cents.

The daily operations were: Business was very sluggish on Monday, and nothing moved. On Tuesday, everything was just as inactive; and the only move was a fall of ½ in British. The market began to arouse on Wednesday; but prices were not very good. Brighton improved 3; but South Metropolitan "B" and Imperial fell 2 each. On Thursday, transactions were no more numerous; but there was considerable change in quotations. Commercial old rose 3; and Brighton and Brentford new, 2 each; but Continental Union fell 2; Gaslight "A," 1; San Paulo, ½; and Buenos Ayres, ¼. Friday was a good deal more brisk. Commercial old rose 10; and ditto new, 9. In Water, Lambeth tens relapsed 2. Business was well up to the mark on Saturday; but quotations did not move.

ELECTRIC LIGHTING MEMORANDA.

The Stafford Electric Light Undertaking—The Character of the Stafford Plant—How Shall the Prospective Demand for Electric Light be Ascertained?

An addition has been made, in the case of Stafford, to the number of municipal electric lighting undertakings placed under the control of the corporation gas engineer. We have much pleasure in congratulating the Stafford Corporation Gas Committee and their Engineer, Mr. J. Ferguson Bell, upon the successful inauguration of their new department, which is the fruit of an inquiry and report commenced by Mr. Bell in 1889. It speaks well for the thoroughness of this initial investigation that many of the recommendations offered by Mr. Bell five years ago have now been carried into effect. As in the case of Leicester, the hospitality of the Stafford Gas Committee has been extended to the electric lighting plant, which is installed upon a site found for it at the gas-works. When Mr. Bell first went into the matter of electric lighting, he deemed it necessary to warn the Corporation that they ought to make sure of their customers before venturing upon the proposed undertaking; and he suggested that there should be an annual revenue of at least £2400 "in sight" to justify the speculation. Naturally enough, a canvass of the householders in the proposed electric lighting district showed only a couple of names as representing the local demand for the new system; and accordingly the scheme was "hung up." In 1893, however, upon the eve of the expiration of the Provisional Order, the question was revived, and the opinion of Dr. John Hopkinson was taken upon the suitability of Stafford for a municipal electric lighting venture. As was to have been supposed, Dr. Hopkinson entertained no doubt at all upon the point. He could not see much promise of a large demand for the electric light in the town. But, on the other hand, it was undeniable that the local conditions favoured the production of electricity at a low cost; and the prospective area in which it would be consumed, if at all, was compact. Consequently, Dr. Hopkinson's advice to the Corporation was like that of the immortal Pooh Bah, when acting in his capacity of solicitor to Koko—to "chance it." What this same eminent authority's advice would have been if consulted in a different capacity, must remain matter of conjecture. At any rate, he completely relieved Mr. Bell, who as a resident in the town would have had to bear the brunt of any failure of the venture, from all the major responsibility of advising the Corporation to undertake it. As to the minor responsibility of designing the buildings and seeing to the execution of the work generally, Mr. Bell would, of course, have no objection to do his best for the Committee and the town and there is a consensus of testimony as to the manner in which this part of the work has been done.

With regard to the electrical features of the Stafford plant there is not much to be said. The plans being Dr. Hopkinson's, the system embodied in them is on his own low-tension, three-wire principle. Dr. Hopkinson did not think well of gas-engine driving for his dynamos; and so he has put down three of Messrs. Marshall and Co.'s well-known horizontal steam-engines, supplied with steam by as many Lancashire boilers fitted with Meldrum breeze furnaces. Every engine drives its own dynamo; and there is a battery of chloride accumulators to balance the current and take up the lightest loads when the demand is not sufficient to employ an engine. According to the detailed account of the works and plant published in the *Electrical Review*, it has been arranged that at such periods of light load the boilers will be used to supply steam to the gas-works, and hence will always be under steam to meet a sudden demand. "In return for this advantage of using the steam, the Gas Department will supply to the electricity works all their refuse coke and coke screenings free of charge." This is a nice arrangement for transferring to the Gas Department all the fuel account for the electric lighting plant. The charge for current is to be 8d. per unit up to a maximum demand of 1½ hours per day, and half the price after this, according to the Brighton system.

It now remains to be seen whether Mr. Bell's caution or Dr. Hopkinson's confidence will be justified by the amount of patronage extended to the Stafford municipal electric lighting venture. In a matter of this kind, it is admittedly difficult to find a sure datum whereon to base an estimate of probable business. Mr. Bell wanted to make sure; and the Corporation ordered a canvass, with the result already stated. Dr. Hopkinson went upon general principles; and it will make no difference to him whether his forecast proves to be right or wrong. The responsibility for launching an undertaking of this kind rests entirely upon the members of the Local Authority themselves; and there are plenty of examples to show how easily persons in this situation may be deceived. There is just now, for instance, a question as to the desirability of the suburban district of Wimbledon going in for public electric lighting, under the guidance of Mr. Preece. Naturally, he tells them that there is not the smallest risk about the project—the Local Authority have only to pluck up courage and be "enterprising," and all will go well. Reminded of the state of affairs in the neighbouring town and similar district of Kingston-on-Thames, this same "guide, philosopher, and friend" of all communities in regard to matters electrical, calmly admits that the Kingston Corporation made their plunge before they had sufficiently assured themselves of the extent to which private residents would support the undertaking. What, then, is a local authority to do? If they take a canvass, the result may be misleading; for few people care to pledge themselves to support a business which does not exist. On the other hand, if they go upon general principles, what are the principles which may be trusted to indicate correctly in such a matter? We believe that the most trustworthy of indicators in this connection is rateable value, intelligently regarded in combination with commercial turnover, manufacturing output, and the general style of a district. Just as shopkeepers know what style of goods to stock for a local trade, and make money—or do not know, and become bankrupt—so must local authorities gauge the probabilities of the demand of their districts for electric or other systems of lighting. It would not be surprising to hear that there is a parity between the consumption of champagne in a particular district, and the demand for electric light by private residents. Let this remark stand, however, for an illustration of what we mean in this regard. Professional electrical advisers of corporations do not talk in this vein. They prefer to dazzle the members of local authorities, always disposed to believe great things of their town, with reference to what is done in places of widely different character; and thus public money is often squandered.

Personal.—Owing to the calls upon his time necessitated by the duties incidental to his position as one of the parliamentary representatives of Ipswich, Mr. D. Ford Goddard has decided to resign his seat on the Municipal Council.——We learn that Mr. M'Kinnon Wood, the Chairman of the Parliamentary Committee of the London County Council, has resigned that position, owing to there being a majority of Moderate members upon the Committee.

UPON SUNDRY LABOUR QUESTIONS.

The actual industrial situation is somewhat peculiar; a revival of trade—or rather, to be more exact, an improvement of the condition of certain trades—having brought about the inevitable concomitant strike for higher wages by some organizations of skilled workmen, while the members of the Coal Miners' Unions, and other followers of rough trades, have enough to do to make their "living wage" by every successive week-end. The first of these circumstances of the hour is discussed in every newspaper and in most technical journals; but not, in any instance that has come under our notice, in connection with the question of profit-sharing—the only system that can be relied upon to prevent strikes. It is again made manifest by the Clyde and Belfast trouble with the working engineers and their allies that when it comes to a question of striking or not striking, the "old" unions of skilled workers are quite as likely to "take it fighting" as the "new" unions which are supposed to differ from them so greatly in many respects. For our part, we have never been inclined to compound with the principle of Trade Unionism for condemning the manœuvres of the new unions by praising the older organizations. We have not been able to forget the performances of the Sheffield trade unions of the last generation—unions of skilled workers surely, if such could have been found anywhere—and cannot believe that organizers of close societies avowedly existing for the sole benefit of their members will ever be squeamish as to the means they employ to gain their ends. It stands to reason that the responsible managers of trade societies with money as well as credit to imperil by any indulgence in lawlessness will be chary of encouraging violent counsels in regard to the conduct of disputes with employers. Moreover, the more perfectly they succeed in getting within their membership all the available followers of trades which cannot be learnt in an hour by the first comer, the less will be their temptation to practise other than waiting tactics for bringing disputes to an end. All the same, when it is brought to ultimate analysis, the way in which the old trade unions apply the principle of unity in practice will be found to differ very little, if at all, from that favoured by the new unions. It should not be overlooked by those who reflect upon this similarity of methods in Trade Unionism, that some of the most savagely-conducted of the conflicts of new unions were carried on under the auspices of men who had learnt in an old trade union of what spirit the creature really is.

The fact that the professional leaders of the new unions are more patently infected with the socialistic taint than the more experienced heads of the older trade organizations, constitutes a difference of detail—it might be said, of ornament—rather than of essence between the two classes of trade societies. The new unions are so many mobs, influenced, as mobs are influenced, by power of tongue and lung; and professional Socialists are apt at this kind of thing. The old trade societies are largely composed of respectable men—family men, and men with money savings. It is useless to dangle Collectivism as a bait before such hard-headed as well as horny-handed customers. The leaders they are prepared to follow are not street-corner spouters, but men like themselves, with a bit of money laid by, and a keen eye upon the means of increasing the store. Yet does anybody think that such men will shrink from fighting their employers to the last gasp, if they are convinced that their wages ought to be a halfpenny an hour more? Not they; nor are they men to stick overmuch at the adoption of any means for gaining their end. They will not stone a recalcitrant employer, or go whining to a Lord Mayor for help before they have been out a month; but there is that in them which would render their company undesirable by a "Free Labourer" of their own class when they had grown desperate.

It is easy to perceive why the labour troubles of the new unions appeal more affectingly to the public, and to the mischievous order of fashionable philanthropists (at other people's expense), than do those of the old ones. The latter, when they are not ordered "on principle," with which the public have no concern, are always upon questions of work, or wages, or working hours. The philanthropist may regard with vague benevolence the spectacle of a body of comparatively well-to-do artizans in conflict with their employers upon the question of whether they should be paid a halfpenny an hour more or less, or whether the factory bell should ring at this or that hour. He may entertain a general impression that the men are probably in the right of it; but so far as he and his class are concerned, the issue is no concern of theirs. There is nothing to be made out of it by an impartial "conciliator" who would have to begin by confessing that the considerations bearing upon the point at issue were too technical for him to understand, much less to pronounce judgment upon. But when it is a case of a whole industrial population of poor fellows claiming no more than a "living wage," which the ogre-like employers do not see their way to paying—ah! then the philanthropist (at other people's expense) sees his chance; and usually, like Bret Harte's hero, he "goes for it then and thar." There is no technical knowledge required, it is thought, for the understanding of a question as to the rate of remuneration of unskilled labour. If the employers happen to be a national government, a municipal corporation, or a statutory company, their duty is plain—they must not only pay a living wage, or pay according to the trade union standard for the district; they must go farther, and "set a good example to other employers." What this means under conditions favourable for the growth of abuses in municipal administration has been published in connection with the reformation of the New York city cleaning service. Here the rate of pay for labourers in that service is actually fixed by law at about double the current rates; and although this step was originally taken for political ends, and in order that the employees might be able to contribute liberally towards the support of what is called "the machine," yet there is no public protest against it, for the reason, as a writer in the *Forum* thinks, that the doctrine of the "living wage" exerts a silent but powerful influence in checking any movement to cut down wages paid to city employees.

The responsibility for rendering this doctrine fashionable is placed by the American writer upon the English municipal bodies who, to the number of two hundred and fifty, are reputed to have adopted the principle, in remunerating their workpeople, that wages ought not to be allowed to sink below the "moral minimum," which is not fixed by the resolve of the labourer not to work for less, but by the sense of the employer of what he needs in order to enable him "to maintain a proper standard of living." The benevolent motive underlying this conduct is affirmed by the American critic, who, however, goes on to show "that whatever increase of wages is thus apparently brought about, is the result of subtraction from the wages of those who do not share the favour, as taxation is borne inevitably by the consumer, and the increase of pay to municipal workers is only possible by increase of tax rate. . . . The whole class must pay for the privilege granted to the few." The writer concludes that "the system is open to serious abuse and public danger; that its effect upon general industry is mischievous; and that safety and economy are to be found only in the application of the same business principles to public business that have been proved by experience to be sound and safe in private affairs."

As sceptics of the principle of Trade Unionism, whether applied by trade societies old or new, and as something stronger than disbelievers in the weak-minded, officious philanthropy (at other people's expense) with which the struggles of the new unionists are treated by people in a superior condition in the community, who ought to know better, it has greatly solaced us to read Lord Grimthorpe's powerful letter to *The Times* of the 21st inst. It was against the socialistic twaddle vented at the recent Church Congress that his redoubtable Lordship took up his parable; but his observations hold good for any time or occasion. Somebody said at this congress that because, under the present industrial system, men who are willing to work do not always get work to do, at the wages they ask for, "therefore the present system, which only means the laws of all civilized, and, indeed, not only civilized, but all society, is all wrong, and ought to be abolished somehow 'by some form of State Collectivism'"—of a character which the speaker discreetly refrained from particularizing. "So may we," says Lord Grimthorpe, "until he condescends to tell us for what wages, or how much food, and for what time, and with what degree of energy or skill, his willing men engage to work; or what is to be done if nobody wants his work either at that price or at all, and if he cannot be employed without turning out somebody else who is now doing the work which people do want and are paying for." This is the same question, as he repeats, with which Lord Grimthorpe "posed Cardinal Manning and a Lord Mayor and other mischievous humanitarians who were encouraging one of the great strikes some years ago." This was at the historical conference at the Mansion House, when the notorious Mitchell Henry, the leader of the coal porters, declared himself in favour of "conciliation"—meaning full concession of all his demands on behalf of the union.

Lord Grimthorpe proceeds to demolish the character claimed for Trade Unionism, as constituting "the best guarantee to employers of the workmen's good faith." He goes on to state that "everybody with the smallest knowledge of these things knows that one of the main objects of the new unionism is to prohibit all excellence and all reward for it, and to inculcate the degrading doctrine that because capital and brains cannot do much without labour, therefore each labourer who does what he is directed, as elephants do very well, does as much towards the advancement of mankind as the one man who invents and organizes the work of thousands who without him could not earn twopence. Their object is to reduce all workmen to the level of the worst, as has been exposed over and over again, and never in the least refuted." It is not only the new unions, moreover, who try to level down excellence in this spirit.

Apart from this aspect of militant Trade Unionism, and reverting to the question of rate of wages, it is obvious that where profit-sharing exists, there can be no temptation to strike for increased pay supposed to be warranted by an improved state of trade. If the antecedent condition existed, it would show itself at the proper time in heightened profits for all the partners; and the funds of the unions would not be spent in testing for the fact by a method as wasteful as the legendary Chinaman's expedient of burning down his house whenever he desired to roast a pig.

AN ARCHITECT'S AND SURVEYOR'S HANDBOOK OF GAS-FITTING.

We recently had occasion to warn our readers as to the unsatisfactory character of a book intended to serve as a "popular" guide to gas-fitting. In consequence of this action on our part, we have received from the author, Mr. Sharratt—a gentleman well known in gas circles, especially round and about Manchester, as an experienced gas lighting engineer—a copy of the little handbook published by Messrs. James Stott and Co. for the guidance of architects and surveyors. It speaks much for the confidence of this author in his work that he should have been undeterred by the severity of our late criticism of another writer from submitting his book to the same ordeal. We have great pleasure in admitting that this confidence on his part is justified. It is unnecessary to give undue prominence to the secondary—or primary?—purpose of the book for advertising the specialities of a particular firm of manufacturers. It could be wished that every trader would give the world the result of his own experience in following his calling; for information of this kind must of necessity be put forward with better credentials than those which can be offered by an unknown writer posing as an expert. Naturally and properly, the present handbook omits all reference to main and service laying—matters with which the consumer has nothing to do. It rightly defines the object of fitting a building with gas piping as that of providing for "an equal distribution of gas, so that, when fully lighted up, the pressure will be found as nearly as possible equal at all points on the same level;" and draws attention to the mischievous consequence of the custom of specifying only the number of points to which gas is to be carried. Subject to the natural limitations due to its origin, the book is a trustworthy guide; a complete one, of course, it is not. In giving instruction with regard to the computation of pipe sizes, the authority of Mr. A. H. Crump (whose article on the subject appears elsewhere) is relied upon. Upon the best working pressure, the authority of Professor V. B. Lewes, who recommends a pressure of 7-10ths all round, is adopted. A good draft of a model specification of gas-fitting work is given; and this alone should recommend the book to architects and building surveyors. We have no fault to find with the general conditions of this specification, except to point out that, while the contractor is required to "test" his work, no particulars of the nature of an acceptable test are given. On the whole, a good deal more practical information is contained in this little sixpenny pamphlet than can be found in some books affecting to treat of the subject in an exhaustive manner.

MINERAL OIL PRODUCTION.*

The text-book now before us is intended to supplement two similar volumes on petroleum, which have already appeared in the series of works on chemical technology emanating from the well-known Brunswick publishing-house of F. Vieweg and Son. The present volume deals only with the oils produced by distillation from shales, lignites, and similar minerals, and incidentally with the production of paraffin, and the manufacture of candles and oil gas. There are two chief centres of the mineral oil industry—viz., the shale districts of Scotland and the provinces of Saxony and Thuringia, in Germany. Dr. W. Scheithauer, the author of the book, is attached to one of the largest works in the latter centre, and is therefore especially conversant with the raw materials and methods of distillation of Saxony and Thuringia. The portion of his work which deals with the industry as conducted in these provinces, bears ample evidence of his first-hand acquaintance with the subject; and no better guide to it could be given to the student. Reviewing the development of the Saxon-Thuringian oil manufacture, Dr. Scheithauer considers that there have been four well-marked periods in its history—the first extending up to the appearance of American petroleum on the market, in 1862; the second to the Vienna Exhibition of 1873; the third to the death of C. A. Riebeck in 1883; and the fourth from the formation of the Company for carrying on Riebeck's works, to the Chicago Exhibition, in 1893. The first period was characterized by speculation and uncertainty, though the products fetched nearly five times their present prices. The next epoch was one of the keenest competition with a most powerful rival, and was marked by the rise, under the stress of opposition, of more careful and scientific methods of distillation. But the end of this period witnessed the first employment of vertical retorts, which have now entirely displaced the early horizontal forms. The third period saw many more competitors besides American petroleum; and the oil-gas market was for a time almost entirely given over to the Scotch distilleries. The briquette industry in Germany was at this time grafted on to the oil industry; and the one helped to support the other. With the death of Riebeck and the close of the third epoch, the firms of manufacturers began to form syndicates for the better sale of their products. There had been a duty of about 3s. per cwt. on petroleum imported to Germany; and in 1885, an import duty of 5s. per cwt. was put on all other mineral oil, in order to protect the native industry. Curiously enough, it has been observed that the demand for Thuringian gas oil fluctuates in correspondence with the depression or inflation of the other large industries of the country.

This very brief sketch of the history of the German oil industry, with which the book is chiefly concerned, will give our readers a fair conception of the subject with which it has to deal. The descriptions of the retorts and methods of distillation are very complete and lucid. The rival shale distilleries of Scotland also meet with adequate treatment; and we notice that the quite modern retorts and methods of Messrs. Young and Beilby are illustrated and explained. The production of paraffin and the manufacture of candles are also dealt with at length. The large quantities of Thuringian and Scotch oil used for gas making, justify the inclusion in the book of some 60 pages on oil gas. This portion appears to partake more of the nature of a compilation than the remainder of the work; and we suspect that the author has not had much practical experience in this branch of his subject. But though the information may be at second hand, it is good; and the author has gone to the best sources for it. The Pintsch and Peebles systems claim the most attention; while Dr. Scheithauer is judiciously reticent as to the future prospects of the Tatham process. Carburetted water gas is only mentioned as an English and American departure in the utilization of oil, and is not described.

The work is copiously illustrated; and the pages teem with references to German and other works and periodicals. We can cordially commend it to those seeking a handbook on the production of mineral oil by distillation from shale, lignite, and cannel—a manufacture which is nearly related to that of illuminating gas, and which is still of immense magnitude, though dwarfed by the colossal "earth-oil" trade of Russia and America.

* "*Die Fabrikation der Mineralöle*," von Dr. W. Scheithauer. Brunswick: F. Vieweg and Son; 1895.

RURAL WATER SUPPLY.

In the period from July to December last year, there appeared in the *Builder* a series of articles on the above subject, specially prepared for students of water engineering. They have since been revised and brought up to date, and issued in the more convenient form of a book.* Of course, in such a work, there is not much scope for original thought; and the authors gratefully acknowledge their indebtedness to many standard works for the information they place before their readers. Those works, it must be acknowledged, are rather too high for the grasp of students and young engineers, to whom, it was thought, a book of a more elementary character might be serviceable. There is no examination in water-works construction at the City and Guilds of London Institute, or Messrs. Greenwell and Curry's handbook would doubtless be recommended to the attention of the candidates. The authors, in their preliminary remarks, emphasize the importance of ensuring for rural districts unpolluted water supplies, seeing that these districts are the feeders of the great towns; and they go on to give an indication as to the legal responsibilities of local authorities in this regard. Assuming that it has been decided to carry out a scheme, the steps to be taken to obtain the necessary legislative sanction are indicated. This it is recommended should be sought by an application for a Provisional Order. In this part of their work, the authors derive assistance from Michael and Will. The important subjects of land valuation, riparian rights, &c., are disposed of; and then engineering work is taken up. The first system of supply dealt with is that by gravitation, which the authors consider to be specially suitable for rural districts. The requirements of a scheme of this kind are set forth, and the leading principles affecting the flow of water in pipes are dealt with. Attention is next given to the various methods of pumping. The authors regard steam as the most economical power for heavy work; but they point out the many advantages possessed by gas-motors as compared with small steam-engines. Their remarks on this subject are followed, in natural sequence, by others on pumps, to which two chapters are devoted. The sources and measurement of water are next considered; and then the authors come to the really technical part of their work—viz., the preparation of the plans for the scheme, including levelling and surveying. All this having been done, materials have to be selected; and these are concisely dealt with. The important subject of the storage and filtration of water is taken up; and then the authors show how it is conveyed to the consumers. Pipes and their joints, fire services, valves, meters, and consumers' fittings are all touched upon. Chapters are devoted to the storage of rain water, supplies from wells, lead poisoning, and the preparation of specifications and estimates; and the book closes with some useful remarks as to the procedure at public inquiries. On the whole, the authors have placed in the hands of students a good deal of information which should be useful in preparing them for the study of the works of the recognized authorities on water engineering; and no more than this was the object they had in view. They have endeavoured, by simplicity of language and formulæ, to make themselves perfectly intelligible; and wherever it has been considered necessary, diagrams have been introduced.

* "Rural Water Supply. A Practical Handbook on the Supply of Water and the Construction of Water-Works for Small Country Districts." By A. Greenwell, Assoc.M.Inst.C.E., and W. T. Curry, Assoc.M.Inst.C.E., F.G.S. London: Crosby Lockwood and Son.

NOTES.

The Cooling Effect of Ribbed Condenser Pipes.

The design of gas condensers is one of the various practical applications to which the results of Mr. W. G. Walker's experiments upon the rate of transfer of heat through plates with variously arranged surfaces, may be adapted. These experiments were described in a paper read before the British Association at Ipswich. The method followed by the author was to observe the effect of heated air, steam, and water upon the surfaces of two exactly similar metallic tubes, one of which was plain, while the other was provided with eight longitudinal feathers or ribs soldered on to it. These ribs were spaced equally and radially round the pipe; and they were tried externally, internally, and both together. The tube was made of brass; and the feathers were of sheet copper. It was found that the presence of the ribs increased to a considerable extent the rapidity of transfer of heat, either when absorbing heat from steam or discharging it into the air. With the ribbed surface in contact with water, the speed of transfer was also increased, but not nearly to so great an extent. The greatest effect of the ribs was seen in the experiments with air. When exposed for 53 minutes in the atmosphere, after having been raised to a temperature of 210° Fahr. in a water-bath, the temperature of the externally-ribbed tube had fallen 102° Fahr.; while that of the plain tube had only fallen 69° Fahr. The addition of internal ribs to the tube produced little or no change in the rate of cooling; and internal ribs alone made but a very small difference. The effect of the internal ribs was greater when the tube was cooled in water. The external ribs were more effective in discharging heat to the atmosphere than in absorbing it from steam. The effect of winding copper wire round the tube was also tried, with the result that the temperature of the coiled cylinder fell faster than that of the plain one—the maximum difference being 6·7° Fahr. When, however, absorbing heat from steam, the effect was reversed, which is attributable to the condensation of moisture on the surface. When cooled in water, the two cylinders—coiled and plain—gave the same results. In these experiments, care was taken that the colour of the respective metallic surfaces was the same.

The Laval Steam-Turbine.

No impulse gas-engine has yet made its appearance; but the dimensions and efficiency of steam-turbines are being increased. A Laval steam-turbine developing 100-brake horse power has been made, which works with a steam consumption of something like 22 lbs. of steam per brake horse power. Recently a slight, but important, alteration in the construction of the turbine wheel has been made; every bucket being formed at the end of a radial spoke, and is a segment of a disc surrounded by a steel hoop. Thus the strength of the wheel to resist centrifugal force is so increased as to exceed any strain that can come upon it when driven at speeds far higher than those employed in practice; although as the wheel rotates at the rate of 20,000 revolutions per minute, it is evident that these strains are an important consideration in a machine of this order. The steam is admitted to the wheel by jets, which, being of an expanding conical shape, allow the steam to expand to atmospheric pressure before issuing and coming into contact with the wheel. The whole of the energy of the original steam pressure is thus spent in imparting a high velocity to the particles of steam as they issue from the jets and strike the buckets, which they do as nearly as possible in the same way as water acts upon a Pelton wheel. The velocity of the buckets must be something like one-half of the velocity of a free jet of steam. This means a considerable amount of gearing to let the speed of the wheel down to that which can be conveniently used. There seems to be a future before these steam-turbines, which are made in at least two leading types.

The Atomic Weight of Carbon.

In a paper submitted to the British Association, Mr. J. A. Wanklyn repeats the statement which he first published in 1893, to the effect that the atomic weight of carbon should be taken as 6 instead of 12. The experimental proof upon which the earlier statement was based was the existence in Russian kerosene of a series of hydrocarbons. Continuing this work, Messrs. Wanklyn and Cooper have published in the *Philosophical Magazine* a parallel investigation with a parallel result, given by a series of hydrocarbons which the knowledge of the day pronounces to be comparatively well explored and well understood. This is the marsh gas series, now regarded as the backbone of organic chemistry. In their recent researches, Messrs. Wanklyn and Cooper have employed a vapour-tension apparatus of their own construction, which they call a "tensiometer." One of the peculiar advantages of this apparatus is that by its aid the boiling-point of a very minute quantity of liquid may be ascertained. It is declared that the new instrument has a future rich in promise. In carrying out the fractionation of a mixture of liquids boiling very near together, it provides a criterion indicative of the completion of the fractionating process. Light on the question whether, in a given instance, there is specific adhesion between the constituents of a mixture, may be looked for by having recourse to this instrument, which imparts a degree of certainty and completeness to the fundamental operation of fractional distillation that was hitherto wanting. In concluding his useful paper, the author exhibits four terms of the Marsh gas series in presence of which he contends that chemists will be compelled to revert to the atomic weight of carbon which was all but universally admitted forty years ago.

Novel Construction of a Masonry Dam.

The construction of high masonry dams for water-works was recently discussed by the American Society of Civil Engineers, upon the reading of a paper on the subject by Mr. J. D. van Buren, which was briefly noticed in the JOURNAL for the 8th inst. (p. 721). In the course of the discussion, Mr. E. Wegmann observed that out of fifty-five such dams, only three have failed, and these were wrecked by faulty construction, not by erroneous design. Mr. Lindenthal suggested that heavy iron vertical rods connected by horizontal members should be built into and anchored into the masonry; thus forming a strengthening net, so that the dam could only fail by giving way bodily. Mr. Skinner described a singular dam that is now being built in California, which somewhat resembles a suggestion that has been heard of in connection with the construction of gasholder tanks. A thin sheet-iron core is employed, coated with asphalte, and its ends are cemented into narrow slots cut in the rocky walls of the valley. On each side of the iron wall there are 24 inches of concrete; and outside again is a thick wall of dry masonry. No reason was assigned for the adoption of this composite description of dam construction.

A New Industrial Pyrometer.

It is reported that, as the fruit of an exhaustive research conducted by Dr. Holborn and Dr. Wein at the Berlin testing establishment, a reliable form of pyrometer has been constructed by Keiser and Schmidt. The instrument is on the thermo-electric principle; and the main object sought was to use in its construction only such materials as could be compared with the standards preserved in the Reichsanstalt, and their thermo-chemical value thus determined. The galvanometer, which is after the D'Arsonval type, reads ordinarily from 500° C. to 1500° C.; but instruments can be prepared for still higher temperatures, as met with in water-gas generators, &c., with a scale indicating to 1600° C. These scales read both in volts, to show the electromotive force, and also directly in degrees of temperature. The new pyrometer has been tested, among other places, at the Royal Porcelain Works, in Berlin; and most satisfactory results have in all cases been attained. The only part of the instrument that needs special looking after is the cell containing the platinum and platino-rhodium couple, which is protected by a porcelain case. These cases are renewable; and a supply can be had at cost price for use when the pyrometer is exposed to the action of an exceptionally fierce blast, or of deleterious gases. Drs. Holborn and Wein recommend the instrument for all technical uses where high temperatures are employed, as furnishing a means of controlling operations likely to effect the saving of time and money, as well as fuel.

Local Authorities' Indebtedness.—At the present time, the local authorities of the country are indebted to the amount of £212,000,000 sterling, more than half of which is owing by Town Councils. Of this sum, about £60,000,000 has been sunk in gas, water, and electric lighting works.

The Value of Sedimentation in the Purification of Water.—That sedimentation plays an important part in the purification of water, was shown as long ago as the year 1886 by Dr. Percy Frankland in the case of his laboratory experiments on the removal of micro-organisms from water. That it is a factor of great importance in the storage of water in reservoirs, was also, says *Nature*, shown by him in his investigations at the London water-works. But quite recently Dr. H. J. van 't Hoff has indicated how this now recognized process of sedimentation may be taken advantage of in the abstraction of tidal water for purposes of water supply. It appears that the city of Rotterdam derives its water supply from the River Maas, and that the Company's intake is situated within the tidal area of the river. The water is, however, only abstracted at particular times—*i.e.*, two hours after high water has been reached. During this period, the river is at rest, and sedimentation can proceed unhindered; and Dr. van 't Hoff estimates that at least 50 per cent. of the bacteria present are eliminated during this time of comparative stagnation. Unlike the city of Hamburg, which before and during the great cholera epidemic abstracted tidal water from the Elbe, and distributed it in its raw condition in Rotterdam, the Maas water is submitted to filtration before delivery. In consequence, however, of a very large demand on the resources of the water-works, the rate of filtration is considerably higher than it should be; and this fact, combined with the unpleasant circumstance that the city disposes of its refuse by conducting it into the river, would naturally lead us to anticipate a bad bacterial filtrate. Dr. van 't Hoff does not, unfortunately, cite any figures for the filtrate, but states that "the very satisfactory bacteriological results which obtain at the Rotterdam Water-Works" are doubtless in great part a consequence of the improvement which takes place in this tidal water through sedimentation, rendering the raw water comparatively easy to deal with, while its microbial contents after the stagnation period average only from 4000 to 10,000 per cubic centimetre—a remarkably small number for a polluted water.

COMMUNICATED ARTICLES.

NOTES ON CURRENT TOPICS.

By "Veritas."

The incandescent system of gas lighting seems coming more and more to the front, and is receiving increasing and well-deserved attention. An interesting communication appeared in your columns on Aug. 27, with reference to the application of this system for purposes of public lighting at Margate, with special reference to its utility in exposed positions. The results appear altogether to be satisfactory, omitting the preliminary failures, which are always a necessary forerunner to success. The testimony of the Engineer to the Gas Company (Mr. H. H. Jones) as to the question of renewal of mantles is decidedly valuable; but his condemnation of the usual bye-pass arrangement, owing to its being experimented upon disadvantageously by the "holiday youth," must be taken more as a comment on the general frivolity of Margate as a health and pleasure resort, than as any generally serious objection to the system. There is no doubt that the great fault of the incandescent light is the want of durability of the "mantles." This has been much remedied by modern improvements. But a considerably increased stability can be attained by avoiding the constant shock arising rom careless lighting; and this is best obviated by the employment of a "pilot light."

That the incandescent system of gas lighting is making rapid progress, is well shown by the numerous patents dealing with this system of illumination. One of the most recent installations is that of the Paris, Lyons, and Mediterranean Railway Company, in which some 4500 lights will be required. From the results published by Mr. H. E. Jones, the Chief Engineer to the Commercial Gas Company, of experiments made by the Company's Chemist, Mr. H. Leicester Greville, it is evidently necessary, in using the incandescent light to the best effect, that the consumption should be restricted within certain limits. This can, of course, be accomplished by the use of suitable governors. The greatest tribute to any invention which receives a prominent place in modern progress, is to have its existence threatened by rivals. It appears that this is already the case with the older form of the incandescent light; advertisements having appeared in the JOURNAL for some time past that the Sunlight Incandescent Company, Limited, are now in a position to supply mantles to their customers, having previously been restrained from doing so owing to the threats of the rival Company. There is at present no published evidence to show whether the "Sunlight" mantles will be cheaper than the well-known "Welsbach." There is also no evidence to the best of our knowledge as to the durability of the modern innovation.

This much is at least certain—that where a system of lighting such as the "Welsbach" has attained a very marked degree of success, such as to induce competition, and when such competition has been to some degree a legal success, the eventual result will probably be a notable reduction in price, which will tend to popularize this special form of lighting, and therefore enable gas companies to more successfully compete with the rapid advance which is being made in electric lighting. It cannot be too widely known, in face of the many electric light installations that are taking place, that the incandescent system of illumination will give from 50 to 60 candle power with an expenditure of gas of certainly not more than 4 cubic feet per hour, which (placing the price of gas at 3s. per 1000 cubic feet—on an average, a rather high estimate) gives the cost for an exceptionally high lighting value at about one-half of a farthing per hour. This, of course, does not include the cost of renewal of mantles; but there is every reason to believe, from the progress which has recently taken place, that the durability of the mantles will be considerably improved as time progresses.

There is no apparent reason why the mantles should not be made slightly thicker, which would increase their stability. The larger proportion of material to be rendered incandescent might possibly, with the same gas consumption that is now prevalent, result in a development of a somewhat less amount of light, in proportion to the gas consumed. But, on the other hand, it is an open question whether the same amount of light as previously obtained might not be secured by a small extra expenditure of gas; and this would be more than balanced by the extra durability of the mantles.

There is one point with regard to the present system of incandescent lighting which, although not widely disputed, was adversely mentioned by Mr. Barton in some remarks made at the recent meeting of the Eastern Counties Gas Managers' Association. The question was as to the diffusibility of the light. Upon this point, there is very little doubt that this system of lighting has the advantage of great diffusive power. The writer has seen on more than one occasion a single burner placed at the meeting of four cross-roads, affording an illumination so powerful in itself, and extending over such an area, that it might have been well mistaken for a good form of the electric light. In fact, when one considers that the question of the diffusiveness of a light depends upon the volume of the illuminating flame, there is perhaps more light-emitting surface from an incandescent mantle than from the ordinary flat-flame burner used habitually for street-lighting, with the additional advantage in favour of the incandescent system that the illumination is equal in all directions.

Some considerable space has been devoted to the subject of incandescent lighting; but considering the importance of the question—not only in the present, but in the future—this may be justly regarded as permissible.

Turning from this special subject to another one equally important, there is the question of the correct method of ascertaining the illuminating power of gas sent out by any gas company working under a Special Act of Parliament. This would not possibly affect the illuminating value of gas, if some form of incandescent light were used as the standard; but, under present regulations, the method employed in testing is of the utmost importance. Under the old regulations, it was considered to be amply sufficient—even in the case of a large London gas company—that tests of the illuminating power of the gas should be taken from a public main, at not less than one thousand yards from the works. In addition to this, it was considered quite sufficient protection to the public interests that the period during which tests should be taken should be limited to the hours at which the maximum amount of gas was sent out. Although a Special Act of Parliament may require that gas should be of a statutory illuminating power of 14 or 16 candles, as the case might be, it is obvious that the company supplying such gas reasonably fulfils its obligations by sending out gas of the statutory lighting power during the period at which it is most used for purposes of illumination. It has been reserved for fussy county council men, and equally fussy members of corporate bodies who do not happen to possess the privilege of supplying gas to the public—which, vested in a private company, they term a "monopoly," but which, if owned by themselves, would be claimed as a public benefit—to alter the methods of testing. It may be in the public interest that corporate bodies, who have the power of controlling the methods of gas-testing, may consider it necessary to construe a Special Act of Parliament that, when the obligation is to supply 14 or 16 candle gas, such quality of gas must be supplied continuously at all hours of the day or night, and at all points of the district supplied. Fortunately up to the present time this policy has not been generally recognized.

At many local works throughout the country, notice has to be given to the manager, as to the time at which an official examiner wishes to test the gas; and such testing is conducted on the works. This is perhaps hardly fair to the public; but, on the other hand, the system in vogue in London can hardly be made a matter of serious complaint by any fair-minded person, who is not infected by the bias of the county council photometrical policeman. Not content with having an officially certified station in which no expense has been spared to secure efficiency, and in which all the apparatus is duly inspected and reported in correct working order by the official body known as the Gas Referees, there is a desire to resort to more stringent measures. There has recently been an increasing agitation by over-officious zealots, to endeavour to gain powers for testing the gas in any bye-street, or at the end of any dead main, that they may think suitable to select for their own purpose. Their zeal for the public, and their anxiety to expose what they imagine to be the nefarious practices of the gas companies, has been strikingly shown by the endeavours of the Chemist to the London County Council to obtain legal sanction to use the peripatetic photometer to test the illuminating power of the gas supplied to the public, at any point of the district, good or bad, which the representative official should choose to select.

That the advocacy of this system is pernicious, is shown in your able leader in the JOURNAL for Sept. 10, in reference to the proceedings of the Liverpool Corporation Committee. You graphically and correctly described this method as "snap-shot" testing of the gas. You also state, equally truly, that if this system is to be considered reliable, the regulation testing-station is altogether superfluous. The distinction between the "snap-shot" and the ordinary system of testing would seem to an average unbiassed mind to be that as applied to photography "snap-shot" means accuracy, but as applied to photometry it means inaccuracy.

There is one point of the general question which the advocates of "snap-shot" testing seem to ignore; and that is that, under the sliding-scale, the greater the amount of economy at which a company can manufacture their gas, the cheaper they can supply their material to the public. As a matter of fact, when a reduction in the price of gas takes place, the public profit to a much larger extent than the shareholders. It is well known that the raising of the illuminating power of gas from that which is derived from ordinary coal to that which is required to meet London parliamentary requirements, involves very considerable expense to the gas companies; and this naturally militates against their being able to make reductions in price to the public. There is an increasing demand for the use of gas for heating purposes, and for motive power; and these special applications are not affected by even material variation in illuminating power. If the gas companies are to be handicapped by having to supply gas of the statutory illuminating power at any hour of the day, tested at any portion of the district, they would have to materially increase the expense of their manufacture. This would mean a less possibility of their being able to reduce the price of gas to the public; and thus the over-zeal of the county councillor with regard to the pure question of

light—ignoring the advance which has been made in the development of the illuminating power of gas in modern burners—actually tends to keep up the price of gas, and thus injures the consumer, especially with regard to the large proportion of gas which is now used for purposes of heating, cooking, and motive power.

ON THE FLOW OF GAS IN PIPES.

By Arthur H. Crump.

I venture to suggest, for the use of gas-fitters, a new formula by which to determine the number of lights that may be supplied by a pipe of given diameter and length. I am aware that, in doing so, I am calling into question the correctness of Dr. Pole's formula; nevertheless, the results accruing from my revised formula agree with the recognized practice of the gas engineers of all the great Railway Companies, whose estimate of the carrying power of a pipe is strengthened by the concurrence of opinion of the best gas lighting engineers of the day.

All previously accepted formulæ fix the value of the diameter of the pipe as varying according to the power $D^{2\cdot50}$. Now this appears to be too high, since it gives a 4-inch pipe 32 times the value of a 1-inch pipe, which I have not found to be attainable in practice. The value of D is certainly more than D^2, since the square gives the sectional area only, without allowing for the enhanced value of the larger pipes which is due to the smaller amount of skin-friction in proportion to the area. But many will agree with me that this reduction of friction is not sufficient to raise the proportion of a 4-inch pipe as compared with a 1-inch pipe from 16 : 1 to 32 : 1. I, therefore, propose to ascribe to D the value $D^{2\cdot25}$, which may be also expressed at $\sqrt[4]{D^9}$; or, for the sake of simplicity in working, $D^2 \times \sqrt[4]{D}$.

There is, however, the question of the constant which requires careful consideration; and since Professor Vivian B. Lewes and others have laid down the rule that London gas must be burned at a pressure not exceeding 7-10ths in order to obtain its full illuminating value in an ordinary flat-flame burner, it becomes necessary to provide pipes of such a size as will carry the requisite volume of gas under that low pressure.

Twenty years of practical experience have taught me that, under such conditions, a 1-inch pipe will not convey more than 200 cubic feet per hour, even when the pipe does not exceed 50 feet in length, without a serious loss of pressure, and consequent unevenness in the size of the lights attached to it.

Having accepted this as a starting-point, and having also agreed that the value of the diameter varies as $D^{2\cdot25}$, the following formula is offered to gas-fitters through your columns, in the hope that (even if severely criticized) it may tend to discussion and consequent enlightenment on a point which is at present insufficiently understood :—

Formula for the Quantity of Gas that may be Supplied through Pipes used for the Supply of Gas-Burners in Domestic or Manufacturing Premises.

Let Q = Quantity of gas in cubic feet per hour.
,, D = Diameter of the pipe in inches.
,, L = Length of the pipe in yards.
,, G = Specific gravity of the gas.
,, P = Pressure in inches.

$$\text{Then } Q = 1000\, D^2 \sqrt{\frac{P \times \sqrt{D}}{G \times 2L}}$$

39, *Victoria Street, Westminster.*

PHOSPHORETTED HYDROGEN IN ACETYLENE PREPARED FROM CALCIUM CARBIDE.

By C. E. Brown, A.I.C.

In an article on "Acetylene" which appeared some time ago in the columns of the JOURNAL, it was stated that acetylene gas prepared from carbide of calcium was not found to possess the well-known odour produced when the flame of an atmospheric burner "strikes back," but that the odour of the gas resembled that of hydrogen phosphide; and the inference was drawn—implied if not expressed—that chemists had all along been attributing a wrong odour to acetylene gas. The accompanying communication, which I have translated from an article by Herr August Pusch in the *Berichte*, explains the facts, and shows most clearly that lime or other substances from which calcium carbide is to be made, should first be tested, so as to ensure the absence of phosphide of calcium in the manufactured article. If acetylene is to be of any service to the gas lighting industry, it is certainly most essential to ensure its freedom from such an objectionable impurity as hydrogen phosphide.

The calcium carbide at my disposal for the preparation of acetylene contained phosphide of calcium; and it may be safely observed that this impurity must necessarily be present if the raw material used for preparing the carbide contains calcium phosphate, since the latter compound will be reduced to phosphide during the process of manufacture of the calcium carbide. When such an impure sample is treated with water, the acetylene evolved will evidently be mixed with a certain proportion of phosphoretted hydrogen. The presence of this gas is speedily indicated by the odour of the impure acetylene; but its existence in the gaseous mixture may be still more satisfactorily established by passing the gases which are produced when the carbide is treated with water, into an aqueous solution of silver nitrate, by means of a leading tube attached to the generating vessel. It will then be found that, when the gas comes into contact with the silver solution, a dense black precipitate forms, which consists of phosphide of silver. If the tube leading the gas be inserted deeply into the silver nitrate solution, separation of a white compound of silver acetylene and nitrate ($AgC_2H \cdot AgNO_3$) speedily takes place; but this precipitate becomes gradually darker and darker in colour, and finally black, in consequence of the formation of silver phosphide. The silver nitrate in the leading tube may, if the current of gas is not too rapid, cause the precipitation of the silver phosphide; but the precipitate in the receiver will eventually be darkened in colour by co-precipitated silver phosphide. After dissolving this silver precipitate, the filtrate, which has now a strong acid reaction, is examined for phosphoric acid by means of ammonium molybdate and concentrated nitric acid, with the result that a copious precipitation of the familiar yellow precipitate of ammonium phosphomolybdate occurs.

For the quantitative estimation of the phosphoretted hydrogen, the gas evolved from 10 grammes of calcic carbide was passed through three flasks charged with bromine water. Experiment showed that, when employing a moderate speed of current, the phosphoretted hydrogen contained in the gas was completely oxidized in the first two flasks to phosphoric acid, and that this acid could not be detected in the third flask. After rinsing the bromine water from the flasks, and expelling the bromine from the liquid, the phosphoric acid remaining in solution was precipitated with ammonium molybdate, and the phospho-molybdate converted into magnesium pyro-phosphate. Ten grammes calcium carbide gave 0·0065 gramme of magnesium pyro-phosphate, representing 0·00193 gramme of P_2H_4.

From these data it follows that, since the vapour density of phosphoretted hydrogen is 33—*i.e.*, 1 cubic centimetre of the gas at normal temperature and pressure weighs 0·0029568 gramme—1 kilogramme of the calcium carbide used by me would, if uniform throughout its bulk, evolve about 65 cubic centimetres of phosphoretted hydrogen.

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Annual General Meeting of this Association was held last Thursday, at the Grand Hotel, Birmingham, under the chairmanship of the VICE-PRESIDENT (Mr. W. R. Cooper, of Banbury). There was a fair muster of members; but several well-known faces at these meetings were absent.

The VICE-PRESIDENT explained that he was called upon to preside, owing to the unavoidable absence of the President (Mr. George Winstanley, of Coventry), who was away from home with the Chairman of the Corporation Gas Committee.

The HON. SECRETARY (Mr. C. Meiklejohn, of Rugby) read the minutes of the meeting held at Coventry in May last; and they were confirmed.

ADMISSION OF THE PRESS TO THE MEETINGS.

The next matter for consideration was a recommendation of the Committee—"That the proceedings of the Association be open to the technical press." The question gave rise to a long discussion, which ended in the adoption of the following resolution: "That the proceedings of the Association be open to the representatives of the *Journal of Gas Lighting* and *Gas World*."

Mr. W. T. TEW (Warwick) then read a paper, entitled

AN INCIDENT IN PURIFICATION.

The consideration of matters of apparently little consequence, sometimes leads to discoveries which eventually prove valuable; but while the experience I am now about to relate is undoubtedly a very small matter, it is much to be feared that it is not calculated to do more than excite passing interest—indeed, should it do this, the object of the author will be attained. It is extremely difficult to find anything fresh to discuss at our meetings. Naphthalene, stopped ascension-pipes, leakage accounts, and many other too-familiar topics have been talked about and written about, until we are inclined to think the last word has surely been said about them. I am, however, not aware that anything has been brought forward respecting the deposits in tar-tanks; and as my experience has been somewhat extraordinary, I venture to lay the same before you.

For some long time we had been much troubled by accumulation of sludge at the bottom of the underground tank which received the tar and ammoniacal liquor produced at our works. Our room for the storage of these products being very limited, the space occupied by the deposit materially reduced the already restricted capacity of the tank; and when pumping tar, the suction-pipe was continually being choked with it. At length things became so bad that the tank had to be cleaned; and after opening in several places the arch which covered the top,

and well ventilating the vault, we proceeded to throw out the obstructing material. Several tons of what appeared to be thick tar were removed and allowed to drain for some days, when, to my surprise, it solidified to a large extent, and the surface assumed a grey colour as the tar and liquor drained away. Upon further testing the material, I found it to consist of carbonate of lime.

The next question which arose was, how did it get there? In order to give a clear idea of the answer to this, it is necessary that you should be acquainted with our method of purification. We use for that purpose lime only; and, as you are aware, the emptying of foul lime in the ordinary manner creates a great nuisance through the liberation of so much sulphuretted hydrogen. As our works are not far from the residences of many who would take a great objection to this nuisance, we, by means of a steam-jet, draw a quantity of air through the lime before emptying. Immediately a box shows a foul test, it is turned off, the lid raised a few inches, and the blower set to work. It then draws air through the foul lime; and the oxygen in the air, combining with the sulphide of calcium, changes it into the sulphate, which, being practically inodorous, can be removed without any nuisance. The gases drawn away by the blower are then passed through a cast-iron box containing oxide of iron, and so go into the atmosphere without offence. The chemical action involved on admitting the air to the foul lime causes a great amount of heat, which is the means of evaporating the moisture contained in the lime. This, being condensed by the sides and lid of the purifiers, drains through the lime; and on passing through that portion which had not altogether been oxidized, it caught up the sulphide of calcium, and held it in solution, finally falling to the bottom of the purifier. On being pumped out, it was found to be of a deep yellow colour.

It had been our practice to empty this solution into the tank which contained the tar, and, of course, a quantity of ammoniacal liquor on the surface. This turned out to be the cause of the deposition in the tank; and the chemical action was found on experiment to be as follows: The ammoniacal liquor, of course, contains a good proportion of carbonate of ammonia in solution; and on the solution of sulphide of calcium coming in contact therewith, the carbonic acid in the ammonia, having a stronger affinity for the lime, leaves the ammonia and forms carbonate of lime, while the sulphur in turn leaves the lime and forms sulphide of ammonium. The carbonate of lime, being nearly insoluble in water, is instantly precipitated to the bottom of the tank, and in the course of time would ultimately fill it.

Having thus solved the mystery to my satisfaction, it became necessary to adopt some means of preventing a recurrence of it. This I did by having the solution of sulphide of calcium from the purifiers pumped into a separate tank, and a sufficient quantity of ammoniacal liquor added, until, by testing a sample in a test-tube, no further precipitation took place. The liquor was then run into the tar-well; and the solid carbonate of lime remaining at the bottom was removed at convenience, when a sufficient quantity had collected to make it worth while.

I fear the conditions under which the purification at my works is carried on are exceptional; and therefore few of my fellow managers are likely to be in the same predicament. If, however, any are troubled with a deposit in the tar-tank, it may be worth their while to see if it consists of carbonate of lime.

There was a short discussion on the paper, a report of which will be published next week.

Mr. John Young (Etruria) followed with a paper, giving

TWO YEARS' EXPERIENCE OF PREPAYMENT METERS.

Since the last meeting of this Association, the inventor of the first coin-freed prepayment meter has passed away; and although the mechanism which he invented is not the one which has been adopted by the gas profession, we must acknowledge our indebtedness to Mr. Brownhill, not only for his keenness in grasping the wants of the small consumer, but also for the mechanical ability and patient work which enabled him to devise a method by means of which the small consumer could obtain his gas supply, and pay for it as he had it, without inconvenience either to himself or the gas supplier. When, in 1888, Mr. Brownhill exhibited and explained his meter to this Association, few of us probably had realized that such a meter was urgently wanted; and few, indeed, would have cared to prophesy that within so short a period such a large number of coin-freed meters would be in use in this country. However, when once a meter was found which seemed fully to meet the requirements of the case, the number required in some of our larger cities was extraordinary; and I should have been glad if we could have had some notes on the experiences of those using large numbers of these meters, rather than the history of the comparatively small number of which I am able to speak. Our Secretary, however, insisted that the experience we have had in Hanley would be interesting, and perhaps useful, to the members; and if this should prove to be the case, I shall feel gratified.

Early in 1893, my Directors desired me to report to them on the advisability of introducing prepayment meters into our district. My report stated that where a district contained a class of people likely to take advantage of the system, it would undoubtedly be to the benefit of a gas company to supply prepayment meters, the meters themselves being a step in the right direction; but that a trial alone would show whether the district supplied by us would prove to be a suitable one for their introduction. It was decided to make this trial; and the first prepayment meter was fixed on March 13, 1893.

It was also decided that everything should be done to give the new system a fair trial, and, if possible, popularize this means of obtaining a gas supply. A meter with the prepayment mechanism exposed to view was fixed in the centre of the office window. A 5-feet governor burner was attached thereto, and kept lighted; and a placard called attention to the fact that a light equal to that exhibited could be kept burning for 5 hours for one penny. The following handbill was also printed, and freely circulated in the district: "Why burn oil, when you can have gas and pay for it, in a penny-in-the-slot meter, as you get it? Meters fixed free of cost. Call at the Gas Offices, and see one at work." Orders came in rather slowly at first; but by the end of June, 1893, we had 195 of the meters fixed. At first, I fancy, they were looked upon with some suspicion. But this was soon dispelled; and as the dark weather came on, orders arrived so rapidly that we had some difficulty in obtaining meters quickly enough to meet our requirements.

On June 30, 1894, we had 940 of these meters at work; and on June 30, 1895, these had increased to 1184. The questions naturally arise, "How many of these are really new consumers; and how many have exchanged the ordinary meter for the prepayment meter?" During the first twelve months, these questions caused a little anxiety; for undoubtedly at first some consumers had their ordinary meters changed for prepayment ones, and the number of the ordinary consumers decreased in consequence. On June 30, 1893, the number of ordinary consumers was 5587, and on June 30, 1894, it was only 5509—being a decrease of 78; but, on the other hand, our total increase of consumers between these dates was 667, so that the proportion of those who had replaced ordinary by prepayment meters was not a serious one. It was carefully explained to each consumer who wished to change, that the new method was a slightly more expensive way of purchasing gas; but nevertheless, since we were only desirous to suit his convenience, we would change his meter if he wished it. By June 30, 1895, however, all fears regarding the displacement of ordinary meters were allayed, as the number of ordinary meters fixed was 5837—an increase of 328 during the year; while the prepayment meters had also advanced to 1184—an increase of 244.

The quantity of gas to be given for a penny was fixed at 25 cubic feet, or 3s. 4d. per 1000 cubic feet, which was 7d. more than the charge to the ordinary consumer, who paid meter-rent. On July 1, 1894, the price of gas to the ordinary consumer was reduced to 2s. 6d. per 1000 cubic feet; and in the case of the prepayment meter consumer, it was decided that, instead of altering the quantity given for the penny, it would be more convenient to return 3d. for each complete 1000 feet registered by the meter. On July 1, 1895, the price of gas to the ordinary consumer was reduced to 2s. 3d. per 1000 cubic feet; and it was decided to return 6d. to the prepayment consumer for each complete 1000 cubic feet registered by his meter.

This arrangement is found to work very well. At first there were a fair number of discrepancies—the amount of money found in the box did not always coincide with the quantity of gas registered by the meter; but we have very little trouble now. Every meter is tested before it is sent out to the district, to ascertain that exactly the right quantity is put on; and it is also run down, to see that it shuts off absolutely when the last pennyworth is exhausted. Both these points are important, as it was occasionally found that a meter would not shut off completely, but would allow sufficient gas to pass to give a small light after the last pennyworth was supposed to be exhausted; and sometimes it turned out that a meter which was quite correct when only two or three pennies were put in, would not give the right amount when twelve pennies were inserted. Since the price has been reduced, any small discrepancy is easily adjusted. The gas and money are made to agree; and the balance is handed to the consumer, who, as a rule, seems to be very pleased to receive it. In the majority of cases, the balance is at once replaced in the meter; a corresponding quantity of gas being turned on. Large discrepancies, in our opinion, are the result of theft; and, by a little pressure, we have usually been able to get them put right.

The meters are read, and the money collected, by the meter inspectors. Each meter inspector is accompanied by a labourer, to carry the bag containing the coppers. At first, when the meters were few, and were widely scattered, the inspector carried his own coppers, and could only read a few each day. But as the number increased, it was found that he could not carry the ever-increasing weight in and out, up and down the whole day; and it was decided to send a trustworthy labourer with each inspector. The district is divided into sub-districts; and a sub-district is never read by the same inspector twice consecutively. A good check is thus obtained on the accuracy of the readings. The same system is adopted in reading the ordinary meters, and is a useful check on the meter reading. In addition to reading the indices and collecting the coppers, the inspectors enter the amounts they have collected in the cash-book provided for that purpose; and pay the money into the bank, after packing it into 10s. packets. A separate rental-book is kept for prepayment meters, ruled to enable index of meter, gas consumed, money received, and date of collection to

be shown. The indices and money collected are posted in the rental-book daily during the time of collection, and checked with the cash-book. Each inspector reads about fifty prepayment meters per day, enters the money in the cash-book, packets and banks his cash, and sees the amounts posted in the rental-book. In the majority of cases, a collection once during the quarter is sufficient; but we have a few which require a bi-quarterly collection, and a few which are collected monthly.

The real point of interest is, of course, does it pay? In our case, it has done so. During the year ended June 30, 1894, the average number of prepayment meters at work for the whole year was 567, consisting of 424 2-light and 143 3-light; and the total quantity of gas registered was 4,714,000 cubic feet. This quantity of gas, at 2s. 9d. per 1000 cubic feet (the price during that year to ordinary consumers), would be £648 3s. 6d.; and the actual amount received was £772 17s. 1d. The difference between the two amounts is £124 13s. 7d., which represents the meter-rent, or, in other words, the interest on the amount of capital required to fix this number of meters. Owing to the peculiarities of the district, the cost of service laying is above the average. Our average cost for laying a service for a 2-light or 3-light meter is 14s. 4½d. This sum includes the main-cock and fixing of meter. A 2-light prepayment meter costs £1 19s., and a 3-light one £2 2s. 11d.; so that supposing each prepayment meter requires a new service, the capital invested is, respectively, for a 2-light meter £2 13s. 4½d., and for a 3-light one £2 17s. 3½d.

During the year ended June 30, 1894, the average number of prepayment meters in use was 424 2-light and 143 3-light, which, on the above basis, would represent a capital charge of £1541 3s. 8d.; and the sum available for interest on this investment was, as already shown, £124 13s. 7d., or 8 per cent. During the year ended June 30, 1895, the average number of prepayment meters in use for the preceding twelve months was 1062—viz., 859 2-light, and 203 3-light, which, on the same basis as before, represents a capital charge of £2873 19s. 3d. The quantity of gas registered was 9,365,100 cubic feet, which, at 2s. 6d. per 1000 cubic feet (the price charged to ordinary consumers during that year), would amount to £1170 12s. 9d. The actual amount received, however, was £1452 15s. 6d.; leaving a balance of £282 2s. 9d. for meter-rent, or an interest on investment of 9·8 per cent.

The capital charges given above assume that a new service has been laid for each prepayment meter. This, however, does not follow. Most of us no doubt have a large number of houses in our districts where services have been laid, and gas used and then discontinued; and the prepayment meter often induces the re-use of these services. In this respect, the following table may be interesting:—

Year Ended June 30.	Total Number of Ordinary Meters Fixed on June 30.	Total Number of Prepayment Meters Fixed on June 30.	Total Increase in Number of Meters During Year.	New Services Laid During Year.
1885	5185	..	..	..
1886	5189	..	4	206
1887	5198	..	9	210
1888	5226	..	28	173
1889	5295	..	69	182
1890	5384	..	89	194
1891	5506	..	122	191
1892	5638	..	132	206
1893	5587	195	144	236
1894	5509	940	667	401
1895	5837	1184	572	434

In seven years prior to the introduction of prepayment meters, although 1362 new services were laid—an average of 194 per annum—the increase of consumers was only 453, or an average of 64 per annum. But in three years since their introduction, the increase in the number of consumers has been 1383—an average of 461 per annum; while the services have increased 1071—an average of 357 per annum. It may, therefore, fairly be claimed that the use of prepayment meters is assisting us in developing capital which has already been expended, but has become unproductive.

The average consumption per prepayment meter was, in 1894, 8666 cubic feet; and in 1895, 8818 cubic feet, which is a little in excess of the amount used by the ordinary consumer.

The paper led to considerable discussion, which will be reported in next week's issue.

Mr. Meiklejohn said it was becoming that they should pass a hearty vote of thanks to the authors of the papers. The subject dealt with by Mr. Tew was not a very large one; but it was one that might appeal to any gas manager under similar circumstances, and so it was well worthy of being brought before the Association. Mr. Young's paper was of an extremely valuable character, as not only would it be of help to those who had the prepayment system in use, but it would be of great assistance to those who had not yet risen to this height in the supply of gas. They were much indebted to both gentlemen, especially to Mr. Tew, who had voluntarily offered his paper.

Mr. W. North (Stourbridge) seconded the motion.

The Vice-President, in supporting it, remarked that there was one thing in Mr. Young's paper that had been overlooked in the discussion. He said: "The gas and money are made to agree; and the balance is handed to the consumer, who, as a rule, seems very pleased to receive it. In the majority of cases, the balance is at once replaced in the meter; a corresponding quantity of gas being turned on." That was a very cautious proceeding. (Laughter.) They were very much obliged to Mr. Young for his valuable information. It was a "burning" question for gas managers; and there was no doubt the system was well worth trying.

Mr. Young briefly acknowledged the vote.

Election of Officers.

Mr. P. Simpson (Rugby) said it was his privilege to propose that Mr. Cooper be elected President for next year. Many of the members had known him since the formation of the Association; and they all knew of the deep interest he had taken in it He hoped Mr. Cooper would be able to fill the office to his own satisfaction, and then he (Mr. Simpson) was certain it would be to theirs. Such a worthy member deserved to be placed in the highest position it was in their power to put him in.

Mr. J. C. Belton (Willenhall) seconded the nomination, and cordially endorsed the remarks made by Mr. Simpson.

The proposition was carried unanimously.

The President-Elect said he appreciated very highly the honour the members had conferred upon him; and he sincerely hoped that he should be able to discharge the duties in the manner Mr. Simpson wished. It would be his earnest endeavour to see that the Association did not suffer at his hands. If he could not tell the members of things that were new, perhaps he would be able to remind them of some things that were old. He would promise that his best efforts should be put forth to merit the honour they had bestowed upon him, and to give them satisfaction during his term of office. Continuing, he said he had to submit the name of Mr. Alfred Colson, of Leicester, for the position of Vice-President during the ensuing year. The members all knew of the kindness, indulgence, and willingness of Mr. Colson at all times to do anything he could to make their meetings pleasant and instructive; and he did not think they could have found a more suitable man for the office.

The Hon. Secretary seconded the motion, which was unanimously passed.

Mr. North proposed that Mr. Simpson be re-appointed Treasurer.

Mr. Belton seconded, remarking that the members would all feel proud in having Mr. Simpson in that capacity so long as he was willing to hold office.

The President-Elect supported the proposition; and observed that it was a long time since he first met Mr. Simpson. It was in the early days of the British Association of Gas Managers; and he believed Mr. Simpson was present at the first meeting of that Association, which was held in Birmingham, under the presidency of Mr. T. Hawksley.

Mr. Simpson having acknowledged the confidence of the members,

The President-Elect said he had great pleasure in moving that Mr. Meiklejohn be re-elected Secretary of the Association. He (Mr. Cooper) had passed through the office of Secretary; and he knew somewhat of the duties appertaining thereto. It was a matter of great anxiety to the Secretary to know how to maintain the interest in the meetings; but he did not think they could find a year during the time Mr. Meiklejohn had held the office when he had failed in his work. He would couple with the motion the hearty thanks of the members for the indefatigable manner in which their Secretary performed his duties.

Mr. Young seconded the motion; and it was cordially agreed to.

The Secretary expressed his appreciation of the kind words which had fallen from Mr. Cooper, and the hearty manner in which the members had endorsed them. He should be happy to do all he could to further the work of the Association.

On the motion of Mr. V. Hughes (Tipton), seconded by Mr. W. W. Hulse (Longton), Messrs. W. Parlby and S. Meunier were elected members of the Committee.

Mr. W. Winstanley (Newcastle-under-Lyme) moved the appointment of Messrs. F. W. Cross and T. Glover as Auditors. This was seconded by Mr. F. H. Darwin (Fenton), and carried.

Thanks to the Retiring President.

Mr. North moved that the best thanks of the members be given to the retiring President (Mr. G. Winstanley), who had done all in his power to make his year of office a success. He (Mr. North) was unavoidably deprived of the pleasure of visiting the Coventry Gas-Works with the members in May; but he was sure they all fully appreciated the kind treatment they received from their President on that occasion. Mr. Winstanley had made his mark in the gas world. He had been a successful Engineer and Manager; and they had been very proud to have him as President.

Mr. Simpson, in seconding the proposition, said they all knew of Mr. Winstanley's retiring disposition, and that they had some little difficulty in getting him to understand that he was the proper man for the position. Now he (Mr. Simpson) thought Mr. Winstanley would be persuaded that he was occupying his right place when President. They had had few Presidents who had excelled Mr. Winstanley's efforts to keep the Association at the pitch at which they liked to see it; and therefore he deserved their best thanks.

The President-Elect, supporting the motion, spoke of the

readiness with which Mr. Winstanley always imparted to his professional brethren any knowledge or information of which he might be in possession. His year of office had been one of profit and pleasure.

The motion was unanimously adopted.

This concluded the business; but, before separating, the members took tea together.

RECENT DISCOVERIES RELATING TO GAS LIGHTING.

We have received from Dr. H. Bunte, of Carlsruhe, a copy of his paper on the above subject, which was read before the meeting of the German Association of Gas and Water Engineers at Cologne this year. The following is a *résumé* of it.

A series of important discoveries bearing directly or indirectly on gas lighting, marked the progress of scientific work during the last few months. We may single out for detailed consideration the discovery of a new element in the air, the industrial production of acetylene, the discovery of larger quantities of the rare earths, and the synthetical production of illuminating gas by means of benzol. These four subjects will be dealt with in turn in this review of the scientific advances of the year.

Argon.

The news of the discovery, by two English scientists, of a new gas in the air, was brought to the Continent about a year ago. Since air is essential to gas-flames, the news was especially interesting to those engaged in the lighting industries. The report was received with much scepticism, for of all bodies the air had been most thoroughly investigated by scientific men. Nevertheless, the extraordinary inertness of the new element—surpassing even that of nitrogen—was found accountable for its tardy discovery; and the name "argon" (from α-εργον) was appropriately given to it. In all former analyses, argon had escaped notice, by reason of the inert residue remaining after the usual absorptions and reactions had been carried out being uniformly classed as nitrogen. But if the nitrogen is absorbed from this residue by means of red hot magnesium or lithium, there remains a small quantity of residual gas, which defies absorption, and has a characteristic spectrum distinct from that of nitrogen. Such a residue is not found with chemically prepared nitrogen. The residual gas, which is argon, amounts to almost one per cent. of the air, and may further be distinguished, and eventually separated, from nitrogen by reason of its greater solubility in water. The suggestion that argon is a modification of nitrogen—as ozone is of oxygen—has not been substantiated; and it must therefore be regarded as a new element. What part the new gas plays in the phenomena of combustion and of luminous flames, we cannot say at present; but even if it has a solely negative influence, it must be of interest to us as an element of highly remarkable properties. Though forming only a small percentage of the atmosphere, the total quantity of argon on the globe is enormous; and only the difficulty of isolating it makes it a costly substance.

We may next inquire if this element occurs in terrestrial bodies other than the air. Oxygen forms a very important constituent of the crust of the earth. Nitrogen, on the other hand, is absent in the primitive rocks, and is found only in the later formations which owe their existence to organic life—such as coal, &c. It was found that some rare minerals belonging to the pitch-blende group, on treatment with acids or heating, gave off a gas which resembled nitrogen in inertness. On examining this gas anew, it was discovered to consist chiefly of nitrogen and argon; but it also contained other gases, which, on spectroscopic investigation, proved identical with elements observed in the sun's photosphere, and in Orion. In the mineral clevite especially, it is believed that an element peculiar to the sun's photosphere, known as "helium," has been discovered. These discoveries are still so recent, that it is impossible yet to say whether these elements may play an active *rôle* in the phenomena of combustion.

Thorium Oxide.

The so-called rare earths which play so important a part in the mantles of incandescent gas-lights, were ten years ago merely scientific curiosities. Though large quantities are now used, the prices of the extracted earths and their metallic bases are still extremely high, mainly on account of the difficulty of extraction. About the end of the last, and the beginning of this, century a great number of the rare earths were first discovered in certain Swedish and Norwegian minerals. Chief among them were the oxides of cerium, lanthanum, didymium, zirconium, yttrium, and thorium. Though the extraordinary power possessed by these earths of emitting light on heating was observed in the first instance by the discoverer, by means of the blowpipe flame, little interest was taken in them, until Auer von Welsbach utilized them for lighting purposes. They have now been found tolerably widely disseminated; and mineralogists and chemists, especially in America, have carefully examined minerals in which thoria and the allied earths are but minor ingredients. Great quantities of monazite, a phosphate of cerium and lanthanum, containing 2 to 4 per cent. of thorium, have been discovered in the United States, Brazil, the Ural, and Australia. Some idea of the quantities now dealt in, may be gathered from the fact that an Amsterdam firm undertake to deliver yearly 20,000 tons of Carolina monazite sand on rail at 9 cents per pound.

The consideration then arises whether the rare earths—particularly thorium oxide—occur in such quantities as to perpetually provide the thousands of mantles needed; and, secondly, whether the high price of the mantles is due to the rarity of the earths, or whether it may not soon be lowered. A calculation, based on the figure quoted above, may serve to elucidate these questions; but the figures have no absolute value, and are only illustrative. The monazite sand will contain on the average about 3 per cent. of its valuable constituent, thorium oxide; and at 9 cents. = 4·5d. per pound = 453 grams, one gram of the thorium oxide in the raw material will be bought at about 0·33 penny, or, as a mantle contains about half a gram of the oxide, the quantity required for each mantle would be worth about 0·165d. Now, if we take account of the difficulty of working up the mineral and purifying the thorium nitrate, and the professional skill requisite, we shall come to the conclusion that the very high price of the mantles is in no degree influenced by the costliness of the raw material; and we may further surmise that they cannot be produced very much more cheaply in future, without sacrificing quality or unduly cutting the manufacturers' profits. With regard to the permanence and sufficiency of the supply, let us take only the one offer of 20,000 tons of monazite sand from Carolina, containing about 3 per cent. of thoria. For the present, we will disregard the rich supplies in Australia, Brazil, the Ural, and Sweden, and therefore are not likely to overestimate the quantity of the earth available. In the 20,000 tons of monazites and, there are 600 tons of thorium oxide, or 600 million grams of the earth which is the basis of the mantles. As each mantle contains half a gram of thorium oxide, we are able, with the above quantity, to impregnate 1200 million mantles annually.

The natural control of price exercised by supply and demand and free competition, will soon bring about more healthy conditions; and incandescent gas lighting will attain its proper scope. Competition, also, will bring about improvements in both burners and mantles; and the light will be adapted to meet various ends. For instance, the present lights are of from 40 to 60 candle power for a consumption of about 3½ cubic feet per hour; but for small rooms, a poorer light—say, of 20 candles—would suffice, and with a smaller consumption would, with penny-in-the-slot meters, bring gas lighting within the reach of the poorest, and make them independent of petroleum. Moreover, spirit and benzine or naphtha incandescent lamps have recently been made. The spirit is drawn up by a wick, and vaporized by means of a small auxiliary spirit-flame. The vapour passes to a Bunsen burner, and is consumed to heat the mantle, in the same way as gas in the incandescent gaslight. The spirit-lamp gives a light of nearly 20 candles, for an hourly consumption of 1000 grains of alcohol (96 per cent.), which, with spirit which has not paid duty, would cost about 0·3d. The incandescent spirit-lamp will, when improved, undoubtedly enter into competition with petroleum lamps for use in country places. Similar to the spirit-lamp is the incandescent naphtha lamp, in which petroleum spirit is gasified by an auxiliary flame, and consumed in a Bunsen burner. This burner also has many remediable defects; but it undoubtedly has a future before it, though it will not seriously compete in districts supplied with gas.

Acetylene.

The news reached us at the end of last year that calcium carbide—which had earlier been prepared by Wöhler by a circuitous process—had, by means of the electric furnace, been produced in America in a simple and cheap way. A short time earlier, Moissan had drawn attention to the fact that both calcium carbide and aluminium carbide were decomposed by water with the liberation of a gas, which with the former proved to be acetylene, and with the latter methane. The importance of the American announcement lay in the extraordinary cheapness of production which was claimed for the new process. Water power had been utilized for producing the current; and at the cost announced, it appeared as though a formidable rival of illuminating gas was about to make its advent. The first claims have not been quite established; but the electrochemical works at Neuhausen and Bitterfeld have taken up the manufacture, and calcium carbide is now to be bought at a price of 2¾d. per lb. The calcium carbide, being easily decomposed by the moisture of the air, is packed in sealed metal boxes holding from 10 to 20 lbs. Aluminium carbide, on the other hand, is not easily decomposed, and comes on to the market in powder without any special packing.

Regarding calcium carbide as a raw material for producing illuminating gas commercially, we must consider the purity of the carbide we have available. The commercial article is not pure, but contains only from 50 to 65 per cent. pure calcium carbide. The yield of acetylene accordingly falls considerably below the theoretical, which has generally been taken as the basis in calculations of the cost of producing the gas. The amount of pure carbide in the commercial product may be ascertained by decomposing a weighed amount with water, collecting the gas evolved, and measuring it. A correction must be made for the solubility of the gas in the confining water; or the volume of gas evolved may be found by measuring the amount of air it displaces from a large flask in which it is produced.

Acetylene gas burns like rich oil gas, with a very luminous flame. A characteristic of the acetylene flame is the almost total absence of the blue core; consequently the illuminating part of the flame extends down almost to the burner. The source of this peculiarity lies in the fact that this gas without combustion is decomposed by heat, with development of heat, and the separated carbon is raised by the heat so liberated to incandescence. This remarkable property of acetylene gas forms the basis of Lewes's theory of the formation of luminous flames, which at first sight appears very clever; but as it is not sufficiently established in some respects, it must not be used as the starting point for further inferences. The relative ease with which acetylene is condensed to the liquid state renders it available for distribution in this form, in cast-iron cylinders, which serve to supply the gas for lighting purposes, merely with the interposition of a reducing valve. It therefore appears that, notwithstanding its relatively high price, acetylene will take its place among illuminating agents. For raising the illuminating power of gas, acetylene possesses the advantage over most carburetting agents of not being deposited from the gas even under the influence of considerable cold. Its price, however, is prohibitive for ordinary enrichment in this climate, where the vapour of liquid hydrocarbons can be used without appreciable separation taking place.

Carburetting with Benzol.

Three years ago, at the Kiel meeting, attention was first drawn to benzol as the natural carburetting material for coal gas. At the prices then obtaining, it was also the cheapest. Apart from this, the synthetic production of illuminating gas by the aid of benzol would give a wider choice of coal, and permit the use of large carbonizing chambers. The experiences already gained at Munich, Dessau, Hanau, and elsewhere prove that, with apparatus for the purpose, carburetting with benzol may be safely introduced at any works where it is desired to raise the illuminating power of coal gas. The Munich works have for some time used benzol for carburetting; and Dr. Schilling writes thus with reference to it:—

At one works all the carburetting has been done with benzol during the winter to the exclusion of the use of cannel, while at the other works benzol has been used whenever the supply sufficed. In the coming year our requirements in enriching material will be wholly met by benzol, which will be solely used at both works. Considerable economy in working has been effected by its use. Before the close of the working year, it is not possible to give exact figures; but the financial gain has taken place in three directions—(1) By a cheaper supply of carburetting material than the cannel hitherto used, (2) by increasing the yield of gas from the coal, and (3) by the addition of 1 per cent. of air to the gas before the oxide purifiers. It is to be remarked that many works which have to get cannel from a distance, would at present prices find benzol the cheaper enriching material; and a considerable rise in price of the latter need scarcely be feared, as the German benzol market would be held in check by the competition of the coal market, as well as of the English benzol market. The coal was carbonized at much higher temperatures, and a higher make of gas obtained; while the small decrease in the illuminating power of the gas was readily made up by benzol. The decreased illuminating power caused by adding 1 per cent. of air to assist purification, was also made up by benzol and more economical purification thus effected; while the air went to increase the volume of the gas. The latest form of the apparatus has only been in use a short time; but it has worked without the least difficulty. It is heated by exhaust steam only, to about 25° C.; and then 21½ lbs. of benzol are vaporized per hour, and suffice for the hourly make of about 31,800 cubic feet of gas, of which only 9500 cubic feet pass through the apparatus to subsequently mix with the rest of the gas. With the apparatus quite cold, about 7¼ lbs. of benzol are vaporized hourly; while by the use of live steam, the quantity can be enormously increased. For example, at 48° C., 108 lbs. of benzol are carried away by the gas every hour—a quantity sufficient to carburet an hourly make of about 170,000 cubic feet—and even then the full capacity of the apparatus is not utilized. At the end of this year, more detailed reports and figures will be published.

To these remarks of Dr. Schilling, may be added, in conclusion, a word on the different ways in which the carburetting may be effected. Measured quantities of benzol may be sprayed directly into the stream of gas, or benzol vapour may be supplied to the whole or a part of the stream, the part subsequently mingling with the main stream. One point, however, must always be regarded—viz., the quality of the benzol. The 50 per cent. benzol of commerce contains too much of the high boiling constituents, toluol and its homologues; and leaves considerable residue, and is easily thrown down from the gas. On the other hand, the 90 per cent. benzol is generally as cheap as the 50 per cent., and is by far the most suitable material. The quality may be readily checked by a simple distillation test.

The Future of Acetylene.—According to the *Electrical Engineer* of New York, the pioneers of electrically produced acetylene are abandoning the problem of utilizing it for the enrichment of gas, and are actively engaged in demonstrating that it may be employed to more advantage in cheapening the manufacture of innumerable substances which are used in the arts, but which, up to the present, have been matters of pure chemistry. In this direction, it is said, "the latest production of the electrical furnace has a utility out of all proportion greater than that which can be derived from its peculiar light giving powers."

THE RECOVERY OF BYE-PRODUCTS FROM PRODUCER GAS.

The above subject has lately been dealt with by Mr. A. Gillespie in a contribution which appears in the *Journal* of the West of Scotland Iron and Steel Institute.

Having succeeded, to a certain extent, in the recovery of tar and ammonia from blast-furnace gases, the author was invited by a glass manufacturing company to direct his attention to the possibility of obtaining like results from producer gas, and especially in connection with a series of producers developing gas for a glass bottle furnace. He was aware that attempts had been made to recover such bye-products after the gas had done its work in the melting-furnace, and that these attempts had necessarily failed, for the products were never recovered, and were no doubt destroyed in the intense heat of the furnace. The question was simply whether or not the gas could be intercepted between the producer and the furnace, robbed of its tar and ammonia, and passed on to the furnace in a condition fit for its main purpose. The author gives the following account of his investigations: Two difficulties presented themselves. The temperature of the gas, as it leaves the producer, is from 800° to 1000° Fahr. This must be reduced to considerably less than 100° Fahr. for the recovery of ammonia. The reduction of temperature is, therefore, in the first place, a loss of useful heat to the furnace; and, secondly, the removal of the bye-products may so reduce the potential energy as to render the gas unfit for its main purpose. The first difficulty is not a serious one, for the initial loss of temperature can be easily restored if the melting furnace is constructed on the regenerative principle. As to the second, and more serious, difficulty—the probable loss of heat energy, by the removal of the bye-products—I felt somewhat uncertain; my knowledge of the subject being mechanical rather than chemical. But if those who are familiar with the chemistry of producer gas can assure us that loss of heat by the removal of the tar compounds is not so great as to imperil the efficiency of the gas for fulfilling its chief function, I shall be satisfied if I can, with the assistance of this explanation, indicate how the bye-products can best be secured. Assuming for argument that it is only a question of proper appliances, in the right place, that is to put us in possession of profitable results, we shall endeavour to ascertain first what it is we may obtain, and then how we are going to get it. The recovery of what are termed bye-products from coal in connection with the manufacture of illuminating gas, has been in common practice for many years, though some of us can remember when they were called "nuisances," and the gas makers were at their wits' end to get rid of them. Their recovery from coal used in blast-furnaces is not a matter of ancient history.

In the carbonization of the coal for illuminating purposes, there is obtained in close retorts about 10,000 cubic feet of gas per ton; and for the removal of impurities, or bye-products, the gas engineer has only to concern himself with this volume. But in the case of blast-furnaces or gas-producers, this volume is enormously increased by the air sent into the furnaces by the blowing-engines or following the steam-jets in the producer; so that, instead of 10,000 cubic feet per ton of coal, the engineer has to deal with 130,000 cubic feet, or thirteen times the volume of the other. Like the search for the precious metals in quartz rock, the 10,000 cubic feet of profitable gas can only be recovered by dealing with the entire volume, which must be cooled and washed—with this difference, that, though the quartz may be of no further use, the mixture of gas and air, cleared of its tar and ammonia, is just in the right state for giving out its energy as a heating agent.

Having no immediate concern with the heating properties, let us inquire what else we may get out of this enormous body of gas. There are two main ingredients—tar and ammonia—varying in quantity according to the nature of the coal. The quantities recovered from the blast-furnace gases range from about 150 to 170 lbs. of tar per ton of coal, and about 5 to 6 lbs. of ammonia. The tar yields by distillation about 80 to 90 lbs. of pitch, and 6½ to 7½ gallons of pitch oil; while the ammoniacal liquor, when treated in the sulphate stills and saturators, is converted into from 20 to 24 lbs. of sulphate per ton of coal, containing about 24 per cent. of pure ammonia. Thus, from a blast-furnace consuming 75 tons of coal per 24 hours, there will be obtained about 2¾ tons of pitch, 825 gallons of oil, and 14¾ cwt. of sulphate of ammonia, which, at present market rates, would yield £15. If we may take it for granted that, in the 130,000 feet of gas coming from a producer, there are the same ingredients in similar proportions to those we know are not blast-furnace gas—and I am not aware that there is any essential difference in the conditions—then it becomes a question how they are to be recovered with the least possible injury to the heating energy of the gas.

This brings us to the second branch of the inquiry: How is it to be done? The dimensions of the apparatus must be regulated by the number and capacity of the producers. Upon a system of six producers, each consuming 10 tons of coal per 24 hours, the result, in proportion to what has already been stated, would be about 2¼ tons of pitch, 420 gallons of oil, and 11¼ cwt. of sulphate of ammonia, the total value of which, at current market prices, would be about £12 per 24 hours. The main element of expense in this result is for sulphuric acid, of

which 18 cwt. are required to precipitate each ton of sulphate. Thus, 20s. worth of sulphuric acid will produce 1 ton of sulphate of ammonia. The temperature of the gas will fall rapidly after leaving the producer, till it may be expected to enter the first vessel—the "tar-washer," which also acts as a collecting-main —at about 400° Fahr. The gas from each producer enters the washer by a separate branch, so that each of the six may be isolated for any purpose. The gas is there broken up into thin streams by a serpentine diaphragm, with serrated edges. The lower, or serrated edge of the diaphragm is sealed in water, which is immediately displaced by the tar as it is deposited from the gas. It has been found preferable to feed the washer with tar obtained farther on in the process, with the double object of so far drying the tar by exposure with the hot gas, and at the same time entangling the tarry particles from the gas as it passes through the serrations. The gas is forced in this vessel from most of the heavier tars, which fall on the sloping bottom, and are drawn off by cocks as required, and the seal kept up in the diaphragm by the addition of fresh tar.

In the tar-washer, the gas is reduced in temperature to about 200° Fahr., and passes by separate branches to a collecting-main of a diameter sufficient to contain the volume from the six producers, and corresponding in length to the condenser-boxes. The condensers consist of a series of four boxes, made up in sections for convenience in construction; each box having 27 pairs of 8-inch diameter steel pipes, about 30 feet high. The boxes are fitted with serpentine diaphragms, serrated on the lower edge, and sealed in liquor. The gas passes from the collecting-main by 27 vertical branch pipes (8-inch), which are connected at the top to the first row of condenser-pipes. The gas descending to the box must pass through the sealed diaphragm before escaping up the other row of vertical pipes. In this process, the gas is washed in the cool liquid—depositing a portion of its tar and ammoniacal liquor; and the temperature is reduced by contact with the liquor and exposure to the atmosphere in the small vertical pipes.

The serpentine form of the diaphragm is adopted to increase the washing area, and enable the gas to be more thoroughly in contact with the liquor than if the mere edge of the 8-inch pipe were so sealed. The gas passes up the second row of pipes to the top—crossing then to the top of the first row of pipes in the second condenser-box, where the process is repeated; then in a similar manner, passing through the third and fourth boxes, when it may be assumed that the temperature has been brought down to about 70° Fahr., or lower, and that, in the repeated washings, the last traces of ammonia have been practically removed.

To facilitate this, and in order to strengthen the liquor as far as possible, the boxes are arranged on a graduated level; the fourth box being the highest, and the first the lowest. Clean cold water is fed continuously into the fourth box, and the level of the seal maintained at the required depth by an adjustable run-off valve and syphon, whence it is carried to the box on the next level, which is thus fed continuously with the weak liquor obtained from the fourth. The stronger liquor formed in the third is fed into the second in a similar way, and from it to the first, whence the resulting liquor is drawn off continuously for further treatment. By this process the gas becomes gradually cooler; depositing light tar, which, along with the ammonia, is carried off in the liquor, while the repeated contact with the gas in the sealed diaphragms, absorbing more ammonia in each washing, so strengthens the liquor that it is made fit for profitable treatment in the sulphate-still.

The tar and ammoniacal liquor come away together. The latter enters at the top, and spreads over the first tray to a given depth, sealing the serrated edges of the cups. The liquor overflows at the required level, and descends to the next tray; sealing the cups on it in the same way, and so down to the bottom tray. Steam at about 20 lbs. pressure per square inch is introduced under the bottom tray, and immediately ascends through the nozzles, where it encounters the liquor; and it can only escape by passing a special vessel, where the products are automatically separated according to their different specific gravities, and pass into separate store-tanks.

As the gas will not pass through water except under pressure corresponding to the depth of the seal, and as it is also desirable that no pressure of gas should be allowed to accumulate in the producer, it is necessary to provide mechanical means for drawing forward the gas by forming a vacuum. This is most conveniently effected by an exhauster, of any of the well-known forms. One or more exhausters are placed near, and connected to, the last row of condenser-pipes, and so regulated that there will be no back pressure in the producers, and just enough forward pressure on the outlet side of the exhausters to suffice for sending on the clean gas to the melting-furnace. The regulation is effected by self-acting valves, which are adjusted to the required uniform pressure. The gas, now freed from the bye-products, is passed on to the melting-furnace.

Our immediate interest is in what has been recovered. The tar contains a large percentage of water, which must be distilled off before the tar can be put on the market. For this purpose, the tar is forced, by a pump or an air-compressor, into an elevated tank, whence the tar gravitates into an ordinary still, which, in the case of blast-furnace tar, is fired by the clean gas. The feed being shut off, the charge is evaporated, and cooled through a worm condenser. When the water has been driven off, the oil, which follows, is passed into receivers, and sold for such purposes as the Lucigen and Wells lights, oil fuel for steamers, &c. When the oil has been run off, the residue (pitch) is passed into a cylindrical cooler, until the temperature is so far reduced that it is safe to run the pitch into open ponds, where in a few hours it hardens, and is then broken up and sold. For certain purposes, the pitch may be required of a softer consistency. This may be obtained by running it off with the oil in it. It is then sold as boiled tar. The other product—the ammoniacal liquor—after being separated from the tar, is also sent into an elevated charging-tank, whence it is fed into a sulphate-still. These are of various forms; but they all treat the liquor in the same manner.

The bye-products having been recovered and disposed of, there need be little anxiety as to the demand for them. Apart from the efficiency of oil as a lighting agent for large areas, if a sufficient supply could be guaranteed, there would doubtless be a constant demand for oil as a fuel. Pitch has maintained a ready sale; while the use of sulphate of ammonia as a fertilizer gains daily in favour.

DIMENSIONS OF GAS-WORKS PLANT.

The above subject has lately been dealt with by Herr Reissner, the Manager of the Berlin Municipal Gas-Works, in the *Journal für Gasbeleuchtung;* and an abstract translation of the article has been given in the Society of Chemical Industry's *Journal.* After many years' experience, the author has laid down the following rules, which have been adopted in the several works under his charge. For estimating the dimensions of the apparatus, the maximum gas production of a day in the month of December is taken, and the so-called normal dimensions calculated therefrom.

Retorts.—With Silesian coal, 15 per cent. of retorts in reserve; but if in any one of the four or five works some benches are unavailable for one whole winter, in consequence of rebuilding, &c., then a reserve of 10 per cent. may, as an exception, be regarded as sufficient.

Condensers.—A minimum of 3·65 square feet of cooling surface per 1000 cubic feet of gas per 24 hours; or, for completely furnished works, 4·56 square feet of cooling surface per 1000 cubic feet of gas. The Berlin form of condenser is a cylinder 4·26 feet diameter and 28·86 feet high, with eleven internal cooling-tubes, 4 inches in diameter; the outer surface, together with the connecting-pipe to the adjoining cylinder, having very nearly the same air-cooling surface as the water-cooling surface of the inner pipes.

Scrubbers.—These are filled with boards. A minimum of 5 cubic feet capacity per 1000 cubic feet of gas per 24 hours; and for completely furnished works, 6 cubic feet.

Exhausters.—One exhauster in reserve at each works.

Purifiers.—Five trays with oxide of iron in each, 1·17 square feet of area per 1000 cubic feet of gas per 24 hours. Where there are four purifiers, all are included in the calculation. In cases of necessity, for a single winter, and with tolerably fresh purifying material, 1 square foot area per 1000 cubic feet of gas will suffice.

Catch Purifier.—With four to six trays of sawdust, there should be one catch purifier to each four oxide purifiers, and of the same dimensions.

Station Meters.—A maximum of 80 revolutions of the drum per hour. On account of unavoidable irregularities in production, the maximum quantity of gas passing per hour should be estimated at 10 per cent. above the average hourly production.

Gasholders.—A minimum of 80 per cent. of the greatest daily production. In Berlin it is at times difficult, with this minimum, to keep all retorts regularly charged. This is especially the case on Mondays.

Works Connections.—Outlet main from five beds of nine retorts in each, 12·5 inches in diameter. From the point where the mains from the retorts unite into large mains, the latter in Berlin are 37·4, 39, and 39·37 inches in diameter, giving an estimated velocity of 9·84 feet to the gas. With smaller mains, the velocity should be between 6·56 and 9·84 feet.

Cross Connections between two mains on the same works may have a velocity for the gas not exceeding 12 feet. For the outlet main from the works to the town, it is estimated that in Berlin there is a loss of pressure in the large mains of 1 inch in 2734 to 3280 yards length of main, with the greatest hourly output on a maximum December day; and this maximum output is about one-eighth of that of 24 hours.

Incandescent Gas Lighting for Roads.—The question of the better lighting of the roads has lately been occupying the attention of the Fulham Vestry; and at the meeting of this body last week, a proposal was submitted for adopting incandescent gas-lights for a section of the Fulham Road, by way of experiment. The members were evenly divided on the question; but the casting vote of the Chairman (Rev. J. S. Sinclair) was in favour of trying the new system.

REGISTER OF PATENTS.

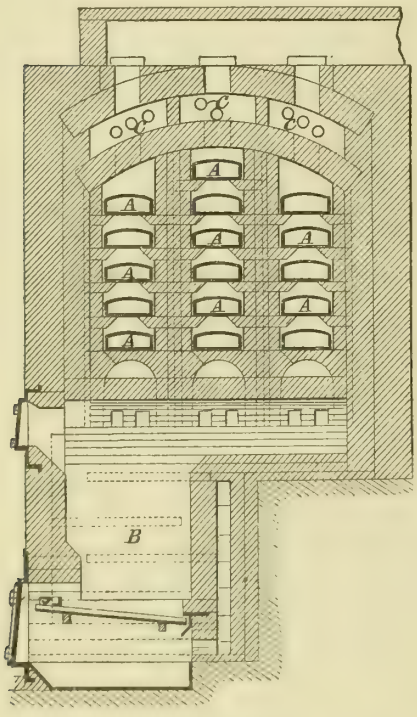
Gas-Generating Plant.—Thwaite, B. H., of Finsbury Pavement, E.C. No. 18,445; Sept. 29, 1894.

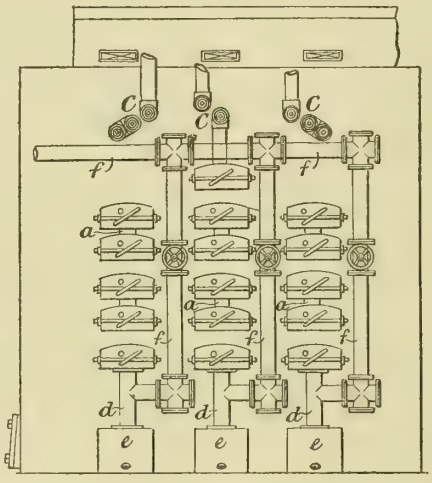
In the course of his specification relating to this invention, the patentee says: In the gas-generator vessel, the expedient adopted to ensure the approach of the air to the fuel, is to provide at the base of an inverted cone casting (which partly acts as a support to the refractory lining, and also as a means of reducing the area of ingress to the fuel) cast-iron lugs, that act as a means of suspension and support for a series of bars—of steel or wrought iron—which project below the level of the inverted cone almost into the water of the hydraulic bath. Such bars may, however, project below the inverted cone, not quite to the level of the water, forming a barred grill or girdle that retains the fuel in a vertical column down to, or near to, the level of the water-bath. This barred girdle enables the air to approach and enter all round the base of the column of fuel; and there is thus no danger that the accumulation of fuel becomes such as to obstruct the passage of air through the fuel.

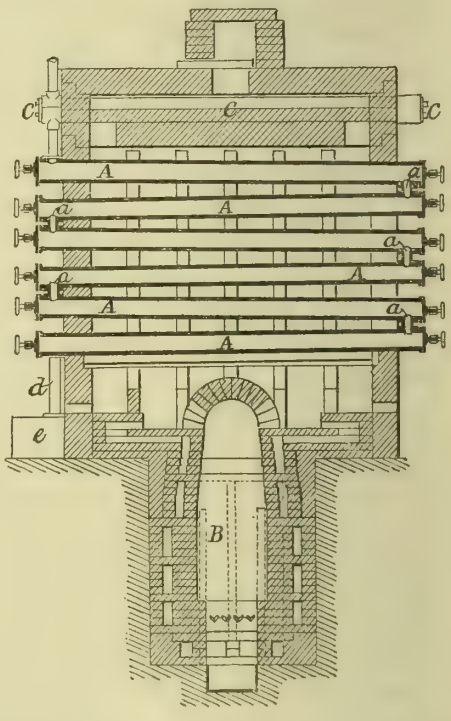
The refractory lining of the generating vessel is of special construction. Instead of using ordinary fire bricks or blocks, fire-clay pipes are employed, smaller in diameter than the iron casing; and the space between them is filled in with a grouting of fire-clay, which, by the heat of the fuel, is baked into a hard condition. When a fan air-blast is used, the patentee prefers to lead the air (after it has passed through a special tubular air-heating apparatus, heated by the passage through it of the products of combustion from the gas-engine) into a jacket surrounding the generator, by which the air is further heated before it enters into the base of the fuel in the generator. By these means, part of the sensible heat of the gas-engine exhaust gases and the heat radiated from the side of the generator vessel is recovered.

For the purpose of catching the unvolatilized hydrocarbons that pass over with the gases from single-vessel generators, the patentee arranges to provide for these vessels a secondary chamber (which may serve for more than one gas-generator) in its general form an almost exact imitation of the gas-generator vessel—that is to say, like the latter or gas-generator vessel, it is provided with a hydraulic bath, and may or may not have a grate to support coal or coke on the solid bottom of the hydraulic bath. The inclination of the conical base of the coal or coke column forms a space by which the air can enter into the base or lower part of the fuel. This secondary chamber is connected to the generator by means of refractory lining conduits connecting the upper parts of the two vessels. It is filled with coke of uniform size; and to enable this material to be replenished in the event of its partial combustion lowering the level of the coke, an ordinary gas-generator feed-hopper is provided, by which more coke can be added at any time.

In order to be able to remove the coke as rapidly as it becomes clogged or otherwise charged with pitch, tar, or other hydrocarbons, the base of the column of coke or clinker submerged beneath the water in the hydraulic bath is being continually reduced by the removal of part of the coke; new additions being made through the feed-hopper. The coke can be raked away from the base submerged in the water of the hydraulic bath without in the least arresting the progress of gas making; nor does it involve the loss of any gas, because the side-plates of both the second chamber vessel and the gas-generator dip some distance into the water of the hydraulic bath. The outlet-gas connection from the coke chamber is at the base; so that the gas produced in the generator is compelled to permeate through the column of coke, and becomes thoroughly scrubbed. Moreover the dust and tar produced when new fuel is charged into the generator, does not obtain access to the gas mains or flues, but is caught in the coke chamber, which also serves the purpose of a down-comer leading the gas to the flues.







Treating Liquid Hydrocarbons and Producing Gas and Bye-Products therefrom.—Dvorkovitz, P., of Bishopsgate Street, London. No. 23,671; Dec. 5, 1894.

The object of this invention (in the words of the patentee) is "to provide efficient means whereby gas and valuable bye-products can be obtained from petroleum or other liquid hydrocarbons, in such a manner that practically all, or a very large percentage of, the liquid hydrocarbon constituents are obtained in the form partly of gas and in considerable part in the form of valuable liquid bye-products, which are in part of a novel character, consisting of unsaturated hydrocarbons of hitherto unknown series, and containing also benzol, toluol, xylol, and the like."

The liquid hydrocarbon is subjected to a gradual rise of temperature, which should not—the specification remarks—exceed about 1000° C., or a dull red heat. This can be effected by arranging a series of retorts so that liquid will flow down through them. For this purpose, they are preferably placed in reversely inclined positions, so that they slope alternately in opposite directions, the lower end of each of the retorts above communicating with the upper end of the retort beneath it. The series of retorts are heated by a furnace in such a way that the lowermost retort is subjected to a temperature of (or about) 1000° C., and the uppermost retort is heated to a temperature of (say) not much more than 300° C. at the most; but it may be lower—for example, as low as 150° Fahr., or lower. The retorts in the series are subjected to a temperature gradually increasing from the highest to the lowest. The oil is fed directly into the uppermost retort; but it is preferably fed first into pipes set in the brickwork or placed above the highest retort, so as to be heated by the otherwise waste heat. The oil thus admitted to the retorts is gradually vaporized, and partly gasified; and the oil and vapours and gas pass down through the upper retort and into the next, and therethrough into the next again, and so on, through the series. The products leave the last retort after being vaporized and gasified; the pipe by which they leave the last retort being the only outlet from the retorts. It dips into a catch-box for the heavier condensed matter; a rising pipe opening from the box, and conveying the vapours and gas to a pipe which conducts them to the condensers and apparatus "where the aforesaid new and other bye-products are mostly deposited—the permanent gas passing to a gasometer, or place of utilization or storage. The bye-products so obtained are very suitable for enriching ordinary coal gas; but they can be used for the manufacture of aniline dyes, or for other purposes to which they are, or may be, applicable. By conducting the process as described, no (or but little) carbon will be formed in the retorts."

The retorts A are shown in the above engraving as being in inversely inclined positions (although, as the object of the arrangement is to allow the oil to flow down through them, they may even be horizontal). The lower end of each retort communicates with the retort next beneath it by pipes *a*. The retorts are contained in a chamber connected with a furnace B, arranged with flues or passages so that the heated products from the furnace pass upwards, and in their passage act upon the exteriors of the retorts in such manner that the lower retorts are heated to a greater degree than the upper ones; the temperature gradually increasing from the upper retort to the lower one, in the manner already stated. The retorts are preferably of considerable width, and small depth in transverse section. C are pipes contained in the upper part of the chamber above the retorts, or in a flue leading from the chamber; the pipes conducting the liquid hydrocarbon to be treated into the inlet therefor in the uppermost retort. The oil and the vapours and gas generated then pass down through the series of retorts in each tier; and the final products pass out through the pipe *d*, dipping into the catch-box *e*, which receives any heavy condensed matter. A rising-pipe *f* conveys the products "to the condensers and apparatus where the unsaturated hydrocarbons, which are a principal product of the process, are mostly deposited—the permanent gas passing to a gasometer, or place of utilization or storage."

The claims for the invention are: (1) The treatment of petroleum or other liquid hydrocarbon, by passing it through an arrangement of zig-zag retorts connected together so as to form a continuous passage, with its exterior exposed to heat throughout its length, and having an inlet for the liquid hydrocarbon at top, and an outlet only at bottom for the products of the treatment; the retorts being maintained at, or

about, the temperature already stated, so that there are produced gas and liquid bye-products of the character stated, with but a small amount of pitch, but with no coke. (2) The production of liquid unsaturated hydrocarbons of the character stated, and suitable for use in the manufacture of aniline dyes, for enriching lighting and heating gas, or for other purposes; the unsaturated hydrocarbons being produced by treating petroleum or other liquid hydrocarbon in retorts arranged as described, and subjected to (or about) the temperatures stated. (3) The arrangement and combination of parts constituting the apparatus described and shown for treating liquid hydrocarbons as, and for the purposes, described, and whether one tier or several tiers of such retorts be used in the arrangement.

Manufacture of Gas-Purifying Material.—Campbell, J. E., of Bradford, Lancs. No. 4799; March 6, 1895.

This invention relates to the preparation of an iron oxide compound primarily intended for use in the purification of coal gas in place of a preparation either of precipitated iron hydroxide, obtained from waste hydrochloric or other acid from galvanizers, wire workers, or copper smelters, or hydrated oxide of iron obtained from the waste iron or borings from aniline or other manufactures, with which a certain amount of sawdust is mixed to take up the excessive moisture, and render the mixture porous, so that the gas can readily pass through it. The patentee maintains that the use of sawdust for this purpose is objectionable "in that it, in itself, contains a large percentage of moisture; and when the material is subsequently treated to recover the sulphur, either by being calcined or used in the manufacture of cyanides or colours, a great quantity of black dust or other useless matter is left as a residuum." He also finds that a mixture of these two forms of iron oxides produces material better fitted for the purpose; and that the combination therewith of "kieselguhr" (infusorial earth), instead of sawdust, gives much better results.

Describing the mode of carrying out his invention, the patentee says: I separate or precipitate iron hydroxide from the waste hydrochloric acid (commonly known as "galvanizers' pickle") by treating it with lime, magnesia, or other suitable material—preferably lime—blowing air into the mixture while boiling, and then filtering, pressing, or the like. I also obtain hydrated iron oxide—that is, the waste iron or borings from aniline or other manufactures. I may also obtain precipitated iron oxide, by treating the waste aniline iron with hydrochloric acid and lime, magnesia, &c. I mix the precipitated and the hydrated iron oxides in about equal proportions, and add thereto a quantity of kieselguhr, infusorial earth, sawdust, or other material, sufficient to take up the excessive moisture, and to render the mixture porous, so that the gas will readily pass through it in the purifier. I, however, prefer the kieselguhr, as giving the best results. A compound or mixture thus prepared, without the addition of sawdust, when being treated to recover the sulphur in the formation of sulphuric acid, does not burn away to any appreciable extent; and the residuum can be repeatedly used for purifying purposes, and also forms a good base from which to prepare red colour. Such pigment is prepared by calcining the spent oxide to drive off the sulphur, and then reducing it to the required consistency by trituration. The material may also be further improved for purifying purposes by treating it with atmospheric air or oxygen in an open or closed vessel, either free or under pressure, with or without agitation, as required, before use or after being placed in the purifier to revivify it. The residual liquor from the galvanizers' pickle, after the iron oxide is separated in the process of filtration, is boiled or evaporated down to suitable strength, and to it is added sulphuric acid. It is then calcined in a retort-furnace or other suitable appliance, condensing the fumes in an ordinary tower, or otherwise, thus recovering the hydrochloric acid in a pure and strong state. The residuum (calcium sulphate) is treated with cyanide blue, or any other colour or material, or disinfecting agent, and formed into bricks for domestic or other use—as rubbing, cleaning, or colouring stones, &c.

Incandescent Gas-Lamps.—Hempel, F. W. H., and Gumpel, M., of Berlin. No. 15,268; Aug. 14, 1895.

The peculiarity of this incandescent gas-lamp is that the head of the burner is covered with wire gauze, or with perforated sheet metal, and provided with a vertical wire gauze or perforated sheet-metal ring, so that the gases issue horizontally and vertically to the ring, and consequently, by the action of a top plate, the flame obtains an enlarged cylindrical form. The carrier for the incandescent mantle is fastened to the plate in the ordinary manner. The object of so arranging that the outflowing vertical gas will meet the horizontally issuing gas, is "to obtain an enlarged and dense flame, and consequently intensified incandescence." If it is desired to use the burner on a spirit, water-gas, or other lamp, a spherical gas collector is interposed between the burner and the gas-pipe. A tube and bell (which cover the top of the tube) give the entering gas an upward and then a downward direction before it enters the collector, whence it travels through the upper nozzle, drawing air through slots in its passage to the burner.

Preventing Naphthalene Deposits in Mains and Services.—Bueb, J., of Dessau, Germany. No. 15,456; Aug. 16, 1895.

This invention relates to "a method for preventing gas-conduits from being stopped by freezing, without reducing the illuminating and heating value of the gas, consisting in producing spirit vapour in an evaporator outside the gas-conduit, in a quantity susceptible of regulation, and in adding the vapour to the gas through a tube introduced into the main-pipe."

In his specification (which is not illustrated), the patentee—after alluding to previous attempts made in the same direction as his researches—remarks that it has been proved by him that the opinion that the water contained in the gas is alone the cause of the freezing-up of the gas-conduits is wrong, as in a severe frost not only water but also benzol is crystallized on the cold walls of the pipes. As in the method of desiccating by freezing cylinders, as well as in the drying of the gas by means of spirits, benzol is also separated, unintentionally, besides water, these methods are no doubt appropriate for preventing the closing of the gas-pipes by freezing. But this is effected at the expense of the illuminating power of the gas. All the methods hitherto proposed in order to prevent the closing of gas-pipes by frost by separating from the gas, while in the gas-works, the condensable constituents, are either inefficacious, or, when they are efficacious, they are inapplicable owing to the decrease of the illuminating power of the gas.

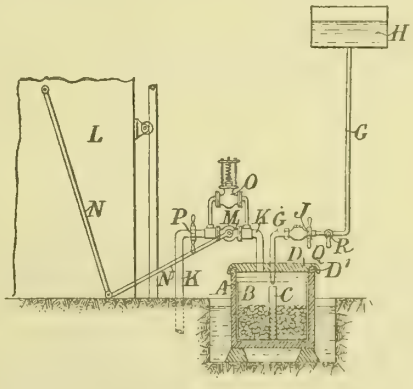
According to the present invention, the patentee proposes to attain the intended purpose, not by withdrawing from the gas any component part, but by adding a substance that shall have the effect of lowering the freezing point of the condensable constituents to such an extent that they precipitate only in a liquid condition. As a suitable means for this purpose, ordinary spirit has proved advantageous. It is added to the gas either at the place of production—preferably behind the gasholder, or at any other point of the pipe network; and in order to avoid any decrease of the illuminating or heating value of the gas, the spirit is added in the form of vapour. This, it is remarked, is necessary, because, although liquid spirit would be absorbed in part by the gas within the gas-conduit, yet, on the other hand, the liquid would absorb benzol from the gas. Moreover, by adding the spirit vapour produced outside the gas-conduit, the quantity of spirit vapour introduced can always be exactly regulated to correspond to the quantity of gas produced, and to the external temperature; while when liquid spirit is introduced into the gas-conduit, the gas passing through takes up a larger amount of spirit vapour, the lower is the quantity of gas delivered at the moment, and the higher is the external temperature.

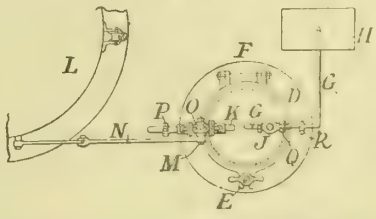
It is necessary to regulate the addition of the spirit vapour, as, on the one hand, there must always be so large a quantity of spirit in the gas that the intended effect is attained, and, on the other hand, only so much must be added as will remain in the gas in the form of vapour. An appropriate quantity is 5 grammes of spirit vapour per cubic metre of gas delivered; but in the case of particularly severe frosts, a little more may be used.

In practically carrying out the method, a small evaporator of ordinary construction, heated by a steam jacket or by small gas-burners, is used. Into this, the spirit enters from a reservoir arranged at a higher level, through a regulating-valve, in a fine jet, which is immediately evaporated. The hot spirit vapour is introduced through a small tube into the main, and absorbed by the gas. The desired effect of the added spirit vapour only takes place in that portion of the gas supply which is exposed to the action of the frost; the other—ordinarily much larger—portion of the gas being burnt without the spirit contained therein exercising any effect. This is claimed as a great advantage of the new method in comparison with the drying by means of spirit. In the latter method, the whole quantity of gas to be delivered is submitted already in the gas-works to the action of the alcohol, absorbing not only the water but benzol, and thereby reducing the illuminating power. This is entirely unnecessary, as it is always only a small portion of the gas that passes to such places of the conduit (in particular street-lamps) which are exposed to frost. When applied according to the present "invention," on the contrary, the spirit "enters into action only where the gas is acted upon by frost, and at the place where such action takes place, in separating from the gas together with the water and benzol, and thus preventing the latter from congealing, and consequently the conduits from being stopped by freezing."

Decomposing Carbide of Calcium.—Gabe, H., of Copenhagen. No. 15,991; Aug. 26, 1895.

This automatic apparatus for decomposing carbide of calcium consists of a reservoir A, inside of which another removable reservoir B is placed; the latter having an upright perforated tube C placed in the middle. The reservoir is closed by a cover D, which, on the underside, is supplied with a packing D^1, fitting the upper rim of the reservoir, against which the cover (being turnable around a hinge F) is pressed down by the hand-screw E. Two tubes G and K are screwed into the cover. Through the tube G water is led from the water-tank H. The reverse-valve J on the tube G shuts off the water whenever the pressure in the reservoir A exceeds the pressure in the water-tank. The tube K, which opens out into the gasholder L, is supplied with a stopcock M, in connection with the holder, so that it is shut and opened by the upward or downward movement of the holder.





When the stopcock is open, the gas developed by the carbide of calcium enters the holder; but when this latter, owing to the pressure of the gas, raises itself, the stopcock will gradually be closed, and

thus shut off the gas supply. The pressure in the reservoir A will then increase, and the valve J consequently shuts off the water; and the pressure having reached a certain maximum, the developed gas will, through the safety-valve O placed on the tube K, pass into the holder. When the amount of water, which at the shutting of the valve M still remained on the carbide of calcium, has been consumed, the development of gas will stop until gas from the holder is being consumed, and the holder moving downwards opens the cock. The pressure in the reservoir A being now reduced below that in the water-tank H, a new infusion of water takes place; and so on, until the carbide of calcium is completely decomposed—only slaked lime remaining in the reservoir. The cock R on the tube G is then closed; the screws P and Q and the hand-screw E loosened; the cover D opened; and the removable reservoir B taken out. After being cleaned and refilled with carbide of calcium, it is closed, and the development of gas again takes place.

The reservoir is shown placed in a water-container that serves to draw off the heat developed through the decomposition.

APPLICATIONS FOR LETTERS PATENT.

19,241.—GIFFARD, P., "Back-pressure valves." Oct. 14.

19,253.—LAKE, H. H., "Manufacture of sulpho-acids of the naphthalene series, and of colouring matters derived therefrom." A communication from the Farbwerk Mühlheim. Oct. 14.

19,267.—GANS, P. F., "Lighting apparatus for explosive gas mixtures, more especially for motors." Oct. 14.

19,270.—HETHERINGTON, A. E., RASCHEN, J., HURTER, F., and BROCK, J., "Manufacture of sulpho-cyanides." Oct. 14.

19,286.—JACKSON, J. C., "Preventing the bursting of service-pipes and hot-water boilers." Oct. 15.

19,301.—CHAPMAN, L., "Valves for controlling and arresting the flow of gases and liquids." Oct. 15.

19,303.—GREENHILL, J. H., "Gas-engines." Oct. 15.

19,307.—CHAMBERS, W., "Gas-engines." Oct. 15.

19,330.—GLADWIN, A. H., "Faceted globes, shades reflectors, &c., for lamps." Oct. 15.

19,353.—JAHNSSON, J., "Electric gas lighting apparatus" Oct. 15.

19,355.—MÜLLER, A., "Regenerative gas-furnaces." Oct. 15.

19,386.—HAMILTON, J. H., "Gas-engines." Oct. 16.

19,407.—PEEBLES, D. B., "Coin-prepayment mechanism for gas-meters." Oct. 16.

19,412.—CROCKER, S. H., "Compounds for treating mantles for incandescent light." Oct. 16.

19,425.—SUTHERLAND, J. G., "Prepayment gas-meters." Oct. 16.

19,429.—MARCUS, S., "Bunsen burners." Oct. 16.

19,445.—ELWORTHY, H. S., and HENDERSON, P. D., "Manufacture of carbonic acid gas by the utilization of waste product produced in making calcium carbide." Oct. 16.

19,528.—MARTINI, A., "Burning, suspending, and securing incandescent bodies." Oct. 17.

19,590.—PARDOE, G. T., "Controlling the flow of liquids in pipes or other conduits." Oct. 18.

19,615.—BOURGOIN, A., "Making gas of carburetted air and carbonic oxide." Oct. 18.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Oil-Gas Experiments at Bradford.

SIR,—Mr. Wood has a fine talent for denying what appears to be evidence furnished by his reports and letters. The account I gave of his sending a letter asking for *information on behalf of his Committee* without the sanction of that Committee, and against the express warning of the member of the Committee who was deputed to look after the business of the sending of a letter to another gentleman, he says is untrue. Before giving that account, I took the precaution of obtaining a categorical statement of the affair, and a copy of the minute relating to it; and the only answer that it is possible for me to send to Mr. Wood's letter of the 16th inst., now that he plants the discussion on the basis of veracity, is to enclose you, with permission, my authority for what I have stated, and the Committee minute for your perusal. Full confirmation of my other statements, the truth of which he now denies, will be found in his various reports, letters, and carburetting-book.

Oct. 26, 1895. LEWIS T. WRIGHT.

[ENCLOSURES.]

Extract from a Letter.

Scarr Hall, Bradford, Oct. 19, 1895.

Dear Sir,—Your account in the JOURNAL OF GAS LIGHTING as to Mr. Wood sending you a letter *without orders* from the Gas Committee, asking for information for the Committee, *is quite correct in every point.* Wood was ordered to write to *Mr. Frank Wright*, who had sent me a letter on this "candle thousand and foot candles," which letter I read to the Committee. Wood then tried to explain the matter away, *but could not.* Your answer to *my* letter was simply: "A" incorrect; "B" correct. Committee then ordered Wood to state his case in a letter to *Mr. Frank Wright*, and hand that letter to me for perusal. He brought me the letter. His case was properly stated, but addressed to *you*, and not to Mr. Frank Wright. I pointed this out to him, and told him he must *not on any account* send that letter to you *without* the sanction of the Committee. He left me to re-write the letter, and returned with one addressed to *Mr. F. Wright.* I said that it is correct, and I forwarded that letter to its destination, but again cautioned him as to the other letter. He nevertheless sent you the letter.

Yours faithfully, (Signed) T. SPEIGHT.

Extract from Minutes of Committee Meeting, April 4, 1895.

It was agreed that Mr. Wood should put his case in his own way, and then it should be submitted to Mr. F. Wright.

The Proposed Lighting of Laira.—The inhabitants of Laira, a suburb of Plymouth, rejected last Friday the proposal, referred to in the JOURNAL for the 15th inst., to adopt the Lighting Act.

LEGAL INTELLIGENCE.

A Moot Point under the Metropolis Water Act, 1871.

At the Worship Street Police Court, on Monday last week, Mr. G. Kebbell, the Solicitor to the East London Water-Works Company, attended with Mr. Tiddeman, a Solicitor representing Mr. J. B. Kyffin, a draper of the Hackney Road, who in July last (see *ante*, p. 243) instituted proceedings against the Company for neglecting to supply to his premises sufficient water for domestic purposes. It may be remembered that, at the hearing of the case, Mr. Bushby dismissed the summons on the broad ground that the water-rate had to be paid in advance, and that this had not been done by the complainant. In addition to the point as to the rates, Mr. Bushby was in accord with a contention raised by Mr. Kebbell, that a notice to the Company requiring them to furnish a constant supply was required before proceedings could be taken for default, in accordance with the Metropolis Water Act, 1871, as amended by the Public Health Act, 1872 (35 & 36 Vict., cap. 79); and he agreed to state a case for a Superior Court. Mr. Kyffin lodged notice of appeal; and the parties now came before his Worship to settle the points for argument.

Stealing the Brentford Company's Gas.

At the Brentford Police Court, on Monday last week, Robert Mixozon Easton, a plumber, of Arragon Road, Twickenham, was summoned for stealing a quantity of gas, valued at about £9, the property of the Brentford Gas Company. Mr. Woodbridge, who prosecuted, said the meter at the defendant's house had been disconnected, and the pipes sealed up; but on an officer of the Company visiting the premises, it was found that gas was being used in all the rooms—a lengthened piece of pipe being carried to the house from the main. The appearance of this pipe denoted that it had been used for a considerable time. The Company had not supplied defendant with any gas; the pipes having been disconnected in 1892, during the tenancy of another person. The amount mentioned in the summons was what would be the average for a year's gas, though the consumption might, of course, have been going on for a longer or a shorter period. The Company were not desirous of punishing anybody; but at the same time they wished to have the case treated in such a way as to show the general public that they could not defraud gas companies with impunity. Mr. E. Bugby, one of the Company's inspectors, deposed to calling at the defendant's house, and finding the gas burning. He made an examination of the premises, and found the Company's main had been opened, and a supply of gas obtained by means of the pipe alluded to, which he was sure had not recently been put in position. He at once cut off the gas, and sealed up the pipe. The cost of a year's supply of gas for premises like those occupied by the defendant would be from £8 to £9. Mr. Lewis, for the defendant (who was only twenty years of age), said his client pleaded guilty, but wished to explain that, owing to his wife's illness, he had been much inconvenienced by not having gas. He, however, did not make the connection, which must have been done by some former occupier of the house. The Bench imposed a fine of £10 and costs; the Chairman remarking that in the last case of the kind, the person accused was sentenced to three months' imprisonment.

The Supply of Gas Companies' Accounts.

The Hertford County Bench had a special sitting on Saturday, the 19th inst., to hear two summonses taken out by Mr. A. Baker, a solicitor, against the Hertford Gas Company (1) for not forwarding to the Corporation of Hertford, on or before March 25 last, an annual statement of the Company's accounts made up to Dec. 31, 1894, in the form prescribed by the Gas-Works Clauses Act, 1871; and (2) for not keeping and selling to the plaintiff copies of their accounts for the years 1890-4. The Company's representative (Mr. C. E. Longmore) having raised a preliminary objection that they had been charged with five separate offences on one summons, Mr. G. Elliott, who appeared for Mr. Baker, said he would confine himself to the year 1893. He then proceeded to explain that the Company were incorporated by an Act passed in 1864; the Gas-Works Clauses Act, 1847, being incorporated with it. The General Act subsequently passed—the Gas-Works Clauses Act, 1871, had to be construed with the provisions of the earlier Act, except where there was inconsistency. The 35th section of the Act of 1871, which provided for the furnishing of copies of accounts to local authorities or private parties, therefore applied to the Hertford Company, who were not exempted from making up their accounts to Dec. 31 instead of to June 30. The well-known Dudley case was quoted in support of this contention. Mr. Longmore submitted that the ordinary reading of section 3 of the Act of 1871 justified the conclusion that it did not apply to the Company in regard to the date for making up their accounts. He went on to explain the difficult circumstances in which they had been placed owing to the disappearance of their books (see *ante*, p. 594); and he urged this in justification of the failure to make out the accounts to the end of last year, and asked the Bench to dismiss the summonses. The Magistrates declined to do this; and they fined the Company 1s. and 9s. costs in each case. [A more extended report of the proceedings will appear next week.]

Sales of Shares.—Some fully paid £10 shares in the *Huntingdon and Godmanchester Gas Company* were recently sold by auction at £18 and £18 2s. 6d. each, with the dividends accruing thereon.——Last Wednesday, 22 £10 shares in the *Brompton, Chatham, &c., Water Company* were sold at an average price of £15 7s. each.——At a sale of miscellaneous shares and stocks at Bradford last Thursday, Messrs. W. G. Stansfield and Co. sold £500 of original 10 per cent. stock in the *Shipley Gaslight Company* at £237 per cent., and £1000 of new ordinary 7 per cent. stock in the same concern at £165 per cent. ——A small amount of original consolidated stock in the *Airedale Gas Company* was disposed of at the rate of £213 per cent.

MISCELLANEOUS NEWS.

THE GAS QUESTION IN LIVERPOOL.

Sir A. B. Forwood on the Proposed Competitive Gas Supply—Alderman Smith Criticizes Mr. Livesey's Letter.

The recent decision of the Liverpool City Council to take steps to start a competitive gas supply, as already recorded in our columns, continues to give rise to much comment in the city. Among the critics of the proposal stands prominently Sir A. B. Forwood, M.P., who, at a meeting of influential Conservatives a few days since, spoke his mind on the subject in no uncertain manner. He charged Alderman Smith and the seconder of his motion (Mr. Holt) with having grievously misled the Council and the public. He then went on to say: "The Gas Company have a parliamentary right to supply Liverpool with gas, and to charge not exceeding 4s. 6d. per 1000 cubic feet, always provided that they do not receive more than a certain rate of interest upon their capital. They have a margin to-day, as security for their interest, between the price they are charging consumers and their maximum price, of more than 50 per cent. Therefore, for all reasonable purposes, they have an almost absolute security for their income. I think I should explain that those who have provided four-fifths of the capital for carrying on the gas-works have bought their stock at public auction, and paid a large premium, representing about £400,000, upon the nominal capital, which premium has also been spent in new works; so that the Company's shareholders are not receiving the gigantic interest which many suppose. In fact, the gas consumers, upon the last issue of shares, are only paying about 4¼ per cent.—not high for a concern trading in an article liable to supersession—and on the bonds £3 12s. 6d. Mr. F. Smith, for the purpose, no doubt, of influencing votes at the coming election, proposed in the Council, and Mr. Holt seconded, a resolution, which was adopted by the Radical members present—'That the Council should promote a Bill in Parliament to obtain powers to establish and maintain a competitive gas supply by the Corporation.' Let me pause and ask you to contemplate for one moment what would have been the effect on the gas consumers of Liverpool if this crazy resolution were to be put into force. The gas shareholders, no matter what may be the demand for their gas, are entitled to charge up to a maximum of 4s. 6d. per 1000 cubic feet. The proposed Corporation competitive works would have taken some of their customers; and to make up for the loss thus sustained, the Company would have simply raised the price from that which they now charge to the 4s. 6d. per 1000 cubic feet, or such lesser price as would enable them to earn their dividend. This resolution was passed at the tail-end of a Radical Council meeting; and the three Radical leaders must have known, or, if they did not, they ought to have known, it was all the time in violation of the Acts under which corporations are bound. I will read you the extract from the Borough Funds Act, 1872, bearing on this matter: 'Provided that nothing in this Act contained shall authorize any governing body to promote any Bill in Parliament for the establishment of any gas or water works to compete with any existing gas or water company established under any Act of Parliament.' It is clear that the gentlemen promoting such a resolution under such circumstances must be judged by one of two alternatives—either they were ignorant of the law relating to the office they hold, or they deliberately lent their support to a put-up job, with a view to deceive the public to catch votes. On either hypothesis, I submit that no party led by them is fit to be entrusted with the government of the city. Mr. F. Smith has a perverse habit of making misleading statements on gas matters, notably when quoting the Chairman's remark of saving in cost of coal of £60,000. But he omitted to mention the falling-off in sales mentioned in the same speech. Also, when comparing the cost of coal in Liverpool for gas purposes with Sheffield, he selected the period of the coal strike, which did not affect the cost of coal at Sheffield during the period under comparison. Undoubtedly there is an opening for improvement in the relations of the Gas Company with the Corporation; and economy in the cost of production can be made by alterations in the standard of lighting, fixed in the earlier days of the science of gas making. I omitted to mention another incorrect statement of this gentleman, when he gave 2s. as the cost of water gas in Liverpool, as against 1s. in Belfast. I am told his comparison is absolutely worthless, and cannot be proved. I am not a gas expert, but I have seen returns which show the high residual results in quantity compared to other towns. No cause can be forwarded by misrepresentation, whether arising either from intention or ignorance; and until a change is made in our gas administrator, Mr. Smith, no satisfactory arrangement is possible between the Gas Company and the Corporation."

In a communication addressed to the *Liverpool Courier*, Alderman Smith has criticised Mr. Livesey's recent letter to that paper, which we gave in the JOURNAL last week (p. 833). He says: "Mr. Livesey states that a competitive gas supply is utterly out of the question, forgetful that we have nine members in a Parliament which is all powerful, and that they must be strongly animated by a desire to benefit Liverpool. Profound respect as I have for Mr. Livesey as an Engineer, are we to take his legal opinion that there are no methods that would enable our great Corporation to go to Parliament to alter the procedure, so that the consumers of Liverpool gas, if they could show a saving of £100,000 to £150,000 per annum, could obtain powers to do it?" Dealing with Mr. Livesey's suggestion that "friendly negotiations" should be opened with the Gas Company, Alderman Smith gives his version of previous interviews, which he says were not helpful; and he thinks Mr. Livesey cannot know the Directors and officials of the Company—the "autocrats of Duke Street"—as he politely designates them—as the Liverpool people do. Passing to the question of testing the gas, Alderman Smith assumes that Mr. Livesey cannot know that the Corporation's powers of testing are "statutorily fixed for one spot only;" as, if he did, he would "smile at such gas testing." He adds that, "if the Company have been and are now providing such excellent light, why should they hide it under a bushel of one test-room? They ought not to do good by stealth, and blush to find it fame." Coming, finally, to the subject of the coals used, Alderman Smith says: "Let Mr. Livesey extend his courtesy to letting the 70,000 odd gas consumers here know if it was defensible of the Liverpool Company to pay 20s. 7d. per ton for coal in 1894, so near to the coal-fields, when he bought at a little over 10s. per ton for his Company in London. He has the fullest knowledge of coal values and the cost of modern enrichment; and if he will give a moment's consideration to the needs of this great trading community, and, in addition to the trouble he has already taken, give a clear and definite reply to the query raised above, his action will be much appreciated." To the letter from which we have extracted the foregoing remarks, the Editor of the *Courier* appended the following note: "There is no need to say one word with reference to the style of this criticism; it carries its own condemnation. It may now please Alderman Smith to sneer at Mr. Livesey's professional competency; but he altogether overlooks the fact that Mr. Livesey was held in such high confidence by the Lighting Committee that they offered him a retainer as their engineering adviser. It is only when Mr. Livesey declines the offer—for good reasons—that Alderman Smith attempts to disparage his reputation. Perhaps the bad temper is attributable to the disagreeable fact that the Lighting Committee are repudiated and censured by their own chosen witness."

LEEDS CORPORATION GAS SUPPLY.

How the Debt on the Gas-Works was Liquidated.

It may be remembered that, when moving the resolution to reduce the price of gas, at the meeting of the Leeds City Council on the 9th inst. (*ante*, p. 787), Mr. Tweedale reminded the members that the deficit of £31,000, which had accumulated during the past few years upon the gas undertaking, had been wiped off, and that the last financial year ended with a balance in hand of £2500. The credit for bringing about this gratifying state of things is claimed by both parties on the Gas Committee; but it is probably really the outcome of the policy pursued by Mr. Alderman Gilston, who was Chairman of the Committee up to November last year. However this may be, there is the fact; and it may not be without interest to show how it was accomplished. This we are able to do by the following extract from the *Leeds Mercury* for last Thursday:—

For many years the control of the gas-works has been in the hands of the Liberals, who formed a majority of the Council and Committee; and though it cannot be said that mistakes were never made, yet, on the whole, considering the price of gas, and its illuminating power, the inhabitants have not had much reason to find fault with the management. It has always been the aim of the Committee simply to make the undertaking pay its way, and to supply gas to the citizens as cheaply as possible. Gas, with an illuminating power of 19 candles, was charged at 1s. 10d. per 1000 cubic feet. The high price obtained for residuals not only allowed the Committee to do this, but, out of the profits made year by year, a sum of a quarter of a million was handed over to the sinking fund; and between £50,000 and £60,000 taken from the funds of the Committee went to reduce the price of gas for the public lamps. Twelve years ago, for every 20s. expended on coal, an equal sum was obtained from the sale of residuals.

These were halcyon days for the Committee. But bad times were to come. Depression in trade had its effect on the residuals; and tar and ammoniacal liquor, which in the two years 1884 and 1885 yielded £103,755, fell suddenly and so low in price that the deficiency in yield for the next two years was, upon the basis of coal consumed, no less than £73,612, and at the end of the year 1887 the accounts showed a revenue deficiency of £36,000 for two years and a half. A few thousand pounds were transferred from the reserve, &c., fund; and the net deficiency at that date stood at £30,976. A small addition to the price of gas would easily have enabled the Committee to get out of their financial difficulty; but they were hopeful that the prices of residuals would recover, and did not suggest any increase to the price paid by the consumer.

In the following year there was a slight improvement. The Corporation now altered its financial year, making it close on the 25th of March; and the next accounts were for a period of fifteen months—viz., from Jan. 1, 1888, to March 25, 1889. These showed a net profit of £15,829 12s. 11d., of which £9407 18s. 9d. was set apart for the sinking fund; leaving a surplus of £6421 14s. 2d., which brought down the deficiency to £24,554 2s. 3d. In March, 1890, there was a surplus profit of £5423 2s. 8d., which reduced the adverse balance to £19,130 19s. 7d. If matters could have gone on thus smoothly, the deficiency would soon have disappeared; but the Committee were about to pass through a troublous period. The coal contracts entered into in June, 1890, were, on the average, 2s. 2¾d. per ton above those of the preceding year, which, on a consumption of 240,000 tons, represented a very large addition to the Committee's expenditure. In the same year occurred the dispute with the gas stokers, which resulted in a reduction in the hours of labour at the gas-works, and an increase in the number of men employed, necessitating an additional expenditure of about £14,000 per annum. For six months these increased charges were borne by the Committee; but it was now obvious that an advance in the price of gas was necessary, and the City Council sanctioned an increase from 1s. 10d. to 2s. 2d. per 1000 cubic feet. The close of the next financial year exhibited a deficiency of £14,728, which brought up the total adverse balance to £33,859. The Committee then began to make a small profit, which, in the year ending March 25, 1893, amounted to £3141, after setting aside £10,118 7s. for the sinking fund; and this reduced the indebtedness to £30,717 17s. 5d.

The prolonged dispute which occurred in the coal trade in the autumn of 1893 placed the Committee in further difficulties, and greatly enhanced prices had to be paid for coal. Supplies had to be obtained from Durham and other places at a sum which was equal to an increase of about 7s. 2d. per ton on the current prices entered into by the Committee in June of that year; and the quantity purchased made an addition of £26,369 to the figures under the contract rates. Increased labour during the same period cost the Committee £1931. On the other hand, there was an increase of £3679 in the sales of coke;

and deducting this amount, the loss sustained in consequence of the coal trade dispute was £24,621. Gas-meter rents were abolished from Jan. 1, 1894; thus conferring a benefit upon small consumers. But to meet the loss occasioned, and the greatly increased expenditure in which the Committee had been involved by the dispute in the coal trade, Alderman Gilston, at the meeting of the Council in December, 1893, moved an increase in the price of gas from 2s. 2d. to 2s. 4d. per 1000 cubic feet; and this was adopted. When the next coal contracts came to be considered, in June, 1894, the price of coal had fallen considerably; and the Committee were able to secure all they wanted —259,000 tons—at an average cost of 9s. 8½d. per ton, or a reduction of 2s. 3½d. on the average prices of 1893.

With the advance of 2d. per 1000 cubic feet, the low prices paid for coal, and the fact that less cannel was necessary in consequence of a reduction in the illuminating power of the gas from 19 to 18 candles, the liquidation of the debt became only a question of time. The way having thus been made easy and pleasant for them, the Tories, in November of last year, accepted the responsibility for the management of the gas-works, which their majority on the Committee entitled them to; and at the close of the financial year, in March, they were able to announce that the debt had been removed, and that there was a balance in hand. At the meeting of the Council, held on the 9th inst., the price of gas was again reduced to 2s. 2d. per 1000 cubic feet; and even with this reduction, should the rates for coal remain low, and the receipts from residuals be satisfactory, there is no reason why the gas-works, whether under the control of a Liberal or a Tory Committee, should not exhibit a handsome surplus at the close of the year. The revenue account for the year ending June 30 last shows that the sale of gas produced £257,861; from residual products £65,916 was obtained; and old metal, carbon, spent oxide, and rents of property realized £564 —making a total revenue of £324,341. On the other side, it is seen that the manufacture of gas cost £200,587; its distribution, £24,609; rents, rates, and taxes account for £6862; and management and general charges come to £4079. The sum of £3511 was put down as bad debts; £43,747 was the amount paid for interest; and there was a balance—being net profit—of £40,944. Of this sum, £11,078 was applied towards the reduction of debt; and there was a balance (being surplus profit) of £29,866.

GAS-WORKS EXTENSIONS AT ROCHDALE.

The Development of the Undertaking.

Last Thursday week, in response to an invitation by the Gas Committee, the members of the Rochdale Corporation visited the Gas-Works, for the purpose of inspecting the extensions recently made. The Chairman of the Gas Committee welcomed the visitors; and then called upon the Engineer (Mr. T. B. Ball) to explain the character and extent of the enlargements and improvements.

Mr. Ball said the new works consisted of a retort-house, which extended right across the yard from Dane Street to Manchester Road. The main approach to the new building was by means of a high-level covered cart-road leading from Manchester Road; and the arrangement of the retort-house was such that it was now unnecessary to touch the coal delivered there after it had been tipped from the carts using this high-level road. When the coal was so tipped, it fell through sloping shoots into the stores 25 feet below; and thence it was raised by means of elevators to storage hoppers and measuring chambers at the top of the building. The retorts, which were all inclined, were fed from the measuring chambers—each charge being measured before being let out; and this feeding was managed by means of a travelling, adjustable shoot, one end of which was fixed in the mouth of the retort that was ready for charging. All these operations were performed by mechanical means; but, of course, the drawing of the retort was still done by manual labour. When the retorts were drawn, the coke fell, again by a sloping shoot, into the basement of the building, or rather on to the ground level 10 ft. 6 in. below the retorts, whence it had to be wheeled into the yard before it could be carted away. As it might seem strange that the coal should be first of all dropped 25 feet in order that it might be picked up again by the elevators, he should like to point out that this was a distinct advantage, as the low-level coal-store resulting from this method formed a natural hopper, which kept the elevator buckets supplied mechanically. If there was not a good depth of coal for the buckets to work through, they would have to be supplied by means of more carting. At present, there was no mechanical arrangement for taking the coke from the basement of the retort-house into the yard; but no doubt even this would be managed mechanically some day.

The party then proceeded to the new retort-house, where they witnessed the charging and drawing of several retorts, and the filling of some of the storage hoppers and measuring chambers. Subsequently the other extensions were also inspected. Altogether, the new works increase the premises by about 50 per cent. The retort-house covers rather more than 2000 square yards; and there is also a new gasholder erected on land in Church Street. This adds about 2,250,000 cubic feet to the storage capacity, which is thus raised to about 3,750,000 cubic feet. The new holder takes the place of one which has been in use for thirty years, and which will now be converted into a tank for ammoniacal liquor. One of the changes involved by the erection of the new retort-house was the removal of a block of workshops and stores. To make up for the loss of these, new workshops are being erected between the offices and the retort house, and stores are being provided on the Church Street side of the site. One-fourth of the new retorts are now in use; and the remainder will be brought into operation as they are required. When the whole of the new retorts are in use, they will deal with from 140 to 150 tons of coal per 24 hours. With the new retorts and the old ones in full operation, the quantity of coal dealt with could be increased to no less than 400 tons a day. For these new works, the Local Government Board sanctioned a loan of £[illegible], and of this sum about £56,000 has already been expended. The greater part of the work for which the loan was obtained has been done under contract.

To celebrate the completion of the various extensions, the Mayor (Mr. Hardman), later in the day, entertained the members of the Corporation and a number of other gentlemen to a banquet. The toast of the evening was "The Corporate Undertakings," in responding to which Alderman Petrie naturally made particular allusion to the gas-works. These, he said, became the property of the Town Commissioners in 1844; being purchased for the sum of £27,700. Since then the growth and development of the undertaking had been strong and steady. He did not know what the production of the works was in 1844; but he found that the weight of coal carbonized in 1877 was 26,000 tons, whereas last year it was something like 43,000 tons. This was a large increase in 18 years—a period during which, as they knew, they had passed through many troublous and depressing times in the town. If the prosperity of the borough had increased in the same proportion during that period, he thought they had good ground for congratulation. It was just thirteen years since the Committee began to feel that the requirements were greater than their plant could supply, and that they must look out for the best way in which to enlarge their powers of production. They had an earnest desire that any extensions they made should be on the very best principle that the science of gas making knew. A corner of the store-room in the old retort-house was utilized, and two systems of retort-settings on the regenerator principle—Siemens's and Klönne's—were tried. The result was satisfactory compared with the old system; but it was not so good as to tempt them to make a large outlay upon those systems. Subsequently they heard of inclined retorts; and they became so convinced of the excellence of this system, that they decided to adopt it. It was a curious system—one of persuasion rather than of compulsion; for it was useless unless they got the retorts inclined at exactly the correct angle of repose. Since the purchase of the works, there had been a capital outlay of some £190,000; but the great bulk of this was expended prior to 1882. From 1882 to 1892, just before the time when they began to spend money on these extensions, they expended less than £10,000 on capital account. In their journeyings, the Committee had inspected some of the very best works; and they were satisfied that their own were, in the excellence of their design and of their construction, equal to the very best they had seen. It would be very remiss and not honest if he did not acknowledge their indebtedness to Mr. Ball for the great ability which he had displayed. The town had been in possession of the works for 51 years; and to his astonishment he found that, by the forbearance and confidence of the Committee, he had had the honour of being Chairman for more than a third of that period. Among the other toasts was "The Town Clerk and Corporation Officials," to which Mr. Zach. Mellor and Mr. Ball replied.

THE NEW HOLDER AT THE MIDDLESBROUGH GAS-WORKS.

Our readers will probably remember that the provision of additional storage at the gas-works was a subject which occupied the attention of the Middlesbrough Town Council on several occasions in the summer of last year; the outcome being the acceptance of a tender submitted by Messrs. Ashmore, Benson, Pease, and Co., Limited, for the construction of a holder, with their wire-rope system of guiding, for £14,400. No time was lost before the work was commenced; and such satisfactory progress has been made that the holder is expected to be ready for the reception of gas in the course of a week or two. In view of this fact, the following particulars, supplied to us by the Gas Engineer to the Corporation (Mr. David Terrace) will no doubt be read with interest.

Exploration holes were sunk near the site of the proposed tank, when it was found that there was a bed of hard clay about 5 feet thick within a few feet of the present surface. Under the clay, the ground is of a very boggy nature; so it was decided to erect the tank on a foundation of 3 feet of concrete on the hard clay. This is extended to receive columns to guide the holder, should this system afterwards be determined upon. The tank is 186 ft. 6 in. diameter and 31 feet deep. It is made of steel throughout; the lowest tier of plates on the sides being ⅞ inch thick—a sufficient strength to stand double the water pressure to which they will be subjected. The platform round the lip was designed for being 2 feet wide; but this was increased to 3 ft. 8 in., in order to give easy access to the pulleys for the wire-rope guiding of the holder. The tank will contain 5,286,000 gallons of water, or about 23,600 tons.

The holder is in three lifts, of the following diameters: Outer, 184 feet; middle, 181 ft. 6 in.; inner, 179 feet. Each is about 30 feet deep; thus giving a total capacity of 2¼ million cubic feet. The lifts are constructed in the ordinary manner with cups and dips. The crown, which has a rise of 9 feet, is on the non-trussed principle; being the usual method with holders of this size—that is to say, instead of the crown being supported on a trussed iron framework attached to the top curb, with the centre post resting, when the holder is out of action, on the foundation in the tank, there are placed 83 wood uprights "anchored" to stone bases. These uprights, braced by diagonal struts, are surmounted by radial arms kept in position by timbers shaped to suit the resting of the crown.

The weight of the holder will be 335 tons; of the tank, &c., 623 tons; of the water, 23,600 tons—making a total on the foundations of 24,558 tons, or a pressure of 1·15 tons per square foot. The weight of the foundation being 7335 tons, there is a total weight of 31,893 tons.

The inlet and outlet pipes (30 inches in diameter) penetrate the bottom of the tank, and are embedded in pitch on concrete foundation. The 24-inch cast-iron pipes connecting the gas-inlets from the works to the holders, and also connecting the gas-outlets from the holders to supply the town, converge to the governor-house, which is being built in such a position, and with the connections so arranged, that it will serve for future holders.

The Proposed Water Trust for West Kent.—The proposal that the various local authorities in West Kent should join in promoting a Bill in Parliament to enable them to form a Water Trust for the acquisition of the undertaking of the Kent Water Company, and of so much of the Lambeth Company's plant as is situated in Kent, has been formally sanctioned by the Beckenham ratepayers.

THE DVORKOVITZ OIL-GAS ENRICHMENT PROCESS AT BRADFORD.

Mr. Isaac Smith's Offer.

At the Meeting of the Bradford Town Council last Wednesday, the Town Clerk (Mr. W. T. M'Gowen) read the following letter which had been addressed to him :—

Oct. 23, 1895.

Dear Sir,—In order to clear away what seems to be the only remaining obstacle to the acceptance by the Council at their meeting to-day of my recent offer, I repeat in writing the statement I made verbally to the Sub-Committee last week—viz., that I agree to the increase, if any, in the fire insurance premium which could be occasioned by the proposed addition to the plant being regarded as part of the expense of enrichment by oil gas; the whole of the expense I am to guarantee shall not exceed ½d. per candle per 1000 cubic feet. That being the case, my combined offers stand as follows:—

(1) The Corporation undertaking to work the oil-gas plant now in Thornton Road for six months continuously, and granting space at one other of the gas-works in the town for the erection of the carburettor or other simple appliance for treating the bye-products, I hereby guarantee that the cost of enrichment by means of the Dvorkovitz process shall not exceed ½d. per candle per 1000 cubic feet of gas supplied for consumption.

(2) If the cost of enrichment, including extra fire insurance premium, if any, be found not to exceed ½d. per candle per 1000 cubic feet, then the Corporation at the end of six months take over the whole plant at cost price.

The above terms are to be treated as additions to the benefits to which the Corporation are entitled under the agreement of Aug. 7, 1894; and I would point out that together they secure to the town the opportunity of using the process for six months without a particle of risk, with the privilege of continuing its use afterwards without royalty or other charge.

The negotiations with the Council having lasted so long, I trust that a definite conclusion will be arrived at to-day. (Signed) ISAAC SMITH.

Mr. H. B. Ratcliffe moved that the letter be referred to the Gas and Electricity Supply Committee. To this proposition an amendment was submitted, that the matter should be dealt with at the present meeting, in conjunction with the Committee's minutes. Mr. Speight thought the Committee should be left to deal with the letter. The Chairman of the Committee (Mr. W. C. Dixon) said the matter was adjourned at the Committee meeting because there were many points to be decided. For instance, some gentleman would have to be selected to conduct the experiment. To carry on a test in the future as had been done in the past, would simply be to make it of no use; and there would be a difficulty in agreeing on some gentleman. Eventually the amendment was defeated by 20 votes to 15; and the original motion was carried. At a subsequent stage of the proceedings, the matter came up again, on the motion for the adoption of the minutes of the Committee. Alderman Morley said that, at the last meeting of the Council, it was resolved to refer the oil-gas question back to the Committee for further consideration. If the question could be settled at the present meeting, the borough would be saved a considerable sum. The offer of Mr. Isaac Smith, as contained in the letter which had been read earlier in the meeting, was a magnanimous one. It was a matter in which no member of the Corporation was interested in any shape or form; and there was no reason why a decision should not be taken at once. He moved, as an amendment, that an experiment with the oil-gas process be made in accordance with the terms of Mr. Isaac Smith's letter. Mr. Ratcliffe called attention to the fact that the Council had already referred this letter to the Committee. Mr. Toothill having seconded the amendment, some conversation arose on a point of order; and the Town Clerk said the amendment was irregular. The Mayor (Alderman Wood) ruled accordingly; and the minutes were adopted.

THE PROPOSED PURCHASE OF THE SOUTH MOLTON GAS-WORKS BY THE CORPORATION.

At a Meeting of the South Molton Town Council last Friday week, a report was presented by the Committee recently appointed to confer with the Directors of the Gas Company as to the purchase of the works by the Corporation. The Committee unanimously recommended the Council to purchase, at the price asked by the Company (£3300). Before a provisional contract was signed, however, it was considered by them advisable to have the advice of a competent gas engineer. The Directors of the Company wrote that it was their desire to benefit the borough as much as they could; and that no such sum as £3300 would have been accepted from any other person or company. The works were in a good state of repair; and the lessee's term expires at Midsummer next. The meters would have to be taken at a valuation, as they were the property of the lessee. The average net income for the past eleven years had been £246.

In moving the adoption of the report, the Mayor (Mr. A. E. Shapland) said he considered the works would be a valuable addition to the borough property, as the Corporation now paid £200 a year for gas. The purchase money could be borrowed for 3¼ per cent.; the repayment being extended over a period of years, so that the borough rates would not be increased. Indeed, the profits made should reduce the rates. The Directors had no wish to force the works on the Corporation; but he considered that the supply of light and water should be under the local authority. Mr. Richards seconded the motion, and referred to the fair manner in which the Directors had met them. They had not only submitted the books of the Company and of the lessee, but the profit and loss account, which showed the Company to be in a solvent condition. The Directors were tradesmen of the town—not speculators who would be off directly the purchase was completed. The Corporation should not hesitate to purchase, and secure the 6 per cent. dividend. They need not fear the electric light. Their neighbours, the Tiverton Town Council, some time ago acquired power to provide electric lighting; but only a short time since, they purchased the gas-works for £20,000. Their predecessors had with much advantage secured the monopoly of the water-works; and they would be failing in their duty if they omitted to secure the gas-works. Mr. Cock, who moved the rejection of the report, said that, if the Council had purchased the works twenty years ago, it would have been a good investment; but the works had had a good many years' wear, and were now in a rotten state. He was surprised the Progressive members of the Council were willing to venture on a worn-out thing, when the electric light was staring them in the face. After further discussion, a member proposed that a ratepayers' meeting should be called to consider the report; but he was ruled out of order by the Mayor. The amendment for the rejection of the scheme was then put and carried by 7 votes to 3—two members who are shareholders in the Company not voting. It was afterwards decided to call in Mr. H. A. Willey, of Exeter, to consider the matter, as recommended by the Committee in their report.

CEARA GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Friday, at No. 9, Queen Street Place, E.C.—Mr. HORATIO BROTHERS in the chair.

The SECRETARY (Mr. T. Guyatt) read the notice calling the meeting; and the report and accounts, which were referred to in the JOURNAL for the 22nd inst., were taken as read.

The CHAIRMAN said the accounts were, as the report stated, satisfactory, considering all the circumstances. The expenditure for the year ended June 30 last was £1891 more than in the previous year; and the receipts had increased by £1634, or a difference on the wrong side of £253. On analyzing the items of this expenditure, it would be found that coal accounted for £760, but, as a set-off, the gas-rental showed an increase of £1253, which would not be deemed satisfactory had the price of coal remained the same. Unfortunately, they had had to pay for coal an extra 5s. 10d. per ton during the past year, as compared with 1893-4, which, on the quantity of coal carbonized, amounted to £644; thus showing that the increase in the amount of the gas supplied—viz., £1253—had the price of coal remained as in 1894, would have been obtained at an increase of only £116, and in the quantity of coal of only 58 tons, which was very creditable to the management at Ceará. The cost of manufacturing, considering the small extra quantity of coal carbonized, was by no means so satisfactory; and the Manager (Mr. T. M'Making) accounted for this by a substantial increase in the rate of wages paid, and the difficulty of obtaining competent hands—there being a great dearth of labourers in the province. The other items of expenditure had been affected by the same cause. Exchange still held a prominent place in the accounts; and it was £545 more than in the preceding year. When he last addressed the shareholders, he was able to hold out some hope that this would be a diminishing item, as the exchange had then risen to 11½d. per milreis. However, it did not long continue at that figure. He saw, from *The Times* that morning, that it was now at 9$\frac{15}{16}$d., or nearly 10d.; and he was afraid it would be some time before their hopes in this respect were realized. He would here mention, as very creditable working, that they had been paid for 9465 cubic feet of gas per ton of coal carbonized; and the leakage was only 2·2 per cent. In his remarks at the previous meeting, he alluded to the additions to the plant then in contemplation, and expressed the hope that they would be in operation at the end of the financial year. They were not so, as the Directors had had to consider very carefully the capital expenditure these extensions would involve; and, after much consideration, they had been able to place the contract for the supply and erection of the ironwork with a very respectable firm, at a considerably less cost than was originally proposed. All the work was now awaiting shipment. The cost of the additions would be paid from the issue of the 6 per cent. debentures, instead of calling up the unpaid 10 per cent. preference shares—thus saving 4 per cent. on the amount. Brazil was a very disappointing country to deal with in its financial arrangements; and he was not able to predict any favourable alteration in the rate of exchange. He would not prophesy, as he did not know; but the Directors indulged the hope that the steps they had taken to increase the plant, and render it more efficient, would result in a financial saving, and give a more adequate supply of good and pure gas to the consumers.

Mr. J. DARELL BLOUNT seconded the motion, which was unanimously adopted.

A dividend was declared for the six months ending June 30, of 5 per cent. on the preference shares (less tax), and of 4 per cent. on the ordinary shares (tax free).

On the proposition of the CHAIRMAN, seconded by Mr. A. J. KING, the retiring Directors (Messrs. J. D. Blount and F. W. Brothers) were re-elected; and on the motion of Mr. SKAIFE, seconded by Mr. M'MAKING, Mr. Magnus Ohren was re-appointed Auditor.

Votes of thanks for their services were passed to the Chairman and Directors and to the Secretary and the Engineer and Manager, and were duly acknowledged.

Mr. M'MAKING (who is in England for a short time) mentioned that the state of the Company's works was very fair; but with the new plant already ordered, he considered they would be the most efficient in the whole of South America.

AUSTRIAN INCANDESCENT SHARE COMPANY.

The following appeared in the *Financial News* last Thursday: "The report of the Managers of the Austrian Incandescent Share Company for the period from the date of the incorporation of the Company, Feb. 4 last, states that the balance-sheet shows a credit balance of £50,125, after providing for the cost of administration. Out of the balance, the Managers recommend the payment of a dividend of 3s. per share (equivalent to 15 per cent. on the capital), free of income-tax. This dividend is the result of a year's working of the Vienna Company, and will absorb £48,000. A translation of the report of that Company shows the flourishing condition of the concern, and the conservative policy that it has followed from the beginning, by preferring to accumulate large cash reserves rather than pay away all profits in

dividends. The Company has only been in existence for about two years and eight months, during which time there has been put aside out of profit 1,690,186fl. (about £140,000), of which about 1,142,015fl. (£95,000) is invested in safe and easily realizable securities, and 548,171fl. (about £45,000) is deposited at interest in the bank as a special reserve fund. The Company hold, also, freeholds, stocks, &c., to a very large amount, as shown in the balance-sheet; and, in addition, the following assets, which, though mentioned in the report, do not appear in the balance-sheet: Hungarian Incandescent Gas-Light shares, since sold for 715,500fl. (about £59,600); Netherlands Incandescent Gas-Light shares, 12,500, which, at the present market value, represent about £19,000; 255 Swiss Incandescent Gas-Light Company's shares, of a nominal value of 1000 frs. (£40) each; and a considerable interest in the Welsbach patents for some of the principal republics of South America. The profit and loss account shows a net profit of 1,907,191fl. (about £158,000) on a capital of 1,500,000fl. (about £125,000), after deducting not only an ample amount for depreciation of buildings, &c., but, in addition, writing 500,000fl. (about £41,000) off the patent account, which is thereby extinguished, and also, as a matter of precaution, 53,556fl. (about £4460) off the book debts. After paying a dividend of 80 per cent., the Vienna Company have carried forward to next year's profit and loss account an amount equivalent to 20 per cent. on their capital. These figures show the extraordinarily strong financial position of that Company. The current contracts for the sole supply for many years to come of fluid to all the Auer Welsbach Companies in the world, except the United States of America, assures to the Company a large augmentation of profits, as the consumption of the fluid increases every year. To this must be added the profits from the sale of burners and mantles in Austria and other countries supplied by that Company. The value of the Austrian Company's investment in the shares of the Vienna Company is further shown by the fact that the shares for which the Managers paid 5000fl. each in February last now represent a market value of about 13,000fl. each.

ELECTRIC LIGHTING NOTES.

We cannot go so far as a local paper, and suppose that the Local Government Board are taking special interest in the electric lighting scheme of the Wimbledon District Council. At the same time, it must be admitted that there has not been much delay at headquarters, as Major-General C. Phipps Carey is to conduct the official inquiry next Friday. The Local Authority have decided to be represented by Counsel; and Mr. Bidder, Q.C., has been mentioned as the gentleman selected. We understand that a barrister will also be retained by the Ratepayers' Association. In the meantime, the energetic ratepayer whose circular was noticed in the JOURNAL a fortnight ago has returned to the charge by again protesting against the scheme—this time through the medium of the local press. He regards with natural alarm the prospect of having to pay 6d. in the pound more on his rating merely to have a light which will, he believes, be more uncertain than the present oil-lamps. He says: "'It goes against the stomach of my sense,' and I resent it." The oil-lamps have for years been an eyesore to him; but these are better than unreliable, wobbling, flickering electric lights. "Why," he again asks, "do not the Council have the district lighted by gas? There is no satisfactory reason why the Council and the local Gas Company should be at variance. Their interests are identical—the well-being of the district. If the Council were to approach the Company in a cordial spirit, there is no doubt whatever that gas for the public lamps, with the beautiful incandescent burners, would be obtained at 2d. per 1000 cubic feet only more than is now charged by the South Metropolitan Gas Company at Tooting (part of Tooting being within the parliamentary jurisdiction of that Company). Not only would gas be supplied to the public lamps at a cheap rate, but the price of gas would be reduced within six months to the consumers." Ratepayer thinks that if the Council carry out their expensive electric lighting scheme to please their friends, and against the will of the bulk of the ratepayers, it will be doubtful if they will hold their seats. They seem to him to be riding for a fall. Time will show.

The Corporation of Hanley are desirous of extending their electric lighting plant; and they have accordingly applied to the Local Government Board for power to raise £20,000 for the purpose. The matter was recently inquired into by one of their Inspectors (Mr. G. W. Willcocks, M.Inst.C.E.). It was opened by the Town Clerk (Mr. A. Challinor), who stated that the population of the borough was estimated at 56,000, and the assessable value was £182,238, with an outstanding debt of £195,460. Included in this debt was £30,000 for the electric lighting works and plant; and it had been incurred in four loans of £21,000, £5000, £1000, and £3000. The purpose of the proposed loan was to extend the mains, building, and machinery; and it was repayable in 25 years. In February, 1893, the Local Government Board sanctioned a loan of £21,000 for providing the plant, &c., required for the introduction of the electric light into Hanley. This sum had been expended; and, in consequence of the inability of the Corporation to meet their requirements, the Local Government Board, on May 29, 1895, sanctioned a further loan of £5000 for the extension of the plant. So far the Corporation had limited the supply of electrical energy to consumers in and about the centre of the town, and within the area of compulsory supply. They now proposed to extend the mains to various parts of the town and to several places outside the area, because the demand for light was increasing; and in the first nine months (ending the 31st of December last), £31 was realized over the working expenses and the interest on capital. As all the power which the Corporation were capable of supplying had long been taken up by customers and street lighting, the Corporation Engineer (Mr. J. Lobley) and the Electrical Engineers (Messrs. Cowell and Sutherland) had presented plans for a further extension of the works, and reported to the Council. Their report showed that a further sum of £21,000 would be required to carry out the plans, and this was the loan now applied for. Mr. Lobley then gave a detailed explanation of the purposes for which the money was needed. The £20,000, he said, would be expended as follows: £5508 in cables; £5900 in extending the generating station, including an enlarged building and two boilers; £1242 for lighting the Park Road (not provided by arc lamps) and for other roads near the park; £4850 for extensions rendered necessary by the great demand of customers; and £1500 estimated for meters (£1250 of which had actually been spent in extra meters to supply demands). The investigation lasted for a considerable time; but there was no opposition to the application.

Those shopkeepers who have adopted electric lighting for their windows find that the change is not unattended by disadvantages. When gas was employed, there was, of course, a certain amount of warmth. Now complaints are made that in cold weather the windows are more frequently "frosted" than before; and, as this is a serious drawback, many firms are returning to gas lighting, using incandescent burners. This is especially the case in the drapery trade. Those who still use gas on the old system are hesitating to adopt the electric light when better results may be obtained with gas. A speaker at the ratepayers' meeting at Wimbledon, referred to last week—we believe he is a large draper in the town—said he had had a few incandescent gas-lights put up. His gas bill came to £197 in 1892; whereas in 1893-4 it amounted to only £174, including the cost of the mantles. He has since had 18 new burners and two stoves for his workpeople; and yet his gas bill for 1894-5 was only £150. Moreover, his employees are much more comfortable than they were before. In face of these results, he is not disposed to go in for electric lighting.

Two companies have served the Corporation of Devonport with statutory notice of their intention to apply for Provisional Orders to supply electricity in the borough. As the result, the Corporation have decided to go for powers themselves; and they will be among the applicants for Orders in the ensuing session. At the same time, the feeling of the municipal authorities is not one of great enthusiasm for the course on which they are entering. A Committee who considered the question came to the conclusion that it would be expedient to defer any steps for the introduction of the electric light until more experience had been obtained. They were, however, unanimously of opinion that the electric light companies should be kept out.

Mr. W. J. Bird Clerke held an inquiry at Cardiff last Thursday relative to an application by the Corporation for sanction to borrow certain specified sums—among them £12,885 for electric lighting, an £500 for the necessities of public lighting. Regarding the first-named amount, the Mayor stated that the compulsory area was now lighted. A portion of the money—£5385—was required for extensions of the distribution system, and to erect a testing-room—the remaining £7500 being needed for defraying the excess of expenditure over capital already borrowed, and for other proposed works. It was mentioned by the Borough Engineer that the Corporation did not anticipate a great loss on this year's working. The revenue was equivalent to £3300 per annum. They had applications for 12,000 8-candle power lamps; and, in addition, they had applications from numerous houses which were already wired and waiting for the current. Evidence was then given as to the other items for the borrowing of which sanction was sought.

Water Supply at Fires.—One of the largest conflagrations which has lately occurred at Doncaster took place on Monday night last week, when the greater part of the Plant Schools, built by the Great Northern Railway Company for the education of their workmen's children, was destroyed. The disaster is only noticed here as an instance of the evil results following upon the entire shutting off of a water supply which has to be drawn upon in the event of fire breaking out. About a fortnight ago, an old restriction came into force, and the water was turned off at eleven o'clock at night. Forty minutes later, the building in question was found to be on fire; and though the firemen were promptly on the spot with their engines, it seems that about twenty minutes elapsed before water was available. In that time, the fire had, of course, assumed huge proportions. The damage is supposed to be covered by insurance; but the question arises whether it would have been anything like so serious as it was, had it not been for that twenty minutes' delay.

Fatal Accident at the Kidderminster Gas-Works.—At the Kidderminster Police Court, on Monday last week, the Deputy-Coroner (Mr. Hebbert) held an inquiry into the circumstances attending the death of Thomas Joseph Haddock, a bricklayer, which took place while he was repairing a retort at the Kidderminster Gas-Works on the previous Friday. The evidence went to show that deceased had repaired 18 out of 21 retorts. In one of the remaining three, there was a certain quantity of coke and ashes which had to be removed; and, instead of asking his labourer to clear them away, Haddock apparently started doing this himself. He was subsequently found dead in the retort. The Manager (Mr. A. Dougall) and several of the employees at the gas-works stated that they considered the repair of retorts perfectly safe employment. There was plenty of air, and no danger of foul gases—all the retorts being well ventilated. Dr. Moore said the deceased died from carbonic oxide poisoning; and he gave it as his opinion that there must have been some small cavity in the retort in which the gas was confined, and that Haddock, in clearing away the coke and dust, released the gas. The Coroner said it was obvious that there must have been some carbonic oxide gas in the retort, though the witnesses, who had had many years' experience, said such a case had never come to their knowledge before. It was for the jury to say whether the deceased was acting in a proper manner in getting into the retort before it had been cleaned out. The jury returned a verdict to the effect that death was due to carbonic oxide poisoning, and that there was not sufficient evidence to show how the gas had accumulated. They suggested that somebody should always be in attendance whenever anyone was in a retort, and that the retorts should be cleared before a man was allowed to enter them. The Coroner said this practically amounted to an open verdict. Mr. A. S. Thursfield, who represented the Gas Company, said they sympathized very much with deceased's widow and children; and he was gratified in being able to tell the jury that, as the Company insured their workmen, there would be £50 for the widow.

METROPOLIS WATER SUPPLY.

The London County Council and the Water Question.

At the Meeting of the London County Council last Tuesday—Sir A. Arnold in the chair—the debate on the water question, adjourned from the previous meeting (see *ante*, p. 838), was resumed. It will be remembered that the Parliamentary Committee of the Council submitted the following recommendation: "That, desiring that the supply of water in the Metropolis and the surrounding districts should be in the hands of a public authority, and with a view to a complete agreement with all parties concerned over the entire area supplied, the Council do invite Her Majesty's Government either to deal with the question themselves or to appoint a Royal Commission to do so." To this an amendment was moved by Mr. J. Stuart, M.P., and rejected by a majority of one, to the effect that the Council's Water Bills should be proceeded with.

Dr. Collins, in resuming the debate, said the result of the vote on the amendment at the last meeting was that the Moderates had succeeded in killing the Water Bills of the Council. The work of years had been destroyed and brought to nought by that one division. As far as he could understand the proposal of the Committee, it was that they were agreed that the County Council should not be the Water Authority for the County of London. It also seemed that they suggested another Royal Commission. He was not prepared to go to the Government, and ask for another Royal Commission on the subject. With regard to the assertion that the Council were not a fit body to become the Water Authority, he could not believe that Moderate members really desired the Council to abdicate their functions, and to belittle and degrade themselves in the eyes of London. He considered that the Council being the Water Authority for London was a *sine quâ non* of all progress in this matter. To test the meaning of the resolution, he would move the following amendment to the Committee's recommendation: "That, the Council having decided not to proceed with the suspended Water Bills, and desiring that the Council should be the Water Authority for London, it be referred to the Parliamentary Committee to report without delay the lines on which they suggest that the Government should be asked to legislate."

Mr. M'Kinnon Wood seconded the amendment. He remarked that the Moderate party, who had gained a victory in defeating the Water Bills, had not, up to the present, indicated any policy upon which they intended to proceed. The Progressives admitted that their policy had been killed; and they demanded that the Moderates, as the representatives of London, should show theirs.

Mr. Beachcroft, in opposing the amendment, said, in his opinion, to have proceeded with the Bills would have meant selling the ratepayers. Two alternatives now presented themselves—either to introduce a new Bill dealing with the whole question, or to take the course suggested by the Parliamentary Committee. This was a question which had passed out of ordinary municipal limits; and the proper plan was to ask the Government to take up the matter. But when they were asked by Dr. Collins to lay down the lines on which the Government should legislate, he joined issue with him. If they were going to Parliament, they should leave Parliament to adopt what course it thought fit. If the Council would sink party differences, go with its united force to the Government, and ask them to take up the question, they would do so; and he believed the first step the Government would take would be to negotiate with the Water Companies, which the Council ought to have done. If this course were taken, they would have a settlement, so far as the purchase question was concerned, probably satisfactory to all parties.

Mr. Costelloe asserted that the policy of the Moderates on this question, so far as it had been foreshadowed by Mr. Beachcroft, was one of ineptitude. They seemed to propose to go to the Government with a blank cheque of the London County Council. But the Progressives were not prepared to give a blank cheque—at any rate, as to the purchase price to be paid. Neither were they prepared to take a single step in the matter until it was fully understood that the Council should be the Water Authority for London.

Mr. H. Clarke believed the Council had done excellent work on the Water Question, and had paved the way for negotiation; but he did not think the Council were the best body now to carry on these negotiations. The whole question was ripe for settlement. If the Council ultimately did become the Water Authority, it would have to raise a vast sum of money; and Parliament would not permit an unlimited time for the repayment of that debt. But London was not in a position to carry on its shoulders an increased rate of half a million a year, or anything like it; and for this reason he should oppose the amendment.

Sir J. Lubbock, M.P., expressed approval of the remarks made by Lord Farrer at the previous meeting, in which he pointed out that, under an open arbitration, they would have to pay much more for the water undertakings than they were worth; and they ought never to do that. The Parliamentary Committee last year struck out the clause on which they relied, and practically handed the Council over to open arbitration. He denied that the Moderates were in favour of increased expense in this matter; they had, on the contrary, persistently complained that the bargain proposed for the ratepayers would be a bad one. They had no interest in the Water Companies; and what action they had taken had been entirely in the interests of the ratepayers. Had the Council allowed the Finance Committee, as suggested by the Moderates, to make a report on the cost, they were confident the result would have been that the scheme would not have been proceeded with. The Progressives had, time after time, rejected schemes costing £100,000 or so, because they would be borne by the present ratepayers, and would benefit the ground landlords; yet now they were quite willing to undertake a scheme costing from £40,000,000 to £60,000,000, which would be borne by the ratepayers, and benefit the ground landlords. It was not necessary to discuss the policy of the late Bills, because the Council had already decided against them. He pointed out that they would have had the opposition not only of the Water Companies but the counties. He quite agreed that they should have power to obtain a supply of water from Wales, if necessary; but they need not go further than that at present. He was in favour of public control, which was the true policy, and not of purchase.

Other members having spoken,

The Earl of Onslow said that the Progressive party, after six years of power, had done their best to settle this question, and had failed utterly and signally. Mr. Costelloe had criticized the Moderate policy as one of ineptitude; but he himself was quite ready to confess that the Progressives had proved themselves incapable of dealing with the matter. There was one important consideration in connection with this subject, and that was the question of time, which was of the essence of the contract. If they introduced into the present House of Commons a Bill in any way similar to the Bills of last year, the only result would be the waste of another session. He had heard it said in many quarters that the object of the Committee's recommendation was to delay and shelve the question. For himself, and on behalf of those with whom he was acting, he emphatically repudiated that assertion. On the contrary, he believed that nothing but the treatment of the question by a strong and powerful Government in their own way would be in the least likely to bring about a settlement. He would be no party to going to the Government and asking them to settle the matter, and then telling them what ought to be done, when the Council had been unable to pass a Bill of their own. The Moderate party had produced a policy. They said this matter could not be settled by the Council, and that it was not likely any of the proposals which the Council might put before Parliament would be acceptable to the House. They said there was in power at the present moment a strong Government with a large majority behind it in the House of Commons, who, he believed, were fully impressed with the importance and urgency of this matter, and who were alive to the terrible disaster which was recently narrowly escaped in London; and if the Government would undertake this matter, they would settle it in a far shorter time than the Council possibly could.

Mr. Stuart, M.P., supported the amendment, and claimed that, in order to preserve themselves from ridicule, the Moderates should indicate the main lines on which they intended to go to the Government, and should give the Council some idea of what they were proposing to ask the Government to do.

Dr. White and Mr. H. H. Marks, M.P., opposed the amendment.

The closure was then carried, and the amendment was put, and, on a show of hands, was declared to be lost by a majority of one.

A division was, however, claimed and taken, when there voted: For the amendment, 65; against, 56—majority for, 9. The amendment was then carried as a substantive motion.

Lord Farrer voted for the amendment.

On the motion of Sir John Lubbock, M.P., seconded by Mr. Westacott, an addition to the resolution was carried, instructing the Parliamentary Committee to print and lay before the Council the Memorandum by the Deputy-Chairman on the water question, with the exception of such parts, if any, as would in their opinion be prejudicial to the interests of the ratepayers.

A report was presented from the Water Committee by the Chairman (Mr. T. H. W. Idris), describing a visit which several members paid during the recess to certain water areas in Wales, with the view of examining sites for reservoirs for the future supply of London. It was resolved that the consideration of the report should be adjourned until after the Parliamentary Committee had reported on the water question.

The Deputy-Chairman's Memorandum on the Purchase Question.

The Memorandum referred to in Sir John Lubbock's motion has since been issued; and we give below the principal portions of the document.

Mr. Dickinson does not claim that his proposals are absolutely right; but he presents them as one view of a problem which is of such magnitude and importance to the people of London that, in his opinion, it cannot be solved equitably to the ratepayers by the simple expedient of ordinary purchase. He takes for granted (1) that the purchase-money allowed by an arbitrator would be such sum as would ensure to the shareholders an income not less than that they at present receive. This was calculated in 1891 as £37,000,000 of Metropolitan Consolidated Stock. (2) That the capital outlay actually sunk in the Water Companies' undertakings does not exceed £15,000,000; and that a large portion of this has long since ceased to be represented by any plant or material property; (3) that apart from any value or goodwill, &c., the actual material belonging to the Companies is not worth £10,000,000; and (4) that a scheme of new reservoirs at Staines would cost at least £10,000,000, and that a supply from a distant gathering-ground would cost £20,000,000.

In approaching the subject, Mr. Dickinson holds that the Council are entitled to look keenly at the position of affairs which has enabled the Companies to offer, at a price of £30,000,000, works which have only cost £15,000,000, and which are not worth to the purchasers more than £10,000,000. This position has been attained chiefly through the power possessed by the Companies of levying every five years increased rates on London houses. Parliament, says Mr. Dickinson, never intended to give the Companies this power; and the Companies themselves, when asking in 1852 for a power to charge on rateable value, not only did not contemplate any material increase thereon, but expressly represented to Parliament that their desire and intention was to have merely a simpler mode of obtaining the same profits. Is there then, he asks, any equity in the contention that the Companies are entitled to compensation on the basis of their present income? This contention, if put baldly, must reduce itself to the following: The ratepayers have paid to the Companies year after year more than they should have paid, and for that reason it is just that the ratepayers should provide now a capital sum sufficient to perpetuate to the shareholders their past exorbitant profits. He should have thought that justice would demand the reverse of this proposition.

Discussing the practical question, whether the Council should purchase the Companies on terms of arbitration, Mr. Dickinson takes the following things for granted:—

(1) That the figure an arbitrator would name would not be less than £30,000,000. (He does not see how any arbitrator could, under the present law, do otherwise than assess the value on the basis of present

income. Parliament could adopt another plan, but no other authority could do so.)

(2) That the report of the Royal Commission proves—(*a*) That the Thames and Lea will suffice till 1931, but not afterwards. (*b*) That a very large capital expenditure will be necessary to make the Thames and Lea water sufficient in quality and quantity. (*c*) That it is uncertain whether the scheme of reservoirs in the Upper Thames will provide sufficient water; the Commissioners themselves having over-estimated the amount of water which will be available at Staines for filling these reservoirs. (*d*) That a much-improved system of supervision must be inaugurated to ensure the quality of the water. (*e*) That no large quantity of underground water can be obtained near London. (*f*) That at any time the Thames may be a source of disease.

If these assumptions are correct, it appears to Mr. Dickinson that those who simply advise purchase, without any regard to the future, are taking upon themselves a very grave responsibility. In the event of an immediate purchase, the London ratepayer would find his charges for the same water materially increased. Estimating the financial result of the purchase at £30,000,000, to provide annual expenditure and repayment of capital, the present water-rates over the whole area of Water London will have to be increased by at least 30 per cent. The London ratepayer would not only have to supply his own 21 square miles with water, but also 500 square miles outside his county. London will, probably, be put under an obligation to supply all neighbouring districts in bulk at certain fixed rates defined by Parliament. These rates (owing to the powerful influence of the Home Counties) would presumably be fixed very low; and, moreover, the obligation would extend to delivering a perfect quality of water. These outlying districts will grow with rapidity. In the estimates of population, that of the County of London was estimated to increase from 4¼ to 6 millions; whereas the outer ring is expected to increase from 1¼ to 5¼ millions. It would be the needs of Outer London that would render a new supply obligatory; and then Inner London would be called upon to sink some £20,000,000 more for an object in which for itself it might have no interest. In a very few years, an expenditure of some £20,000,000 would be incurred in abandoning altogether the Thames as a source of supply, and the rates would be raised in respect of this by a further sum of 6d. in the pound. Mr. Dickinson thinks it is certain that if it happened that disease, originating in the valleys of the Thames and Lea, did succeed in reaching London, and causing an epidemic, there would be at once an irresistible popular demand for water from a new source. If it is not at once resolved to abandon the river supply, large capital sums will have to be expended in forming reservoirs in the valleys of the Thames and Lea. In this work much would be experimental. The report of the Commission, while stating that 300 million gallons a day could be obtained by storing the winter waters, gave no opinion as to whether the water in these vast reservoirs would be wholesome or not; and it is quite possible that, having completed these works, it might be found absolutely impossible to intercept and store sufficient water without danger to health, either in London or in the country surrounding the reservoirs. If the Council foresee the danger of their position, what reason is there for them to undertake the risk? It seems to Mr. Dickinson that those who should experimentalize upon the capacity of the Thames and Lea to supply water are those who formulated the proposals. He would leave the Water Companies to carry out the recommendations of the Royal Commission, and do all that is necessary for supplying London with good water for forty years. As shown by the Commission, their capacity for doing so would cease in 1931; and then the Municipality of London would take over the whole water supply. Mr. Dickinson thinks that Parliament should enact as follows:—

(1) That the powers and obligations of the Companies shall continue as at present until 1931, subject to (*a*) more efficient inspection as to quality, (*b*) obligation to raise money by auction, and (*c*) limitation of charges upon existing houses to the charges at present allowed.

(2) That the powers of the Companies shall absolutely cease and determine in 1931, and that in that year the Council shall take over their undertakings, or so much as it requires; paying therefor the actual value of the plant and materials so taken over.

(3) That at any time prior to 1931 the Council may agree with any Company to take over its undertaking.

The advantages of these proposals, Mr. Dickinson holds, would be—

(1) They would place the Council in a position to decide whether that body would continue to take a supply from the Thames and Lea, or should seek another gathering-ground free from considerations as to the throwing away of £30,000,000.

(2) They would define the rights of the Companies, and thus enable the Council, if they deem fit, to agree upon purchase at fair terms.

(3) They would not be unfair to the Companies, who would be left for forty years in possession of a valuable property—a property, indeed, depreciating in value, but depreciating gradually. It would not inflict the hardships upon individual shareholders which a sudden destruction of their property would inflict. For several years the market value of the shares would not alter to any great extent; and by a slight reduction in dividends, it would be possible to form a reserve fund towards providing for the capital loss.

(4) If, as seems probable, the Council were to resolve to obtain pure water from a distance, the necessary works would take many years in preparation and construction. It could be accurately estimated as to the epoch when these works could be completed. The Companies could only lay out money on reservoirs, &c., sufficient to carry them through until that date; and after that date the Council might provide the Companies with the new supply, or would probably come to an agreement for purchase.

If the Council were to resolve to adopt some such plan as the foregoing, the question of their action with respect to the Bills of the Water Companies now pending in Parliament would, Mr. Dickinson thinks, be simple. It would be necessary to oppose all these Bills—not with a view to their being thrown out entirely, but to obtain provisions in them which would ensure (*a*) that the Companies should take no more water out of the Thames or Lea than they can at present take without making provision for storage, as required by the Royal Commission, and (*b*) that all money raised should be raised by auction.

In conclusion, Mr. Dickinson urges that, with respect to the Thames Conservancy Bill, the Council should insist that a provision should be inserted which would prevent any Company taking any water out of the river which would cause less than 300 million gallons a day to flow over Teddington Weir. The duty of the Council would then be to prepare a General Bill for submission to Parliament, which would deal with all the London Water Companies in the way proposed, and, at the same time, if it deemed it advisable, might apply for power to commence the construction of works for a new supply.

The Quality of the Water in September.

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied in London during September, as ascertained by tests of samples taken daily on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 175 samples examined, all were found to be clear, bright, and well filtered. The weather during September was in every respect remarkable; the rainfall in the Thames Valley having dropped from 2·66 inches (the average of 25 years) to 0·57 inch—leaving a deficiency of 2·09 inches. Rain fell on six days only; the bulk of it (0·39 inch.) on Sept. 6. This, together with the excess of sunlight, had a marked effect on the quality of the water, as can be seen by the following table:—

Average of the Five Supplies derived from the River Thames.

	Common Salt, per Gallon.	Nitric Acid, per Gallon.	Hardness, Degrees.	Oxygen required, per Gall.	Organic Carbon, per Gall.	Organic Carbon, per Gall.	Colour. Brown:blue
Aug.	1·994	0·740	13·09	0·039	0·093	0·108*	11·7:20
Sept.	1·980	0·685	12·97	0·032	0·081	0·098*	10·4:20

* Maxima; all the other figures are means.

Bacteriological examinations of the filtered and unfiltered samples were carried on unremittedly throughout the month. We find that the average of raw unfiltered Thames water contained 2432 microbes per cubic centimetre, and the River Lea water 1710 microbes per cubic centimetre; whereas the filtered samples from the five Thames Companies contained only 62 microbes, and the filtered Lea water 73 microbes, per cubic centimetre.

GUERNSEY WATER-WORKS COMPANY, LIMITED.

An Extraordinary General Meeting of this Company was held last Tuesday, at the Offices, Tokenhouse Buildings, E.C.—Mr. G. Snell in the chair.

The Secretary (Mr. A. C. Tulk) having read the notice calling the meeting,

The Chairman said the shareholders had been called together to pass a resolution to increase the capital of the Company to £45,000 by the issue of 2500 new shares of £10 each. During the past summer the demand for water for glass houses alone had been so great that it had been decided to relieve the drain upon the pure spring water supplies obtained from the wells, and establish an independent supply from quarries for these purposes. It was also proposed to erect additional pumping-stations, with powerful pumps capable of throwing upwards of 250,000 gallons daily from these new sources, with additional mains, and to construct a large reservoir in connection with the new system. The new works to be undertaken were estimated to bring in from 5 to 10 per cent. in dividends.

Mr. C. R. Hutchings furnished some particulars as to the supply of water furnished by the Company's wells, and also as to the prospects of additional water being procured from the quarries. He said the latter were in such a position that they could readily be connected with the new reservoir by the mains. One, known as the Du Val, contained 742,000 gallons of water; the next—Salt Pans—contained about 2 million gallons; another, called Baubigny, contained about 20 million gallons. This was a tremendous place, said to be from 60 to 70 feet deep. Then there was the De Lancy quarry, which contained about 4½ million gallons. In addition to these, they had Bennet's quarry, which had in it about 4 million gallons. Therefore, there was water in reserve in the quarries amounting to no less than 31 million gallons, which, at 200,000 gallons a day, would last 155 days, or six months.

After some questions by shareholders,

Mr. Hutchings moved—"That the capital of the Company be increased to £45,000 by the creation of 2500 new shares of £10 each."

Mr. W. H. Rose, in seconding the motion, said he had the greatest confidence in the success of the works.

The motion was carried unanimously.

CHESTERFIELD WATER SUPPLY.

A Serious Drought—Curtailment of the Supply.

Owing to the scarcity of water at Chesterfield, the supply has had to be restricted in the greater part of the borough ever since the 25th of August. In the town itself, the inhabitants have water for only five hours a day; and were it not for the existence of capital springs on the premises of certain manufacturers, operations in these places would be seriously hampered. Under these circumstances, it is only natural to find that Mr. C. E. Jones, Assoc.M.Inst.C.E., the Manager of the Chesterfield Water and Gas Company, has been "interviewed" on the matter by a newspaper representative. Mr. Jones confessed that the Company had only once before been in such a tight place in regard to the supply of water. He complained, like Mr. Bryan at the East-end, of the waste which goes on continually among consumers, even when everyone knows that the rainfall has been very limited. The cause of the present drought is the abnormally slight amount of rain; and to this must be added, as an important factor, the rapid growth of the population of Chesterfield during the past few years, in which time more houses and works have been put up than in scores of years previously. The buildings and population have gone on increasing; but the Company's gathering-grounds and storage capacity have remained the same. It might be concluded from this that want of

foresight had been exhibited by the Directors. But Mr. Jones shall furnish the explanation: "To meet the growing requirements of the area supplied by the Company, and to prevent a failure of the continuous supply experienced in some parts of it, they about a couple of years ago decided to seek powers from Parliament to enable them to increase the storage capacity and secure more water. The Corporation of Chesterfield and some of the local bodies combined in opposition to the Bill, on the ground, principally, of the enhanced water-rates which would have come into operation had it passed—charges which the Company said were absolutely necessary to enable them to obtain the capital requisite for the new works. The Parliamentary Committee did not consider the preamble proved; and they threw out the Bill. At the same time they required the Corporation to take steps within a year to acquire both the gas and water undertakings—rather more, perhaps, than the Corporation desired. A Board is now being constituted to take over the concern; but arbitration will, in all likelihood, have to be resorted to before the price at which it shall be acquired is settled. It is stated by those in a position to form an opinion, that fresh gathering-grounds will have to be sought, as Linacre will not be sufficient to meet the demands of the district. There is at the present time about 5 feet of water in one of the reservoirs, and about 8 feet in the other; but the water is low, and these figures do not by any means represent top water. The whole of this could be rushed through the mains in 24 hours; and the grave state of affairs may be seen when it is stated that there is only enough water now in the reservoirs to last a week, perhaps, at the most, at the restricted supply of five hours per day. It is quite possible that this is not the limit of supply that will be reached in case the clouds are not more kind. The scheme promoted by the Company before Parliament would have provided Chesterfield with a continuous supply for twelve or fifteen years to come, and made provision for 400 days' use. The present storage capacity of the Company is 156 million gallons. The gathering-ground covers 1300 acres; and by the hills about Chatsworth and other parts of the country farther away the clouds are denuded of a good deal of their water before Linacre is reached." Mr. Jones gave the interviewer his theory as to the recurrence of dry and wet seasons. It was that weather repeats itself, as does history, and that there are cycles of wet and dry seasons—the cycle extending over not seven but eleven years. He thinks we are now in the fourth year of a cycle of dry weather.

EXETER WATER SUPPLY.

Important Extensions of Works Suggested.

The question of the improvement of the water supply has lately been under the consideration of the Exeter City Council. The Water Committee reported at a recent meeting that the subject had received their serious consideration for some time past. Each succeeding summer showed an increased demand, and the time had arrived when there should be an increased supply together with an improvement in the filtration. A report by the City Surveyor (Mr. Cameron) estimated the demand for water thirty years hence at 2,550,000 gallons per day, or an increase of about 750,000 gallons daily on the present maximum demand. The total filtering area required was 70,000 feet; and there being no land in the vicinity of the reservoirs where filter-beds of this area could be constructed, he suggested that new ones be made at Pynes. He estimated the total cost of the works required at £16,245; including £5500 for new filter-beds, £1600 for engine and boilers, £4295 for a rising main, £2600 for an intermediate reservoir, and £1125 for an engine and boiler at Dane's Castle. If the alterations were made, there would be a reduction of £100 or £150 a year in the working expenses, and a plentiful supply of properly filtered water. It would be worth while to consider what gain could be effected by having the principal pumping-station under the same roof as the electric lighting works. Though it would not be possible to take refuse to any of the pumping-stations, no objection could be raised against bringing the water in a closed conduit to a place where sifted town refuse could be used for raising steam. If a site for such a station were selected in Exe Street, a new 15-inch main would have to be laid, involving an additional outlay of not more than £1000. Instead of suggesting the construction of a destructor, he recommended the making of producer gas; but such a scheme as this would need further consideration, though this need not delay the resolution to construct the filters and proceed with other parts of the works. The Water Committee recommended that they should be authorized to obtain opinions from gentlemen of recognized experience and authority upon the suggestions of the City Surveyor. Mr. Fulford, the Chairman of the Water Committee, in moving the adoption of the report, pointed out that the expenditure would amount to £20,000 or £22,000; the Surveyor's estimate being £16,500 without the acquisition of land, wages, and contingencies. Mr. W. Wreford seconded the motion; and it was carried.

PLYMOUTH WATER SUPPLY.

Considerable discussion took place at a recent meeting of the Plymouth Town Council on a motion challenging the decision of the Water Committee to complete the construction of the Burrator reservoir without the intervention of a contractor. Mr. J. T. Bond, the Chairman of the Water Committee, said the resolution no doubt pledged the Council to the expenditure of a large sum of money; but it was part of an expenditure sanctioned so long ago as 1892. About one-half of the whole sum likely to be involved had been laid out. The Committee had so far done the whole of the work themselves, by the sanction of the Corporation; and it was a piece of work of which all connected with it, as well as the ratepayers, were distinctly and justifiably proud. The pipe-line for Burrator to the service reservoir at Hartley had been completed by their own labour, and under the direction of their own staff, well within the estimated amount. The land for the reservoir had been bought at less than the estimate; and with half the work done, the total sum expended was below the mark. What had been accomplished was the best possible evidence why the recommendation of the Committee should be adopted, and a consistent course maintained from start to finish. A contractor would primarily work for a profit; the Corporation would, of necessity, primarily work for a perfect and lasting memorial to commemorate their labours. He was satisfied that ninety out of every hundred ratepayers were in favour of the Corporation doing the work; and the Committee of the Operative Stonemasons' Society had memorialized the Committee in favour of this course. Another reason for going forward on the lines proposed by the Committee was that any change now would involve negotiations which would cause serious delay of the work. Mr. J. A. Bellamy asked whether Mr. Mansergh, the Consulting Engineer to the Corporation, had expressed any opinion as to the desirability of the Corporation constructing the masonry dam, and also with regard to the employment of a firm of surveyors to get out the quantities for the work. Mr. Bond replied that Mr. Mansergh was strongly of opinion that the Corporation should do the work at Burrator themselves. The other question was one of detail, which could well be left to the Committee. It was merely a matter of expenditure involving a sum of £300 to £500. Alderman Shelly said the question of whether or not they should do the work themselves was of great importance; but, after the opinion expressed by Mr. Mansergh, and the explanation of Mr. Bond, he was satisfied on this point, and advised the withdrawal of the motion. After some further remarks, this course was adopted.

THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD WATER COMPANY.

A short time ago, the City Engineer of Newcastle-upon-Tyne (Mr. W. G. Laws, M.Inst.C.E.) visited the new works of the Newcastle-upon-Tyne and Gateshead Water Company now in progress, with Mr. Charles Hawksley, M.Inst.C.E., their Engineer. The whole of the works—from Ramshope, near which place the Catcleugh reservoir begins, to Woodford Bridge, where the Rede water is delivered into the old aqueduct leading from Little Swinburn to Hallington—were inspected; and Mr. Laws has since presented a report thereon, from which we make a few extracts.

Commencing at Ramshope, near the head of the proposed reservoir, the work now in progress is that of exploring the site by cutting trenches across the bottom through the loose river drift and down to the water-tight strata, so as to prove their continuity. There are five or six of these trenches now open. On the site of the proposed dam at Catcleugh, the same operation of proving the depth of the water-tight stratum below the surface, and its thickness, is being carried on, but in rather a different manner—viz., by the sinking of trial pits on the line of the puddle trench down to, and in most cases for some distance through, the water-tight shales. The deepest of these pits is about 102 feet from the present surface; and some of them extend to about 40 feet below the level of the river-bed. This work of exploration is always, or ought always to be, done on the site of a projected dam; and, in this instance, it is being carried out with unusual care and completeness. There are eleven pits at present sunk, or being sunk; and the work goes on night and day. About 300 men are employed, and preparations for a much larger number (in the way of huts, &c.) is being made; so that as soon as the exploration is so far complete that the exact position of the puddle trench can be fixed, there need be no delay in pushing the execution of the work with all safe speed.

A short distance above the site of the reservoir dam, and so far as to be clear of the present work, a small timber dam about 3 or 4 feet in depth has been constructed across the river-bed. In this dam are formed two submerged openings, or slot gauges, about 21 inches below the top. These openings are of such a size that, when submerged to the depth of a foot, they will pass, if both be open, 4½ million gallons per day; and if the smaller one only is open, 2 million gallons. These are the respective quantities of compensation water to be delivered to the river at the different seasons—viz., 2 millions for the nine months from May to January, and 4½ millions in February, March, and April. Above the dam a temporary intake and recorder-house is constructed, with a grid next the river and wire-gauze strainers to strain off floating matters, and a weir of which the crest or upper surface is just a foot above the level of the submerged gauges in the river dam already described. The effect of this arrangement is that, so long as the water in the river is less than the compensation water required by Act of Parliament to be discharged during the season, it all passes through the gauge openings in the river dam; and so long as its level never rises more than a foot above these compensation gauges, no water can get over the intake weir into the main. So soon as the water in the river exceeds 2 or 4½ millions, as the case may be, the level in the dam rises higher than a foot above the gauges in the dam; and consequently water falls over the recorder-house weir and into the intake of the main until this carries off its full capacity—say, 8 millions.

The permanent 30-inch pipe is now laid from Catcleugh to Brig, a distance of 13 miles; and from Brig down to Woodford Bridge, another 13 miles. At Brig it is intended to construct a break-pressure reservoir. This will be almost exactly central between Catcleugh and Woodford Bridge; and it is also on the hydraulic gradient—that is, on a line drawn on the section from the point of intake to the point of delivery. The point of intake at Catcleugh outside the reservoir will be about 730 feet above Ordnance datum; the point of delivery to the old aqueduct at Woodford Bridge is 530 feet above the same datum; and the Brig break-pressure tank will be at 630 feet. The total fall of 200 feet is thus divided into two parts of 100 feet on each 13 miles of pipe; making the head on each section the same, and therefore the delivery practically equal. The proposed water-level in the Catcleugh reservoir, when full, is 810 feet above Ordnance datum; but as the intake-pipe does not enter the dam, but takes its water from a gauge-tank outside, which is open, there will be no variation in the head of water on the main from any change in the water-level in the reservoir as it is more or less full.

From Brig downwards, there is nothing to remark upon until Woodford Bridge is reached, where the water from the Rede is delivered into the Swinburn and Hallington aqueduct at a point about half a mile below the Little Swinburn reservoir. Here a gauge-house is being erected, with measuring weir and recording apparatus, similar to, and as complete as, those at the Whittle Dene filters. By this apparatus, it will be possible not only to measure and record the quantity of water coming down from Catcleugh, but also (after it has been rated), inferentially, the amount passing down from Little Swinburn and Colt Crag. At the time of the visit, there were 2⅛ inches of water on the gauge weir, which would correspond with about 1½ million gallons passing over. It is estimated that, while the Rede was in flood, as much as 10 millions have passed over per day; but that the average discharge has been about 3½ millions. It is possible that, the pipe being new, 10 millions a day might pass; but it would not be safe to reckon on more than 8 millions when it is in regular work. The latter part of this season has been favourable; so that since June there has been water enough in the Rede to provide the compensation water, and an average of (say) 3½ millions besides.

Assuming that it will be possible to reckon on an average, over the year, of 3 millions, this would supplement the present storage by about 1000 million gallons, and certainly should enable the Company to commence the season with full reservoirs, which has not been the case since the winter of 1892-3. This should make them secure until the Catcleugh reservoir is complete, when the storage will be roughly 5000 millions, backed by any surplus of the Rede over the ascertained amount to be delivered to the river after January, 1902. By that time it may be hoped that the efforts of the Company to check leakage, and the joint efforts of the Corporation and the Company to check waste, will have reduced the consumption per head to a more moderate figure.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This is the season when candidates for seats at municipal boards make their onslaught upon the communities. Generally speaking, those of them who are possessed of the highest wisdom say least; while those with the least wisdom, are very voluble. It is among the latter that the men of one idea—the faddists—who want the Corporation to build workmen's houses, to find work for the unemployed, and such like matters, are to be found. With them we have nothing to do here; but there is a type of candidate, in towns where the gas supply is in the hand of a company, who thinks to find favour with the electors by denouncing the company. In towns where the gas supply is in the hands of the corporation, if he be a sitting member, he usually defends the policy of the committee who manage the gas-works; and if he be a new candidate, he attacks them. Whichever way he inclines, his talk is, as a rule, quite ephemeral; for after the elections are over there is seldom any public result from it. But no falsehood can be told without being followed by pernicious effects; and no misrepresentation can be made without doing harm, it may be to the man himself, by lowering his own self-respect, but almost to a certainty it will be harmful to the gas consumption, in consequence of the prejudice it creates in the minds of individual consumers. There is another occasion when public men lower their dignity; and that is when there is a proposal on foot for the acquisition of a gas company's undertaking. To depreciate the article you wish to buy is a fixed point in the creed of many commercial men. Provided it is done fairly, there can be no objection; but if otherwise, evil consequences result. In the horse market, such practices can be, and are, indulged in with impunity; but in the case of a public question, they are apt to have after-effects. Take the case of the Falkirk gas transfer. There were some who could not sufficiently run down the Gas Company. Now it is seen that all their abuse was a mockery; and they have had to "hide their heads." The other evening Provost Griffiths, to whose high talents I bore testimony last week, intimated his intention to retire from public life, and stated that he had been ostracized from the Committee who had charge of the taking over of the gas undertaking for venturing to assert that the cost would be from £60,000 to £80,000. He went on to say that they had spent over £8000 in the process of acquiring the undertaking, and that they had paid a higher price than they would have done had they arranged the matter in Falkirk rather than in London. The Provost is right. I think I told them more than once, while they were negotiating, that they were going the wrong way about the matter, when they set up hostility in the Gas Company instead of approaching the subject with an open mind and in a friendly spirit. These remarks may be taken as a warning to those who may be contemplating the acquisition of local gas undertakings.

That this warning is not altogether unnecessary, will be apparent when I state that at Brechin, where there is a proposal in the air (though not in very definite form) for the taking over of the Gas Company's undertaking, Provost Vallentine told the Town Council that he thought they ought not to pay their gas account, because the gas they had been supplied with for some time was simply abominable. Whereupon several members of the Council gave voice in the same direction, as if they were a pack which had just found a good cry. One said it was a scandal to any civilized city (the people of Brechin always speak of the place as a city, on the ground of some eminence which has palpably "long since passed away"). Another said that as the quality of the gas was at least 50 per cent. below what it ought to be, he intended to deduct 50 per cent. from his account; and he would recommend all other consumers to do the same. Still another said the gas was not equal to two candles. Then rose one member, who is evidently acquainted with the affairs of the Gas Company, and who informed them that the oil gas retorts at the works had been taken out and the new ones had not been got into work; and that the Directors were as much annoyed as anyone at the bad quality of the gas. There would, in this case, seem to have been some foundation for the complaints; but it could only have been for a few days, and was not worthy of the dignity of a full dress discussion in the Town Council, unless there had been a prior feeling towards a showing up of the Gas Company. This appears from, as much as anything, the fact that no resolution on the subject was arrived at, or even submitted.

The subject of the taking over of the Gas Company's undertaking is at present agitating to its very depths the community of Dunfermline. I must say that the agitation in this case has started more fairly than in any instance with which I am familiar. The proposal is that the Burghs Gas Supply Act of 1876 shall be adopted. The Council have already agreed to its adoption, and are waiting, according to statute, till the electors shall have considered it. In these circumstances, I regard it as highly creditable to Provost Walker that he, before the annual meetings of the electors, called the community together in order that he might explain the situation to them. As a further instance of his desire to deal with the subject fairly, I may state that, after calling the meeting, he discovered that the place at which it was to be held was engaged, and altered it to a smaller hall, which was found to be altogether incapable of containing the number who wished to attend; and that then he postponed a visit to London, at great inconvenience, in order that the meeting might be held before the meetings of the electors to choose their representatives. The meeting took place on the succeeding night, and was attended by about 1200 persons. Provost Walker made a long speech in favour of the adoption of the Act. I may say that Provost Walker, who is a large manufacturer, employs electric light in his works; and is satisfied with it, though it costs him one-half more than gas did. When this is considered, his fairness of mind will be the more appreciated. He threw no stones at the Gas Company. From beginning to end of his speech, there was not a single complaint of anything they have done. I was particularly pleased with the following passage: "They need not expect to secure the works below their real value. He knew that there were peculiar ideas regarding the Gas Company's shares; but, as was done in every other business, the shareholders took a part of the money they made in interest, and spent it in extending and improving the works, until they had a larger capital than they originally had. It would be neither right nor just that they should expect to buy the works at their original value. If a man saved £50, and then started business and made £500, would it be a right thing to say to him—'You must hand over your business to me for the £50 capital you started with, because we will not recognize anything you have made since'?" That is the right principle to begin negotiations with. Provost Walker then went on to tell them the folly there would be in attempting to start rival works, which, he said, might result in their ruining the Gas Company; but it would cost the town a great amount of money. Then he dealt with the possible objection of the electric light superseding gas, and said he had seen it stated that they wanted to force the matter on the community because gas was on the backward track. But he had written to a number of places where electricity had been introduced, and the replies showed that in every one of them except Brighton, the gas consumption was increasing. Hundreds of people in Dunfermline, he was told, did not use 1000 cubic feet of gas (3s. 7d. worth) in a year. It would cost those people as much for globes (lamps?) if they used electric light, as they paid for gas. He thought it would take a much bolder man than him to introduce an installation of electric light into Dunfermline. He advised them to adopt the Act, not necessarily in order that they might at once take over the Company's undertaking, but that they might be in a position to negotiate. A discussion followed, in which the opinions expressed were in accordance with the Provost's view; the only additional matter introduced being that they should not pay a fancy price, which was quite reasonable. The meeting was simply one for discussion; and the subject was laid before the electors at their annual meetings on Wednesday night. Nearly everyone spoke on the subject; and there were, I think, only one or two who did not favour the adoption of the Act. It came out, however, in some cases that the desire to adopt the Act was founded on the notion that with it in their hands they would have a compulsitor with which to approach the Gas Company in the matter of the charge for public lighting. This is not so satisfactory, and shows that everyone in Dunfermline is not so upright in public matters as Provost Walker. One gentleman entered upon the subject of price, which he said might be, by one method of calculation, £75,000, and by another method £100,000. Two gentlemen thought it was too late in the day to acquire a gas undertaking; but they would not oppose the adoption of the Act. It is evident that there are mixed opinions on the subject; and the further progress of the movement will require to be watched, because, with the notions prevailing, there is danger of the Corporation getting into trouble.

The progress of the gas industry at Hamilton is a fertile subject of comment in the Corporation, by whom the gas-works were bought in 1861. During the past week several ward meetings were held, at which gas affairs figured prominently. Mr. Purdie, as a member of the Gas Committee, was able to speak as with authority on this subject. He contrasted the figures for the years ending 1892 and 1895. In the former year, the quantity of coal used was 7515 tons, and this year, 7772 tons; while the output of gas was respectively 61,738,900 and 80,623,100 cubic feet. The tar and liquor made in the former year amounted to 372,965 gallons, as compared with 546,458 gallons; and the quantity of coke sold in 1892 was 1353 tons, against 3067 tons in 1895. There was thus an increase of 257 tons of coal used, while there was an augmented make of gas to the extent of 18,884,400 cubic feet. In respect of tar and liquor sold, there was an increase of 173,493 gallons; and the increase of coke sold was 1714 tons. Through the reduction of 10d. per 1000 cubic feet in the price of gas last year from the 14th of March, the revenue for this year had been reduced to the extent of £2725 11s. 4d.; but, notwithstanding this great reduction, they had a gross profit for the year ending March, 1895, of £2408. The total revenue for the year was £10,282, which was upwards of one-half of the total revenue of the burgh exclusive of the Common Good. Referring to the last enlargement of the works, he remarked that there was an Engineer of high standing (Mr. Barr, of Glasgow) appointed to superintend the works. Now, however, with far more extensive additions and alterations in fact, a new gas works—Mr. Ewing, their most esteemed Engineer and Manager, was doing all the engineering work in connection with the new undertaking, and, to all appearance, in a thorough and most efficient manner. This would be a saving to the town, perhaps, of nearly £1000, because the cost of the works, when completed, would not be much less than £20,000; and, beyond

that, the salary of an inspector had been saved. The whole work of the management was, therefore, surely worthy of very fair credit. Bailie Hamilton, the retiring representative in the Second Ward, gave credit to the Convener of the Gas Committee (Mr. Brown) for doing his work faithfully and well, in conjunction with their able and energetic Manager. At the same meeting some remarks were made on the gas affairs of the burgh which were in a very different key, as might be expected when it is mentioned that the speaker was Bailie Tainsh, who seems to like the *rôle* of objector-general to almost everything that is done by the Committee and the Manager. His criticism was very fully replied to at the meeting of the Third Ward by Mr. Brown, whose constituents thoroughly enjoyed his free handling of Bailie Tainsh and his co-objectors to the extension of the works now in progress.

Dr. M'Lachlan, a Town Councillor of Dumbarton, has just been telling his constituents some interesting facts as to the progress of the gas industry in the town. In 1864 the price of gas was 6s. per 1000 cubic feet, and over and above that, there was a charge for meters. At that price the gas did not pay, but left a considerable deficiency. From 1875 to 1895, under the present management, there was a clear profit on the gas of £1000 yearly. During that time, gas in Dumbarton was cheaper than in any other town similarly situated. The present price of gas in Dumbarton is 3s., with no meter-rents, and 2s. 5d. for public lighting. From 1875 to 1895, £14,000 has been obtained in the shape of gas profits and applied to the reduction of capital, *plus* £6000 to the Common Good, which had gone for the upkeep of the Clyde Pier and the public park. This spoke volumes, he said, for the management of the local gas-works.

The Forfar Gas Corporation have fallen on evil times; but these are of their own making. Mr. Forbes Waddell, the Manager, has been only a short time in his position; but he has done good work for the Corporation. I know I may wound the feelings of some gas managers, as I have done before on this subject; but, in order to protect Mr. Waddell, it is necessary to state that he got the works in a condition which required a good deal of "redding up." In this, he has received only divided support. The works were over-staffed with workmen; and when he was urged to reduce his wages bill, and attempted to do so, some of the Commissioners objected. He got his way then, however, and things looked as if they had settled down; but the trouble has broken out again. There were two foremen in the works. Mr. Waddell thought that one, with himself in active superintendence, was sufficient; and as he was not satisfied with one of the foremen, he reduced him, offering him a situation to break coal. My reading of what took place after that is that the man, forming a hostile spirit to Mr. Waddell, began to talk outside the works about certain pipes and bends which Mr. Waddell had sold, and about the quantity and quality of tar and liquor. For that, Mr. Waddell dismissed him. The workman then presented a petition to the Corporation for reinstatement. This petition was considered by the Corporation on Monday. A scene of great and lamentable disorder ensued, which it would be impolitic to enter into. It is sufficient to say that the proceedings were not conducted with any approach to judicial forms—in fact, the members seemed to have made up their minds on the one side or the other, and to have come prepared for a field night. The supporters of the workman endeavoured to make out that Mr. Waddell was lax in the matter of not entering coal unpaid for in the balance-sheet; of entering the pipes at 6s., and then selling them as old iron for 1s.; and in representing that there was more tar and liquor in stock than was actually the case. If these things were to have been charged against Mr. Waddell, they should have been brought up and disposed of separately—they are of sufficient importance for that—instead of being mixed up with a question of dismissing a workman. But, of course, that was not the card they wished to play. It is sufficient to show that their charges were not serious that no proposal was made to have them so dealt with. Mr. Waddell's explanations were that the coal account had not come in; that the pipes were sold because they were old, and time was wasted in fitting them; and that he informed the Commissioners of the quantity of tar and liquor, and that it was under quality. As the Commissioners themselves did not seek to substantiate the allegations, it may be taken for granted that Mr. Waddell was correct. This being so, the true nature of the proceedings comes out; they were simply an attempt to break the authority of the Gas Manager, in the interests of the workmen. This much appears from the statement very irregularly made by one of the workmen, that he was never more disgusted in his life than he had been under Mr. Waddell. The workmen wish the works to revert to the easy ways of old times—which, of course, will not do—and they are able to move some of the Commissioners to their view. It is truly disgusting to think that this should be the case; but so it seems to be. These men have not yet secured a majority in the Corporation; but they are very near it. When a division was taken as to whether this workman was to be reinstated or not, six voted in favour of reinstatement, and seven against. Provost M'Dougall, who headed the majority, put it very sensibly when he said that the management of the works must be left entirely in the hands of the Manager. That view prevailed this week; but notice of motion was given to the effect that the power to dismiss men should be taken out of the hands of the Manager, and placed in the hands of a Committee. To do so, would be more than folly; and it is to be hoped—not for Mr. Waddell's sake alone, but in the interests of other gas managers—the motion may never be adopted.

The shareholders of the Cupar Gas Company met on Thursday, and resolved to form the Company into a limited liability one. The proposal was made by the Chairman, and was opposed; but the opposition only counted 17 votes, as compared with 153 votes in favour of the change.

Last night there was an explosion in an electric light box at the corner of West George and Renfield Streets in Glasgow; and the cover of the box was blown off. A lad who was passing was struck by the cover, and was so severely injured that it was necessary to take him to the Royal Infirmary.

The financial statement of the Perth Water Commissioners for the year ending Sept. 30 shows that the income amounted to £6473, and the expenditure to £3242—showing an excess of receipts of £3231. After wiping off the debit balance of £294 at the beginning of the year, providing £1505 for interest on debt, £1021 for instalment of debt to Insurance Companies, and £218 for the sinking fund, there is a balance on hand of £192. Of the income, £6175 was received from assessments, and £297 from rents. The principal items of expenditure were: Wages and salaries, £854; coal and gas, £645; engineer work, £210; pipe-tracks, £101; meters, valves, &c., £98; expenses of electric lighting, £76; management, £429; public burdens, rents, feu-duties, £543. During the year, £500 of the sinking fund was applied in payment of bond; and the sum at the credit of this account now stands at £232. The total amount of the debt at present is £39,178. The amount of the assets is stated at £64,901, of which £62,573 is put down as value of the works; the remainder being cash in bank and in Treasurer's hands.

On the instruction of the Wishaw Police Commissioners, bores have been put down to ascertain if a suitable supply of water for the town could be got in the neighbourhood. The Commissioners, at a meeting some time ago, differed as to the quantity of water obtained from the bores; and they then asked Mr. J. M'Callum, of Motherwell, to make a gauge of them. This has now been done, and Mr. M'Callum's report brought out a quantity of about 30,000 gallons per day less than had been previously reported. Samples of the water have been analyzed by Dr. Tatlock, of Glasgow, who has reported that the water is hard, being from 16·95 to 21·80; and that it also contains iron in solution, becoming turbid on standing, and depositing flakes of brown oxide of iron. It also contains a considerable amount of both free and albuminoid ammonia, which, though it may not be from sewage sources, is nevertheless objectionable. The water from one of the bores is free from ammonia, but it is the hardest of all. The Commissioners resolved not to proceed any further with the boring.

The Police Commissioners of Arbroath have for a number of years had trouble with the water supply to the town, which is pumped. To pump water for town supply in Scotland, where there is so much water which could be got by gravitation, looks almost absurd. Arbroath is, I think, the only town in Scotland of any size where it is done; and I suppose the reason has been that a considerable distance would have to be gone before a suitable elevation could be got for a water supply. The matter has been forced upon the Police Commissioners, however, by the failure of the supply from the wells. Last week the Commissioners had before them a report by Mr. J. Wilson, of Edinburgh, on the water supply, in which it was stated, as the result of three months' continuous pumping night and day, that the supply from the Nolt Loan Wells and from the experimental well at Warslap had diminished—the former from 171,000 to 141,000 gallons per day, and the latter from 211,000 to 130,000 gallons. The report continued: "As sufficient water for the wants of the town is not being got at present from the Nolt Loan Wells, it would be necessary to supplement the supply by pumping at the Warslap Well. I think it is unnecessary, however, to carry the pumping tests any further; and the Commissioners would require to consider whether it would not be advisable, as formerly suggested, to go for a gravitation scheme, and after its completion to abandon the pumping altogether." After discussion, the Commission, in accordance with a recommendation of the Water Committee, resolved, by a majority of 10 votes to 8, to approve the report.

A Ghastly Discovery at Beckton.—The Central News says: "The skeleton of a man has been found in a coal heap at the Beckton Gas-Works. It is believed that it had been there since the coal was stored about nine months ago."

The Water Scheme for Malvern Link.—The result of the poll in the Malvern Link district upon the water scheme which the District Council propose to carry out is a majority of 304 votes in its favour Some particulars as to the scheme proposed have already appeared in the JOURNAL (see *ante*, p. 645).

Alleged Deficient Water Supply in the Rhondda Valley.—Arbitration proceedings have been commenced (and adjourned till the 8th prox.) in the matter of a complaint by the Ystrad District Council—acting under section 52 of the Public Health Act—to the effect that the Ystrad Gas and Water Company were not willing and not able to supply the district with a proper and sufficient supply of water for all reasonable purposes for which they were required to so provide by the local authority. The matter was originally referred to Mr. G. Chatterton, M.Inst.C.E., for the Council, and Mr. G. H. Hill, M.Inst.C.E., for the Company; but these gentlemen having failed to determine the differences that exist, the appointment of Sir Benjamin Baker as Umpire was agreed upon. The proceedings were private; but it is reported that Mr. Cripps, Q.C., opened the case at great length for the Council, after which evidence in support of their contention of insufficient supply was given. A large number of expert witnesses are yet to be called—including Mr. Deacon and Mr. Middleton.

Labourers' Wages at the Leeds Gas-Works.—The labourers in the service of the gas mains and meters department of the Leeds Corporation are agitating for an increase of remuneration. About 150 men are interested in the movement. Some of them, it is stated, have been receiving as little as 4½d. an hour, which they contend is too little for the class of work they have to do. The subject came up for discussion at a recent meeting of the Gas Committee, when it was decided to leave the consideration of it to the new Committee which will be appointed after the elections. The officials of the local branch of the Gas Workers' and General Labourers' Union (of which most of the labourers are members) wrote, however, urging that the Committee should forthwith give them an answer to their demand. A special meeting of the Gas Committee was in consequence held last Friday. A deputation from the labourers, headed by Mr. T. Paylor and Mr. Smith, of the Gas Workers' Union, attended, and pleaded their case. After a sitting of a couple of hours, the Committee decided to adhere to their former resolution. The Chairman, however, informed the deputation that they would recommend the new Committee appointed after Nov. 1 to favourably consider the men's demands, with one exception. Messrs. Paylor and Smith informed a meeting of the men on the same day of the promise the Committee had given. It was decided to take no further action in the matter at present; but to await the decision of the re-constituted Gas Committee.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 26.

Sulphate of Ammonia.—The larger demand for covering contracts, referred to in the last report, led to a further advance early in the week. But pressing requirements being satisfied, the orders have dropped off; and, in consequence, the market has assumed a quieter tone, with a return to last week's prices—the closing quotations being £9 to £9 2s. 6d. per ton f.o.b. at the ports. From this, it seems pretty clear that the interest of the operators is still in low prices. Consumers generally did not follow the advance to any great extent; and their attitude is unchanged. They would still be buyers at a shade under closing quotations for prompt delivery; and for forward delivery, they would pay a moderate premium. But prices asked for delivery over spring months are not sufficiently tempting to induce much business.

Nitrate of Soda is quiet on spot; but, in the forward position, there is a better feeling, notwithstanding heavy October shipments. On spot, fine quality may still be had at 7s. 9d. per cwt.; but for refined quality, late autumn shipment, something over 8s. would now have to be paid.

LONDON, *Oct.* 26.

Tar Products.—Benzols maintain the firmness noted last week. An unsuccessful effort, however, has been made by the Continental buyers to depress benzol. Important business has been done at 1s. 3d. and 1s. 2d. respectively for 90's and 50's, which are the best prices that have been obtained for a very considerable time. Gas manufacturers are now recognizing the great superiority of benzol over all other carburetters for enriching gas; and in cases where deposited naphthalene is troublesome, the use of benzol is of great value and extremely effective. There is a good deal of inquiry for anthracene; and notwithstanding the unscrupulous attempts to wreck this product, it is in better demand and value than it has been for some time. Both buyers and sellers will be interested to know the Tar Products Sales Committee have been unanimously renewed for a further long period. Pitch is not quite so firm; and as the large make is now coming on, it is not unlikely prices may be easier. Naphthalene salts are in excellent request; and a fair business is being done in carbolic acids. The following values have been realized during the week: Tar, 19s. to 23s. 6d. Pitch, 35s. west coast; 38s. east coast. Benzol, 90 per cent., 1s. 3d.; 50 per cent., 1s. 2d. Solvent naphtha, 1s. 2½d. Toluol, 1s. 3d. Crude, 30 per cent., naphtha, 5d. Naphthalene salts, 25s. to 40s., according to quality. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic, 60's, 1s. 6d.; 75's, 1s. 9½d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia is in good request at the advanced prices. Buyers have no doubt held off as long as they possibly could; and this accounts for the heavy shipments which are now taking place. The stocks held by makers are extremely low; and it is reported, on the best authority, that the large Continental consumers have practically no stocks at all. Extensive contracts have been made during the week for early delivery at £9 to £9 5s., less 3½ per cent., according to port of delivery. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the close of the month, there is here and there some slight levelling-up in prices, to the extent of 3d. to 6d. per ton, where they have previously been exceptionally low. This, however, is confined chiefly to some of the medium qualities; and so far there is nothing approaching any general upward move in prices, as supplies are still too plentiful, and pits have barely yet got on to full time. The winter weather during the last week has necessarily given more activity to the demand for the better qualities of round coal, suitable for house-fire purposes, in which there is a fair business doing; but the lower qualities of round coal, for iron making, steam, and general manufacturing requirements, still hang upon the market, with supplies excessive. At the pit mouth, best Wigan Arley remains at 10s. to 10s. 6d. per ton; seconds Arley and Pemberton four-feet, 8s. 6d. to 9s.; common house coals, 7s. to 7s. 6d.; and steam and forge coals are not fetching more than 6s. to 6s. 6d. A very moderate business comes forward in engine classes of fuel; and some collieries report a scarcity of supplies. But this is by no means general; the quantity of slack offering on the market being ample for requirements, with prices not more than maintained at 3s. to 3s. 6d. for common, to 4s. 6d. and 5s. per ton for better qualities. The increased requirements for slack suitable for coking purposes may, however, take a good deal of engine fuel off the market, and thus tend to harden prices; and colliery proprietors in some cases are chary about contracting forward. For shipment, business continues very limited; and ordinary steam coal has been sold at as low as 7s. per ton delivered at the Garston Docks. Better qualities of steam coal are quoted at 7s. 6d. up to 8s. per ton delivered at the Mersey ports.

Northern Coal Trade.—Through the week, the variation in the northern coal trade has been more in the volume of the trade than in the prices; and this is due largely to the change that usually takes place when the ports of the North, and especially in the Baltic, are beginning to close. The effect has naturally been most marked in the steam coal trade; because the increase in the demand for gas and household coal for the inland more than counterbalances any falling off in the exports of those qualities. The price of best Northumbrian steam coal has not been much affected by the variation in demand; and it is to-day 8s. 6d. per ton f.o.b. Second-class steam coals are quoted 8s. per ton also f.o.b. The irregular working of some of the collieries has reduced the output of small steam coal, and made it rather scarce; so that the price of this quality is decidedly firm at 4s. per ton. In regard to manufacturing coals, the contracts have just been signed for the largest quantities used by any one local company; and they are substantially at the same prices as those that will expire with the year—one or two of the lots showing an advance of 1d. to 1½d. per ton only. Gas coals have steadily maintained their prices; and as the large deliveries will be further increased with the beginning of November, it may be supposed that the rates will be stiffened for any additional quantities. At present, the price varies as much as from 6s. 6d. up to 7s. 3d. per ton f.o.b.; but it is well known that the deliveries are under contracts at much lower prices—from 6s. to 6s. 3d. per ton f.o.b. Coke is dearer, owing to the larger demand from the blast furnaces, both locally and for the north-west; and thus, though the Baltic demand is less, the price is on the whole rather higher—as much as from 14s. to 15s. per ton f.o.b. being asked, while 14s. 9d. has been actually paid for shipment. Gas coke varies with different companies. Some of the inland producers have large stocks; but at the waterside, the large demand for shipment lessens the stocks, though production is increasing. For this use, the price is about 10s. per ton f.o.b., or perhaps equal to 8s. 6d. per ton at the works.

Scotch Coal Trade.—There is, if anything, an improvement in the demand for coal; but values do not rise. The output is very large. It is stated that in Lanarkshire alone 20,000 tons per week more are being put out than was the case very recently. Several coal companies have issued their annual reports, and all speak of losses. The Lothian Coal Company, who are owners of the Newbattle cannel, lost £10,000 by the strike of the miners last year. Another item they report is that the price of cannel is now £1 per ton lower than it was when at its highest. Splint coal is said to be very plentiful, and is being pressed on the market. Steam coal is in good request, and offers to continue so; the manufacturing industries being well employed. The prices quoted are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s. od.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 148,775 tons—a decrease, as compared with the preceding week, of 14,653 tons, but an increase as compared with the corresponding week of last year of 60,393 tons. For the year to date, the total shipments have amounted to 5,922,426 tons—an increase when compared with the corresponding period of last year of 1,963,880 tons.

The Water Supply of Perranporth and St. Agnes.—A movement is on foot for the formation of a Company to supply water to the Cornish villages of Perranporth and St. Agnes. It is said that the capital will be £9000, in £10 shares.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 869.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	26 Oct.	10½	Alliance & Dublin 10 p. c.	10	24—25*	..	4 4 0
200,000	10	..	7½	Do. 7 p. c.	10	16—17*	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb	100	107—109	..	4 21 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼—7½	..	4 3 10
40,000	5	..	5½	Do. New	4	5¼—5½	..	4 20 3
350,000	Stock	14 Aug.	12	Brentford Consolidated	100	253—256	..	4 13 0
180,000	..	..	9	Do. New	100	207—212	+2	4 4 21
220,000	Stock	27 Sept	12	Brighton & Hove Original	100	227—232	+5	4 14 10
933,500	Stock	25 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	27 Sept	10½	British	20	54—56	−½	4 1 10
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	25½—25¾	..	4 17 10
50,500	10	..	8½	Do. 7 p. c.	10	18—19	..	4 9 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8½—9	−⅛	4 5 11
200,000	100	2 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	37—38	..	5 0 0
550,000	Stock	26 Oct.	13½	Commercial, Old Stock	100	325—328*	+13	4 4 11
765,000	..	..	10½	Do. New do.	100	232—237*	−9	4 8 7
160,062	..	12 June	4½	Do. 4½ p. c. Deb. do.	100	145—147	..	5 1 3
800,000	Stock	12 June	13	Continental Union, Limited	100	276—289	−2	4 11 10
200,000	..	..	10	Do. 7 p. c. Pref.	100	215—220	..	4 11 10
555,000	Stock	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	128—130	..	4 0 9
486,000	10	26 July	11	European, Limited	10	25½—26½	..	4 5 0
350,000	10	..	11	Do. Partly paid	7½	17—18	..	4 14 5
5,626,590	Stock	12 Aug	12½	Gaslight & Coke, A. Ordinary	100	293—297	−1	4 5 10
200,000	..	..	4	Do. B 4 p. c. max	100	107—110	..	3 11 5
665,000	..	..	10	Do. C, D, & E, 10 p. c. Pf.	100	282—287	..	3 9 8
30,000	..	..	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	..	..	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,500,000	..	..	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
465,000	..	..	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
400,000	..	..	6	Do. K 6 p. c. Prf.	100	167—170	..	3 10 7
1,062,250	..	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	..	..	4½	Do. 4½ p. c. do.	100	145—150	..	3 0 0
900,000	..	..	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stock	30 May	12	Imperial Continental	100	245—250	−2	4 16 0
75,000	5	26 June	6	Malta & Mediterranean, Ltd	5	6—6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne 5 p. c. Deb	100	115—116	..	4 6 2
541,000	20	12 June	5	Monte Video, Limited	20	18—19	..	5 5 5
150,000	5	24 May	8	Oriental, Limited	5	7½—7¾	..	5 3 2
60,000	5	12 Sept	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	20	14 Feb	2	Para, Limited	20	1½—2½	..	8 0 0
				People's Gas of Chicago—				
400,000	100	2 May	6	1st Mtg. Bds.	100	108—112	..	5 7 1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	28 Oct.	7	San Paulo, Limited	10	11—12*	−½	5 16 8
500,000	Stock	29 Aug	13½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	..	..	12	Do. B do.	100	308—313	−2	3 16 8
308,625	..	..	13	Do. C do.	100	345—350	..	3 18 9
500,000	..	31 July	5	Do. 5 p. c. Deb. Stk.	100	174—177	..	2 16 2
600,000	Stock	12 Sept.	11½	Tottenham & Edmonton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES				
746,021	Stock	26 June	10	Chelsea, Ordinary	100	293—298	..	3 7 1
1,719,514	Stock	26 Oct.	7	East London, Ordinary	100	221—225*	..	3 1 5
691,700	..	26 June	4½	Do. 4½ p. c. Deb Stk	100	157—162	..	2 15 6
750,000	50	26 June	7	Grand Junction	50	118—122	..	3 17 5
700,000	Stock	29 Aug	12	Kent	100	307—312	..	3 16 11
1,043,000	100	26 June	7½	Lambeth 10 p. c. max.	100	256—261	−2	3 17 0
400,000	100	..	7½	Do. 7½ p. c. max.	100	206—211	..	3 10 5
1,000,000	Stock	27 Sept	4	Do. 4 p. c. Deb. Stk.	100	141—146	..	2 11 4
500,000	100	14 Aug	12½	New River, New Shares	100	175—185	..	3 2 9
1,000,000	Stock	26 June	4	Do. 4 p. c. Deb. Stk.	100	145—148	..	2 14 2
700,000	Stock	12 June	4	Southwk & Vauxhall 10 p. c. max	100	147—152	..	3 12 7
150,000	100	..	4	Do. D 7½ p. c. do.	100	140—145	..	3 15 8
1,125,000	Stock	12 June	10	West Middlesex	100	295—298	..	3 7 1

* Ex div.

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

The Deliverance of Liverpool.

AT length the marching and counter-marching in the English boroughs which precedes the November Municipal Elections are over for another year; and it only remains for the victors to divide the spoils of power, and for the vanquished to find excuses for their defeat. From the point of view of the party politician, last Friday's returns are tinged with the colour of the general parliamentary election results. We should, of course, have nothing to say here respecting this aspect of the municipal elections, but for the regrettable circumstance that, as time passes, questions of gas supply enter more and more into the armoury of the municipal politician. It is fortunately impossible for us to be identified with the cause of the same party in every borough; for the simple reason that no political party possesses the monopoly of sound principles of gas administration. It must, therefore, be understood that, whenever we discuss the influence of political parties upon the gas supply of any locality, we do so purely from the basis of the best interests of the industry and the public; so that it does not make the slightest difference to us whether a particular development of gas politics that comes up for praise or unfavourable criticism in these columns happens to form a "plank" in this, that, or the other local party "platform." With this proviso applied to the salient example of the Liverpool Municipal Elections, it is open to us to congratulate the people of this great city—greater now than ever, by reason of the extension of its boundaries—upon the results of last Friday's contests. Liverpool has been delivered from the rule of those who have rendered the counsels of the Corporation ridiculous; and with them has gone the fatuous project for the establishment of a competitive gas supply.

Strictly speaking, the collapse of Alderman F. Smith's "plan of campaign" against the Gas Company occurred before the election, as will be seen by our report in another column of the proceedings of the old City Council at their last meeting. Like the famous French King, Alderman Smith having marched his forces up the hill, was forced to consent to the ignominy of seeing them all march down again. It appears that the Council, in executing this brilliant manœuvre, committed a bigger piece of banality than was to have been suspected; for they were warned beforehand by the Town Clerk that their resolution to compete with the Gas Company was *ultra vires*. It was a source of wonder to us at the time that the Town Clerk did not prevent the Council from following Alderman Smith's blind lead. But it is only doing this officer justice to put it upon record that he tried in vain to do so. The passage we report elsewhere between the Town Clerk and the Lord Mayor fully exculpates the former from suspicion of having failed to do his duty in this regard, while leaving the Mayor in a very unenviable position. His Lordship seems to have been incapable of properly appreciating either the facts of the question at issue, or the law as rightly expounded by the duly appointed adviser of the Council. The incident ended in the Town Clerk having to correct the Lord Mayor in open meeting; and the circumstance that everything he had to say was unexceptionable, heightens the confusion in which the Lord Mayor and his party are overwhelmed.

It is not true, as the Lord Mayor is reported to have asserted, that a local authority are powerless to redress mismanagement on the part of a statutory Gas Company; and no lawyer occupying the position of Town Clerk could have said as much, and be worthy of the confidence of the public. It is true that the way to seek redress against a statutory Gas Company is not by promoting a competitive undertaking, but by proceeding for an amendment of the Company's statutory powers. This is what the Town Clerk of Liverpool advised, and very properly. Only it is not to be supposed that Parliament can be induced to make such an amendment of a Gas Company's Acts as may be suggested by Dick, Tom, or Harry, be he Alderman of Liverpool or even a more eminent person. The Lord Mayor of Liverpool and his colleagues in this matter seem to have persuaded themselves that they are experts in gas administration, upon the somewhat shaky grounds that they have discovered from a well-known statistical publication what the Liverpool Gas Company paid for coal in the year 1894, and that they entertain the

belief that the price is excessive. What do these gentlemen know about the technics of the local gas supply? It is not too much to say that the misuse of statistical data in this way is a very serious discouragement to those well-wishers of the gas industry and the community who are accustomed to advocate the utmost publicity in respect of the conduct of gas undertakings. The old saw which recommends discrimination as to who should be permitted to handle edged tools comes to mind in this connection.

The chief honours in the game that is being played at Liverpool have been gained by Sir A. B. Forwood. To him belongs the credit for pointing out that the Council, by passing a resolution to which they could not give legal effect, placed the Corporation in a position of antagonism to the Gas Company which must hinder the establishment of those good relations between the two authorities which are so desirable in the interest of the community at large. All this has now been changed. The new City Council will resemble the old one only in name; and under a new Lord Mayor there should be no reason why a good understanding may not be brought about between all the parties interested in the Liverpool Gas Supply. The first step has already been taken towards a new departure in the matter of the appointment of an Auditor of the Company's accounts. The hostility of the old Council to the Company led to the rejection of their nominee for this post, which was eventually given to an independent candidate. Sir A. B. Forwood has, moreover, sketched out a positive policy for the new Council to adopt in their treatment of the gas question, to which we do not believe the Company will oppose any insuperable objection. He proposes, in the first place, that the Company should be approached without hostile intent, and treated as honest dealers; and then that the question of the most economical illuminating power for Liverpool gas should be opened up with a view to a fresh settlement of the point by agreement. Lastly, he favours the introduction into Liverpool of the Sheffield plan of direct representation of the Corporation upon the Board of the Company. These are, at any rate, counsels of fairness and soberness, and such as can be discussed by the parties concerned upon a common ground.

Explosion in the Strand.

An alarming and most destructive explosion occurred in an alley off the Strand, opposite Somerset House, on the evening of last Tuesday, resulting consequentially in the death of a member of the Fire Brigade, and in more or less serious injury to a considerable number of persons. The thoroughfare is called New Church Court, and the houses bordering it are mostly very old, not to say dilapidated, structures let out in tenements, and occupied by market porters and the poorest class of town labourers. In our account of the affair, which will be found in another column, we give some particulars both of the locality and the disaster, which was forthwith reported by the newspapers as being due to an explosion of coal gas. The immediate effect of the explosion was to blow out the fronts of two of the tenement houses, Nos. 26 and 27 in the court, and to set the wreckage on fire. The time was seven o'clock, and it was therefore quite dark, which heightened the terror caused by the report and the rising of clouds of dust and flames from the fallen rubbish. Nobody could tell how it all happened; and, naturally, for a considerable time the most dreadful stories were circulated with respect to the effects of the explosion and consequent collapse of the houses. The explosion may or may not have been a very considerable one in itself; but the fire that followed it was admittedly a small affair. It need not have been much of an explosion to blow out some of the fronts of the houses in which it occurred; and the greatest mischief was due to the fall of the rest of the buildings. The firemen were, of course, on the spot very soon after the first alarm, and the man who was killed—the sole victim, as it happened, although some of the first newspaper reports gave the number of deaths as thirteen—was buried by the falling timbers and rubbish. The only marvel is that nobody else was similarly sacrificed, the neighbourhood being a crowded one, and many people about in and near the court. The hour, however, was favourable to the residents being for the most part out of doors.

At the time of writing, the cause of the explosion remains conjectural. The report of the Chief Officer of the Fire Brigade (Captain Simonds) states that "the "supposed cause of the fire was an explosion of gas;" but nothing has transpired to prove that this was the truth of the matter. There was a 4-inch gas-main passing through the middle of the court, which was flagged; and though the large shops and offices at the corners of the court were supplied with gas, and there was a public lamp in the court itself, the tenement houses were not so served. Of course, this is not to say that gas did not find a way into these buildings; but the curious feature of the case is that, though the opinion has been expressed that "there "must have been a considerable accumulation of gas before "it ignited, as the shock caused by the explosion was "very great, and extended a considerable distance," this supposititious accumulation of gas did not betray its presence in any way before the catastrophe happened. True, one newspaper report states that some men "were "recently engaged in repairing a water-pipe" in the court, and that a tenant of one of the houses said "he noticed "a strong smell of gas on the following day." But the absence of dates from this tale robs it of all significance. Colonel Majendie, of the Home Office, was early on the spot; and it is possible that he may have something to say at the inquest about the explosion. In the meantime, it is only just and reasonable that judgment should be suspended as to what it was that exploded, and how. The damage was so great, and the reported effects so violent, as to lend colour to the suspicion that something more powerful was concerned than the quantity of coal gas that could have accumulated unnoticed in houses in which people were continually going in and out. Be this as it may, and whether or not the truth of the explosion is fated to be ascertained, it was a terrible and lamentable affair, with the sole redeeming feature that if it had occurred at almost any other hour of the day or night, the danger to life would have been far greater.

The American Gaslight Association.

The twenty-third annual meeting of the American Gaslight Association was held in Philadelphia from Oct. 16 to 18, under the presidency of Mr. Walton Clark, of that city, whose address was devoted chiefly to a critical examination of Gas Managers' Associations in general, and the American Association in particular. Mr. Clark is reputed a man with ideas; and his address bears out the author's reputation. A good deal of what he says about the American Association applies with equal force to other organizations of the kind in which our British readers are more particularly interested. He observes, to begin with, that these voluntary Associations of men are as good as the associated deserve; for they are what the associated make them—a profound saying, and one worthy of acceptance by all whom the subject may concern. If an Association lacks the standing and efficiency expected by its founders, and desired by its true friends, it is only because the members prefer to have it as it is, or are incapable of improving it. Mr. Clark does not believe that the American Association is all that it ought to be; and accordingly he takes it upon himself to speak a few home truths respecting the reason why the efficiency of the organization is low. He does not find fault with the papers read before the Association—rightly admitting that among the transactions are to be found many technical memoirs of the highest quality. He does complain, however, in regard to the quality of the discussions. Too few members join in discussing papers; and what they say usually amounts to very little. His is not the only technical society troubled with the same constitutional weakness. The trouble is partly due to the lack of opportunity for preparation; partly to lack of interest; and partly, no doubt, to hurry. Most societies now-a-days follow the plan of distributing prints of papers beforehand, so that members may get up a case for or against the author's views as they may prefer. But what is to be done when, as too often happens, papers trumpeted in advance as of the first importance do not reach the printers' hands before the very eve of the meeting? The circumstance of its being usually the "prominent members" of the society who offend in this way renders all suggested remedies hopeless. With regard to the hurrying of discussions, Mr. Clark declares it a mistake to hold, as most presidents and councils do, that "the greatest good comes from the "reading of all the papers presented, whether or not time "is left for discussion." He believes that "the discussion "of a paper should not be cut to leave time for the reading

"of another; that one paper thoroughly discussed is of "more value to us than many papers without discussion." He is largely right in this regard.

Mr. Clark strongly recommends the establishment by the American Association of technological examinations in gas manufacture on the lines of those conducted by the City and Guilds of London Institute, which he esteems as admirable, but "insufficient to meet the occasion." Surely, it must have been a help to many a student in gas manufacture, as practised across the Atlantic, to learn from the English question-papers what it is that passes for knowledge of the rudiments of the industry. It would be gratifying to know how much farther this kind of educational effort can be extended. Mr. Clark made a considerable number of recommendations to the American Association with the object of improving it, and increasing its usefulness, the fate of which is scarcely doubtful. It is not so much what a technical society professes to do for its members, by remitting all sorts of business to committees with high-sounding names, that renders it respectable; but it is the character and quality of the membership itself that attracts or repels the best element of the personality of the calling which the society pretends to represent. When good men of any order or class of the community are invited to join a club or a society, it is more important to them to know what the company is like than what the organization is called or what is inscribed upon the official programme. The American Gaslight Association, like many others, has suffered, and is still suffering, from commercialism, internecine rivalries, troubles with the national technical press, and one or two other afflictions that need not be mentioned here. But it still numbers among its members some of the brightest and best men in the whole world-wide profession of gas engineering; and while these continue to attend and take part in its meetings, the transactions will not lose interest for the technical world.

"Automatic-Prepayment," or "Coin-Freed"?

What is the most apposite and best descriptive generic term for the gas appliance popularly known as the "penny-in-the-slot" meter? Everybody knows what this phraseology means; but it is unavailable for formal use in patent specifications and in official parlance generally. Week after week our own "Register of Patents" contains entries referring to gas apparatus of this order; but every actual or would-be patentee pleases himself as to how he classifies his invention. Most British applicants use the single word "prepayment," or the couple "auto-"matic prepayment," to indicate the character of their invention in connection with the measurement of gas or other fluid; and nobody has objected to the practice. It is obvious, however, when one stops to think about it, that neither the word "prepayment" nor the two words "automatic prepayment" would convey the idea which is perfectly expressed by the phrase "penny-in-the-slot," to anyone not aware beforehand of the fashion in which the act of prepayment has to be performed, and the way and the degree to which the action is automatic. There might be fifty ways of prepaying for gas through the intermediary of a meter, and several media by means of which the payment could be made. Thus we might have a way of paying for gas in stamps or special tokens prepared for the purpose; and these might control the action of a gas-meter in all sorts of ways. As a matter of fact, however, when we read of an "automatic," or an "automatic prepayment" meter, fancy conjures up, as is intended, the mental picture of a "penny-in-the-slot" device, and no other. A few days ago, we had occasion to chronicle the patenting of a "coin-"freed gas-meter." The phrase is distinctively American, and so was the thing. There is no mistaking what these words mean. Logically speaking, they should be preferred to the more general British title for the same thing—being shorter, more expressive, and less reliant for intelligibility upon an antecedent acquaintance with the special order of mechanical appliances so designated. Which title will survive? Will America supply us with the right word for the thing which we first produced? There is no saying. The point of terminology must be left to settle itself. But, meantime, as at present advised, we incline to the opinion that "coin-freed" is a more explicit title than "auto-"matic-prepayment," as well as being much less trouble to write and pronounce. On the other hand, it is not a very harmonious combination of vowel and consonantal sounds, which is a drawback.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 939.)

The Stock Exchange has had another very agitating week; and this time all the trouble came from across the Channel. The home settlement, delicate matter as it was, proceeded quite as smoothly as might be expected, and only one or two small failures transpired. But on the Continent things were much rougher. Paris was the focus of the mischief where speculation had been most rampant; and the defeat of the Government just came in the nick of time to make matters worse. To liquidate their mining accounts, the Continental operators sold foreign stocks freely; and the "bears," who were badly in want of an innings, did their best to make things worse, and get up a little panic. The obvious result of this pleasant little game was that prices were knocked about handsomely, and not one of the big departments escaped. Even Consols on Thursday were done at 106⅝—the lowest point touched for a long time. Money, meanwhile, was in demand, and rates were firm. In a general way, business was much interfered with by the closing of the Stock Exchange on Friday; and perhaps the time is ripe for considering whether the May and November holidays might advantageously be abolished. In the Gas Market, business during the earlier portion of the week was at a very low ebb indeed. But it rallied considerably later on, especially in the two largest issues; and Saturday was as busy a day as any. Changes in quotations are few, and for the most part unimportant; and they are all in the upward direction, but one. The exception is Gaslight "A," which opened no stronger than it had closed, and fell to 292 without any symptoms of recovery. The secured issues, however, were firm. South Metropolitans were rather quiet and unchanged. A bargain was done in Commercial old at a fair price; and the position of the new stock was partially remedied by a rise of 5. Among the Suburban and Provincial Companies, business was quiet; but Brighton was conspicuous for good prices. Quotations did not move. In the Continental division, Union recovered its position; and European was steady. Imperial was largely dealt in; but prices showed no improvement. None of the rest presented any feature calling for remark. Dealings in the Water Companies were not extensive; and movements were irregular. Chelsea advanced a point; but Lambeth was in bad odour, and lost ground.

The daily operations were: Business in Gas was very inactive on the opening day; and prices were rather poor on the whole. Quotations were not varied. There was no sign of any greater vitality on Tuesday; transactions continuing much restricted. Continental Union advanced 2; but Gaslight "A" receded 1. On Wednesday, there was considerable revival, though prices showed no disposition to advance; and quotations remained as they were. In Water, Lambeth tens fell 5. Thursday's business was fairly extensive, and at about the old figures. Commercial new advanced 5. Lambeth Water was flat again, and dropped 2 more. On Friday, the Exchange was closed. Reopening on Saturday, business was quite brisk; but quotations underwent no further change.

ELECTRIC LIGHTING MEMORANDA.

Major Cardew's Report on the Portrush Tramway Fatality—The Trolley Wire and the New Westinghouse Traction System—High Voltage in St. Pancras.

Major Cardew's report on the causes which led to the fatal accident that occurred on Aug. 26, upon the Giant's Causeway and Portrush Electric Tramway—when a bicyclist met his death by coming into contact with the charged conductor—is a very grave indictment of the system employed in this undertaking. There has been a good deal of advertisement given at one time and another to this experiment in tramway working, which has been "cried-up" as a successful example of the use of electricity for the purpose. But Major Cardew has found—what visitors to the locality could not fail of observing—that, as a matter of fact, the tramway was chiefly worked by steam-engines. Only a few of the cars were provided with electric motors; so that it was only by a stretch of courtesy that the line could be termed (as it habitually was) an "electric" tramway. Yet, little as electricity has ever done in the way of earning money for the Tramway Company, it has been effective enough in getting them into trouble. Now it is officially condemned; and it is only to be permitted again under conditions which will in all probability be deemed prohibitive. It must be admitted that the system was crude and dangerous in the extreme. The electricity was generated by water-power some distance from the line, to which it was conveyed by overhead wires. The charged conductor, from which the cars took their current, was a stiff iron rail, wholly without protection of any kind, supported at a height of 18 inches above the ground along-

side the line, except at road crossings, where the connection was effected by means of underground cables. Elsewhere there was nothing to prevent people, or cattle, from coming into contact with this rail, which might be at a potential of anything from under 290—the average of Major Cardew's tests—to 360, which was the admitted maximum observed. In the circumstances, there is less cause for wonder that at length somebody was killed upon the conductor than that no such casualty had occurred before August. It has transpired, however, that since the opening of the line four horses and five head of cattle have been killed in this way, and others injured. Major Cardew recommends that the existing charged rail should be removed and replaced by an overhead system, or raised to a height of not less than 8 feet above the ground. Meanwhile, the line must be worked entirely by steam-power.

The circumstances dealt with in the foregoing paragraph are calculated to arouse reflection in the minds of others besides the Directors of the Giant's Causeway and Portrush Tramway Company, with which undertaking the Board of Trade will have more to do yet. Advocates of the newer trolley-wire principle of electric traction will see in the official condemnation of the old system and the implied recommendation of some substitute in their line, a source of encouragement and reason for congratulation. It indeed appears fairly proved that, where electric traction is wanted, the choice of available systems lies between the trolley-wire and the underground conductor, when any consideration of expense must determine the preference in favour of the former. At the same time, whatever electricians may say and desire to the contrary, there exists in English public opinion a rooted objection to the intrusion of the posts and overhead wires requisite for the trolley-wire system into any locality or thoroughfare having the smallest pretensions to good appearance. It may appear strange to people whose ideas in regard to such matters have been moulded by Transatlantic experience, but it is nevertheless true, that the inhabitants of most of our manufacturing towns, who have become reconciled to the steam tramcar, still profess an unconquerable aversion to the trolley-wire. It might be thought by outsiders that there is nothing to spoil in the average trunk thoroughfare connecting a manufacturing centre with an industrial suburb. But the residents in such neighbourhoods are still averse to the intruder in question—possibly because they entertain the reasonable suspicion that it would be difficult to set bounds to the intrusion, if once permitted. It remains to be seen what fortune will attend the latest suggestion that has been put forward with a view to avoiding the eyesore of the overhead wire without involving the expense and difficulty of working an underground conduit necessarily open at top for permitting running contact with the car motors. This is a device brought out by the Westinghouse Company, who are nothing if not progressive, in which the continuous underground conductor is actually buried, presenting only a line of metal studs projecting above the road surface at such intervals that only a suitable bar disposed beneath the tramcars can make temporary rubbing connection from one to another, and so take the current required for the travelling motor. It is claimed for this method of connecting the car to the conduit, that the main circuit can never be closed except by the car itself, so that there is no danger in it for man or beast. There is some little objection to the requirement that the metal studs must stand a regular distance of ⅜ inch above the general street level—not so much with regard to the ordinary traffic, as to the effect of this traffic upon any such nicely-adjusted appliance. It is amusing to note meantime that those who are recommending this new system, in the interest of the particular firm of electricians who are introducing it, can make mention for their own ends of that "unsightliness of the overhead trolley" which they deny when advocacy of the latter is in question.

Another consideration growing out of the Portrush fatality bears upon the moot point of the expediency of increasing the voltage of low-pressure incandescent lighting circuits from about 100 to 230 or thereabouts. The precise voltage of the current that killed the man who fell across the condemned tramway conductor will never be known. But it was something which showed an average of 290 volts upon testing. It may consequently not have been widely different from the regular voltage that the Electrician to the St. Pancras Vestry (Mr. S. W. Baynes) wishes, for reasons of economy, to establish in this undertaking. There can be no doubt as to the advantage that would accrue to the proprietors of low voltage systems of electric distribution from merely doubling the voltage. Mr. Baynes has recently reported very fully and conclusively to the St. Pancras Vestry upon this head; claiming, among other benefits, that the area that could be covered by the higher voltage service is sixteen times greater than that of the low voltage service, because with the same outlay in copper four times the lighting could be done, or the same lighting duty could be served at four times the distance with the same percentage of loss. It is true that complaints have been made public as to the difficulty of procuring suitable incandescent lamps of moderate lighting power for the high voltage. But this is declared to be a mistake. At any rate, it may be expected that the Board of Trade will have something to say to any electric lighting authority introducing a dangerously high voltage into consumers' premises, though an "accident" may be permitted to occur before anything is done in the matter.

A STUDY OF THE PRESTON GAS-WORKS.

To the gas engineer, one of the peculiar fascinations of his profession is the scope it affords for individuality of treatment of the mass of detail that constitutes modern gas engineering practice. The non-technical observer usually sees nothing in the process of gas making but a shovel-full of coals at one end and a gasholder at the other; and every stage of the operation is to him attended by such unpleasant concomitants of dust, heat, mess, and odour, that he is inclined to set the whole business down in his mind as a rough, dirty, and objectionable performance, undeserving of the name of a scientific industry. This is notoriously the view of gas manufacture taken by writers in the newspapers; and even technical authors not specially instructed in coal-gas making are apt to sneer at it as an essentially coarse, unprogressive industry. None but a trained and sympathetic observer, perhaps, can distinguish the real science that underlies the rough aspect of a modern gas-works; and the "man in the street," who is so prone to be impressed by externals, would never understand that there is in a gas-works occupation enough and to spare for the most painstaking and ingenious of experts. For in gas manufacture, as in all other organized industries, the essence of the thing—its science, that is to say—is in the proper application of means to ends. All gas-works generally resemble each other in respect of both means to be employed and ends to be attained; but this fundamental unity may, and often does, permit of, and require, great variety of detail development. One gas-works is more interesting than another, in expert opinion, in the degree in which it expresses the individuality of the designer and manager, in his proper application of means to ends. Some gas-works are a desert to the skilled observer, because there is nothing in them to show that any more pains have been taken in their arrangement and outfit than are involved in copying good commonplace designs, and employing respectable firms of contractors in carrying them out. It is not size, nor even good commercial working, that gives interest to a gas-works. The competent critic of gas making would rather see a few mistakes (as he might esteem them) made for some show of independent reasoning, than be treated to a dead-level of inexpressive excellence that suggests nothing to ponder over whether as a hint to be worked up or an example to be avoided.

After this exordium, we venture to engage our reader's attention to a brief description of Mr. Henry Green's Moor Lane gas manufacturing station in Preston, which, judged by the standard we have endeavoured to set up, must be regarded as one of the most interesting establishments of the kind in England. This is one of three works belonging to the Preston Gas Company, which has been managed by Mr. Green with credit to himself and advantage to the Company and the town for thirty-four years. Mr. Green's predecessor in office was Mr. Rofe, who ranked, with Mr. Alfred King, of Liverpool, among the most eminent members of the profession in his day. Mr. Green has naturally had a great deal of remodelling and extending to do during his service at Preston; but he has done it all so quietly, and has been so little inclined to put himself forward in places where gas engineers and managers are commonly seen and heard of, that few of his compeers know the quality of his work. A visit to Moor Lane, however, will show that, while Mr. Green is fully abreast of "the movement" in all gas engineering matters, he has attacked familiar problems in his own way, and has made his personal mark upon every department of the works.

The Moor Lane station is situated on rising ground, and consists of two works divided by a thoroughfare. It is with one of these—in which most reconstruction has been effected—that we are to-day chiefly concerned. Among other novelties, this works is being provided with a pair of Messrs. Humphreys and Glasgow's carburetted water-gas generators, rated to manufacture 135,000 cubic feet of gas per day; and as the blowing plant has to be accommodated in the other works, the dividing roadway is now opened for the construction of a subway for the connecting mains. The controlling consideration in the design of the new works is the absence of any other means besides carts of conveying coal and coke, or other materials, into or out of the works. Next in importance came the fact that upon the site of the present retort-house there existed a couple of old gasholders, with tanks going a good depth below the ground level at the entrance gate. To meet the case thus presented, Mr. Green has laid out the new station in three levels, approached from the gate by roads at easy gradients. The lowest level is that of the coke-hold, which is extended to form an open-air coke yard, at a depth of 18 feet below the ground-line, which is that of the charging-floor. Thus the old excavation is utilized. The subsoil of the site being a fine dry sand, there was no difficulty from water in carrying out this arrangement, which affords plenty of head-room for the water-gas plant, and the generator furnaces of the retort-settings which amicably share the same roof. In the adjoining yard are the oil storage tank and the relief gasholder, which is upon the Gadd and Mason spiral-guide principle, in a wrought-iron above-ground tank. The highest road level—1.4 feet above the ground line is that of the coal-store approach, which thus enables trimming to be dispensed with. Such is the general

arrangement of the works in respect of coal and coke handling; and, although originally the yard had only one level, the three levels have been so naturally planned that it looks as if these had always existed and grew out of the lie of the land.

Mr. Green believes in single settings of sevens, set with the three middle retorts in line. He lays the courses of bricks in the piers of the arches on a slope towards the inside (somewhat in the style of an inverted arch) so as to help the buckstaves to restrain expansion by offering the brickwork an inclined instead of a horizontal bed to slide upon. The dip-pipes enter a hydraulic main which is run dry when gas is being made; the dips being closeable instead by means of a flat disc-valve actuated by a rod in front, in the usual way. With such an arrangement, of course, the exhauster must be run at zero; regulation being effected by way of the gas, and not of the steam. The gas connections throughout the works are 24 and 18 inches diameter.

The scrubbers are of great height, but of comparatively small diameter; this being one of Mr. Green's special points. He has an arrangement of canvas friction-screens, for filling the scrubber, and a (patented) device for distributing the water over the whole circular area, which works very well, and has done so for many years. It is Mr. Green's practice to arrange his scrubbers so that the amount of friction to which the gas is exposed in passing through them is as great as can be obtained without producing any back-pressure, and he has no faith in scrubbers of large area, however packed. It is obviously essential to the usefulness of canvas screens in scrubbers that they should never be maltreated by having tar poured over them by mistake. Wherever Mr. Green requires to separate tar from ammoniacal liquor, he employs a separator of his own design. The difference between this and a simple box-separator, with a middle partition extending downwards from above the water-line to near the bottom—in which there must be some tar in the liquor or inlet side of the box—consists in the partition being carried down to the bottom and made tight; the connection of the two divisions being effected by a U pipe hanging, and extending some distance, below them. Thus the tar is kept out of the liquor-box, and the latter can be pumped clean.

It is in the matter of purifying that Mr. Green has certainly struck out his most important departure from ordinary practice. At Moor Lane, there is a purifying house in a special sense of the term, inasmuch as in some dimensions the structure is both house and purifier—that is to say, there are two lines of purifiers in the house, and the outside plates of each line are fixed flat up against the wall of the house. Thus, making allowance for the necessary central and other gangways, every available square inch of the area covered by the house is purifier-room. This is made possible by the abandonment of water lutes, and their substitution by plain, flat lids sealed with a simple india-rubber cushion. With Mr. Green, this method of sealing his purifiers dates back some twelve or fourteen years. It should be stated here that Mr. Green does not prefer any claim to priority as having originated the system of dry lids; he only claims to have used it with unequivocal success for at least the period specified. The suggestion came to him originally as a way out of a difficulty. The gas made at the then Moor Lane and other stations had to be pumped a considerable distance into the holders, through mains of insufficient size to take the maximum output of the three works without throwing a back-pressure so heavy as to make the purifiers blow. It appeared, therefore, that the only thing to do was to lay a bigger main, or put the exhausters past the purifiers—either course being open to serious objection on the score of expense and trouble. As a simpler expedient, Mr. Green decided to attack the blowing purifiers; and accordingly he converted at the Walker Street works eight oxide purifiers into two. The purifiers converted consisted originally of eight ordinary water-lute purifiers, worked in two sets of four purifiers each; there being four boxes on each side of the centre gangway. These were turned into two purifiers, by connecting together the various inlet and outlet pipes respectively. The alteration was found to answer the anticipation; the pressure being very considerably reduced. The only difficulty feared from the change was the danger of passing impure gas during the time one set of the combined purifiers was being discharged. It was, however, found in practice, that there was less danger with the gas passing through one layer of clean oxide in a large purifier than through four layers in two small purifiers. It then suggested itself to Mr. Green that a greatly improved purifier could be made, at considerably less cost, if the water-lute lid could be dispensed with, which would enable him to adopt much larger purifiers, to be worked in sets of two. He, therefore, adopted the dry lid as an experiment; and, after many years' use, finding the expedient satisfactory, when the Moor Lane works were remodelled, the system in a perfected form was applied to the new purifiers. The advantages of the system are so considerable that we have deemed it worthy of special illustration; and the views on pp. 922-3 of Mr. Green's 90-feet purifiers being emptied, and ready for work, have accordingly been prepared from photographs.

The house, as will be seen, is light and lofty—the roof, we believe, originally belonged to one of the buildings erected at the Liverpool Exhibition. The purifiers are well above the ground; there being plenty of room for a horse and cart to move about underneath them. Mr. Stelfox's Belfast arrangement of cross-connection boxes is here followed, in order to avoid having two tiers of gas-mains. The main purifiers are a noble pair, each 90 feet long by 35 feet wide, holding two layers of oxide, 15 inches thick. Besides these, there are three smaller boxes for lime, each 30 feet by 35 feet; and a single catch box for oxide, of the same dimensions. These divers boxes, therefore (all upon the same plan), fill the house from end to end. Each of the main boxes has twelve covers; and the others are fitted with lids of the same size—that is, 13 ft. 6 in. by 11 ft. The openings covered by these lids are edged with a planed rim, behind which stand up the 1-inch bolts which hold the covers down. The covers are quite flat, framed with angle iron, on the underside of which a packing of square india-rubber about 1 inch on the face, is secured with the "solution" used by waterproofers. The plate upon which this packing bears is prepared for it by a coating of blacklead, so as to prevent sticking. That is the whole mystery. There is no blowing or leakage; the weight of metal in the purifiers is greatly reduced; the boxes are tied together in every way so that nothing can give; there is nothing to freeze; the weight of the covers is so small that all the lifting can be done by means of a traveller carrying two 1 ton differential chain blocks, which holds up two lids at a time. In one of the illustrations there is shown a block which appears to be holding up a kind of pot. This is a "dummy" cover that goes over the opening of the shoot through which the oxide is discharged down below; and when lifted it gives an opening for the immediate discharge of the contents of the box. Mr. Green estimates the saving due to the abolition of the lute as amounting to one-half the cost of purifiers so fitted, to say nothing of the value of the room economized.

After the unique purifier-house, there is little more to be noticed in the rest of the works devoted to the manufacture of gas, which nevertheless manifest in every detail the forethought and skill of a thorough manager. The sulphate of ammonia plant is, however, certainly deserving of notice. The saturator is wholly constructed of copper. It is circular, with a domed cover, and a conical bottom tapering to an outlet. Once a day steam is shut off; and the contents of the saturator are then run off into a tumbling-box placed below. Here the sulphate drains and dries by its own heat, until it is ready for packing. The operation of emptying the saturator and getting it ready for work again occupies only about seven minutes; and this is all the labour required in discharging the sulphate from the saturator. The saturator is made of copper because lead would not stand the alterations of temperature to which the vessel is subjected, nor would it work kindly into the requisite shape and size.

One or two other points of Mr. Green's gas engineering and management might be mentioned; but we have probably said enough to persuade our technical readers that whatever else might be claimed for them, the works of the Preston Gas Company are interesting to visit and full of instruction for the student of the industry of however ripe a growth. Mr. Green will be found a kindly and candid guide by any sympathetic visitor to his works; for although a natural diffidence, rather than reserve, has kept him from taking any prominent part at gas engineers' meetings, he is always glad to foregather with a kindred spirit, and on such occasions he shows himself to be most instructive and entertaining.

Fires of Electrical Origin in America.—In a paper read before the Fire Underwriters' Association of the North-West, Chicago, Mr. W. H. Merrill stated that a comparison of causes among 815 electrical fires published in the first eight reports shows that 113, or over one-seventh, of these losses were caused by the crossing of telephone, telegraph, and similar wires with trolley or electric light wires. The total loss due to these fires was $324,957 (about £65,000).

Institution of Civil Engineers.—The new session of the Institution will open next Tuesday, by which date it is hoped that the structural alterations which have been going on in connection with the premises in Great George Street will have made sufficient progress to allow of the remodelled theatre being made available not only for the delivery by Sir B. Baker of his Inaugural Address, but for temporary use during the session, at the close of which the work will be completed.

Personal.—Mr. H. P. Harris has been elected Chairman of the Parliamentary Committee of the London County Council in succession to Mr. T. M'Kinnon Wood, whose resignation of the position was mentioned last week.——Sir H. Bodkin Poland, Q.C., has been chosen as an Alderman of the London County Council in place of Mr. C. T. Ritchie, whose acceptance of office under the Government necessitated his resignation.——Mr. A. Denny has been elected President of the Institution of Junior Engineers, in succession to Mr. A. Siemens; and he delivered his Inaugural Address at the opening meeting of the fifteenth session of the Institution on Friday evening.——Mr. Thomas Duxbury, formerly the Manager of the Darwen Corporation Gas-Works was a candidate at the municipal elections in that borough last week. He contested the Central Ward as an "Independent;" but he was defeated by 135 votes. His opponent was Mr. Tomlinson, a colliery agent, who, as a member of the Gas Committee, had a good deal to say about Mr. Duxbury's management of the gas-works.

NOTES.

Use for the Phonograph.

A great deal is heard from time to time of the superior advantages enjoyed by the present generation as compared with our forefathers, by reason of the height to which time and space annihilating appliances have in these latter days been brought. It is not always easy, however, to adduce positive evidence in support of the case for modernity; and therefore considerable interest attaches to a report that has been put in circulation by the Knowles steam-pump works, of New York, concerning the practical use they have been able to make of that brilliant, but hitherto unappreciated invention, the phonograph. It is stated that some years ago this Company put up one of their large pumping engines at the works of a Californian water company. All went well with the machine until recently, when something happened to put the pump wrong. The works' manager thereupon used a phonograph cylinder as a means of communicating news of the trouble to the makers; and he finished up by so exposing the phonograph receiver in the pump-room, that the pulsations of the machinery registered themselves upon the wax roll. When the cylinder was put into the repeating machine at New York, the voice of the Californian water-works engineer was first heard giving his description of the mishap, followed by the characteristic noises made by the pump. Thanks to the latter, the cause of the trouble was immediately diagnosed; and it became possible to warn the user of the machinery as to what was the matter and how to remedy it—thus rendering unnecessary the despatch of skilled assistance from one side of the Continent to the other. Other engineers and works' managers might see their way to similarly using the same appliance.

The Preparation of Graphite.

It is not many years since the form of carbon known as graphite was only to be obtained from the incrustation upon the inside surfaces of gas-retorts; and the term "gas-retort carbon" is still occasionally employed by writers who mean to refer to what is really graphitic carbon. Numerous experiments—in particular those of M. Moissan—with the electric furnace, have now proved that graphite is the most stable form of carbon at high temperatures, and is in fact the form to which all other descriptions of carbon can be brought at a proper temperature. The best way of making graphite is by means of the electric furnace; but this has hitherto been also the most expensive process. Messrs. Girard and Street, engineers to a French manufacturing society, claim to have successfully overcome this difficulty of cost, and to be able to transform powdered carbonaceous material into graphite electrically, at an expenditure of current not too great to prejudice the commercial utility of the process. Their apparatus consists of an arrangement of refractory blocks, through which passes a rod or tube of the material to be converted into graphite, and a set of carbons for striking the electric arc across this tube or rod. An equable distribution of the heat is effected by causing a magnet to rotate the electric arc, according to a well-known principle. A stream of hydrocarbon gas can at the same time be passed through the furnace, which thus reproduces—although at a much higher temperature, and through a shorter period of time—the conditions under which graphite is formed in a gas-retort. The new process, however, can hardly be a cheap one where the electric energy is not produced by water power.

The Reverse of Generator Firing.

An interesting illustration of the reversibility of thermic conditions is given in two recent numbers of *Nature*. In the first, Mr. E. Blass writes from Essen-Ruhr, Germany, stating that Siemens taught us how, by using the heat of the gases escaping from a furnace to heat the gas and air before entering the furnace, we could obtain temperatures limited only by the fire-resisting quality of the materials of which the furnace is constructed. It had occurred to Mr. Blass, that very low temperatures might be reached upon the same principle. It would only be necessary to reverse the operation of the Siemens furnace, with compressed cooled air in place of the furnace gases, to get lower and lower down in the scale of temperature. The idea is, that as compressed air in expanding to atmospheric pressure does work and is cooled to a corresponding extent, it would only be necessary to keep up a continuous supply of compressed air through a tube made of a good conductor of heat, and allow it to escape at one end and expand between the exterior of this tube and the interior surface of an enclosing tube of non-conducting material. In passing over the outside of the inner tube, the expanding air would obviously cool the supply of compressed air more and more. Mr. Blass asked what would be the limit of low temperature that could be reached in this way. In the later number of the same journal, there appeared a letter from Mr. E. T. Dixon, of Cambridge, which stated that Herr Linde has succeeded in making a machine upon this principle which produces liquid air and oxygen upon a commercial scale. At the very first trial of the machine, about eight litres of liquid air (the fluid being slightly blue in colour) were obtained. When this liquid had again become gaseous, it was analyzed, with the result of showing that it contained 70 per cent. of oxygen, instead of the 21 per cent. normal in atmospheric air. It was evident, therefore, that a segregation of the elements of the air had taken place. What had happened was, simply, that the nitrogen had boiled off first, leaving the oxygen behind it. It is therefore possible to obtain oxygen from the air by purely mechanical means. The preparation of liquefied air is only a stage in this new oxygen process. The cost of the oxygen is the cost of compression, which with the first machines works out to a yield of about 1 cubic metre of 70 per cent. oxygen per horse power per hour. The *Engineer*, commenting upon the process, shows that this is equivalent to about 14d. per 1000 cubic feet of oxygen of this standard. The whole story is a most remarkable one in all its aspects.

The Boiling Point of Hydrogen.

If liquid air, produced by the Linde process, is to be a common article of commerce in the immediate future, liquid hydrogen is still sufficiently novel to attract the attention of the man of pure science. Professor Olszewski has recently determined the boiling-point and the critical temperature of hydrogen; and the result shows that it is possible, by taking proper precautions, to do experimental work in the domain of physics at a point very near the absolute zero of temperature. The process is described in detail in *Wiedemann's Annalen*. The method of expansion, which had already been successfully employed to ascertain the critical pressure, was again utilized. The critical temperature being that at which liquid hydrogen, when slowly released from pressure, first boils up; and the boiling point is the temperature reached when the pressure is reduced to that of one atmosphere. The chief difficulty in these experiments is the thermometric one; and Professor Olszewski successfully overcame this by the employment of a thin platinum wire immersed in the liquid hydrogen, which by its varying resistance indicated the fall of temperature. It is interesting to note, in connection with what has been stated with regard to the effect of cold upon the strength of materials, that Professor Olszewski used cast-iron cylinders brought down to a temperature of − 210° C. (not far from the absolute zero) by means of liquid oxygen, at which the cylinders still held hydrogen compressed to 180 atmospheres. The critical temperature of the hydrogen was, however, still lower, and was not reached until − 234·5° C. had been registered. The boiling point was − 243·5° C., or − 406·3° Fahr., (probably the greatest cold ever attained by artificial means).

A Statue to Sir Isaac Newton is to be erected by the Municipal Council of Paris. Referring to this matter, *Nature* says: "We cannot imagine the London County Council paying a similar graceful tribute to the greatness of one of France's renowned investigators—say, Laplace or Lavoisier; but we dare to suggest that the action of the Paris Municipality ought to be reciprocated."

Hygienic Decision on Potable and Household Waters.—At the last general meeting of the German Association for the Care of Public Health, Professor Flügge put forward the following propositions: (1) The customary hygienic decision on waters simply on the basis of a chemical, bacteriological, and microscopic examination of samples sent, is in almost every case to be rejected. (2) A single examination of water as to its admissibility for drinking or domestic consumption must, above all things, be followed by a visit of inspection to the place where the sample was taken. In many cases, this examination alone leads to a conclusion that it may be supplemented by microscopic inspection, and a determination of the hardness and the iron. In new installations, freedom of the water from micro-organisms should be ascertained. (3) The hygienic significance of remarkable analytical results can be generally ascertained only by repeated inspection and examination.

The Physiology of Death by Electric Shock.—The report of Major Cardew on the fatality on the electric tramway between Portrush and the Giant's Causeway, to which reference is made in our "Electric Lighting Memoranda," necessarily causes one's attention to turn to the subject of death from electric shock; and therefore it may be justifiable to notice here some remarks in the *Electrical Review*, based on correspondence which has been going on in the *Lancet*. A theory has been put forward by Dr. Bleile that death is due to stoppage of the heart caused by the contraction of the large arteries. Sir G. Johnson disputes this conclusion, which, he says, is vitiated by the fact that these arteries do not contract owing to their nerve-centres being directly excited by the electric shock, because in this case they would be congested, and not empty as they are always found after death from this cause. Sir George considers that the condition of the body corresponds exactly with that found after death by asphyxia; and he thinks there is always hope of resuscitation except when the respiratory nerve-centre has been destroyed. This view agrees with that enunciated some time ago by M. d'Arsonval, who mentioned a case in which a workman was stunned by being subjected for a short time to a pressure of 4500 volts. About a quarter of an hour after the accident, assistance arrived, and artificial respiration was practised, with the result that in two hours the man was able to speak, and was eventually restored. Sir G. Johnson's conclusions appear to our electrical contemporary to be authoritative; and they emphasize the opinion they have frequently expressed that it may often be a means of saving life to remember that "a man struck by electricity should be treated as if drowned."

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Quarterly Meeting in Birmingham.

In the JOURNAL last week (p. 874), we published a general report of the proceedings at the above meeting, with the two papers read on that occasion. We now give the discussion on the short communication by Mr. W. T. Tew, of Warwick, entitled "An Incident in Purification."

The VICE-PRESIDENT (Mr. W. R. Cooper) said that Mr. Tew very properly stated, in the opening of his paper, that little matters often led to important results. Mr. Tew had been somewhat troubled; but he had relieved himself to his own satisfaction. If any gentleman had had similar experience, and would give the members the benefit of it, they would be much obliged.

Mr. W. W. HULSE (Longton) said he had had a somewhat similar experience to Mr. Tew. They used to find that the pipe at the bottom of the tar and liquor well became stopped up; and they had to periodically clear the tank out. He always noticed that the substance that stopped the pipe was of a greyish colour after it had been allowed to stand; and he came to the conclusion that it was carbonate of lime. They did not exhaust air through the lime; but the liquor condensing to the bottom of the purifiers used to be emptied into the tank. It was usually of a deep red colour, which was due to the presence of sulpho-carbonate of calcium. The lime in solution, as stated by Mr. Tew, on coming into contact with the ammoniacal liquor in the well, entered into combination with the carbonic acid present; forming carbonate of calcium, which was precipitated. In order to remedy it, they simply refrained from putting the liquor from the purifiers into the well; and they had adopted other means of disposing of it. It contained but very little ammonia; and one result of putting it into the well was to weaken the liquor. He did not find any benefit. He tested for ammonia, and found it was not worth consideration, and was, in fact, nothing more than spent lime in solution; so he thought it would be better to find another way of disposing of it, instead of passing it into the tar-well.

Mr. V. HUGHES (Tipton) remarked that Mr. Tew had said that he mixed a certain quantity of the liquor from his purifiers with a given quantity of ammoniacal liquor; and he (Mr. Hughes) would like to know what difference Mr. Tew found in the strength of the ammoniacal liquor after he had treated it in this fashion. From tests made some time ago, he thought he must find it considerably reduced.

Mr. B. W. SMITH (Smethwick) said he took it that the liquor, or rather the condensation from the purifiers, ran direct into the well, and that Mr. Tew did not collect it in a settling-tank as usual at the bottom of the purifiers, or any more convenient spot, and then allow it to overflow into the well. He presumed, in Mr. Tew's case, Warwick being a residential town, it was absolutely impossible for him to send the liquor into the river or sewers. He believed this was the cause of the trouble, which might have been obviated by emptying the boxes by means of a plug at the bottom of the purifiers, and then catching the liquor and throwing it on to the lime as it came out.

Mr. F. W. CROSS (Wellington) said the members must all be grateful to Mr. Tew for bringing a matter of this sort forward. But it was a subject they could not adequately discuss, as it was an experience practically new to a great many of them. The value of the paper lay in the fact that it would help them to steer clear of falling into the same error that Mr. Tew had done. He would withdraw the word "error," as it was more a matter of circumstance with Mr. Tew, who had been forced to get rid of the foul smell from the purifiers. He did it in the best manner possible, and got into this small hole in doing it, and in running his liquor away through his centre-valve. Although there was not room for much discussion on a paper of this sort, it was valuable to every gas manager; and they were indebted to Mr. Tew for having brought it forward.

The VICE-PRESIDENT said they all felt much obliged to Mr. Tew for having brought this matter before the Association. It was a thing that did not often occur in the experience of many of them. This stopping up of the pump suction in the tar-tanks was a nasty, troublesome job. Then they did not often get to the real cause of it; and the thing became an intolerable nuisance. He thought that, if Mr. Tew adopted the suggestion of Mr. Smith, and took the water away, instead of letting it go forward to the well with the other stuff, he would obviate the difficulty.

Mr. TEW, in reply, said he did not anticipate that the paper would provoke any discussion; as it was not calculated to do so. With respect to Mr. Hughes's question, he did not find any alteration in the strength of the ammoniacal liquor, for the reason that the change which took place was something like this: The carbonate of ammonia was changed to sulphide of ammonia; and only a small quantity being affected, no change was made in the strength of the liquor. Mr. Smith offered some kind remarks; and he (Mr. Tew) would like to explain to him how their purifiers were situated. They were so low as to be incapable of being drained. Hence the moisture from them went into the centre-valve in the ordinary way. But when condensation took place through the adoption of the steam-jet, they partially plugged the hole which communicated with the centre-valve, so as to allow the liquor to rest in the purifier; and then, as it would not drain away, it was pumped out. He also thanked Mr. Cross for his remarks. He should like to add that they used to allow the liquor condensed in the purifiers, when ventilating, to drain to the centre-valve; but they found that it soon blocked the valve with the deposition of solid matter, and so they allowed it to fall to the bottom of the purifiers, and then pumped it out. It might be thrown on the lime, but the nuisance from it would be considerable; and he thought that, by letting it go into the tar-well, all nuisance was avoided.

[We are compelled to hold over till next week a report of the discussion on Mr. Young's paper on "Prepayment Meters."]

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting in Philadelphia.

The last number of the *American Gaslight Journal* to hand contains a general account, in the form of special editorial correspondence, of the Twenty-Third Annual Meeting of the above-named Association, which took place in Philadelphia on the 16th, 17th, and 18th ult., under the presidency of Mr. Walton Clark, of that city, whose Inaugural Address, noticed in our editorial columns, is given. The attendance of members and visitors was larger than on any previous occasion.

The proceedings were opened punctually at ten o'clock on the morning of the 16th; and the first business was the presentation of the Council's report, which showed that the number of active members had increased by 18, and of associates by 4. But, on the other hand, nearly as many had either resigned or dropped off the list. Some other routine business followed; and then came the Inaugural Address. An interesting feature in connection with a suggestion contained in it was the announcement by the President that one of the Past-Presidents, who did not wish to disclose his identity, had offered certain money prizes to be awarded for meritorious research. They were as follows: $100 for 1896, $200 for 1897, and $300 for 1898. Then came the reading and discussion of papers. The first was by Mr. W. H. Rogers, of Paterson (N.J.), on "The Creation of a Healthy Public Sentiment towards the Gas Company in the Locality in which it Operates." In the author's absence, it was read by the Secretary; and it gave rise to a good discussion. The next subject to claim attention was "Retort-House Design and Practice," which was introduced by Mr. A. E. Forstall, of Newark (N.J.). These matters occupied the members till the midday recess. Mr. Forstall had prepared an appendix to his paper; and this was taken up on re-assembling in the afternoon. Then came a paper by Mr. A. C. Humphreys, of New York, on "The Commercial Value of Photometry," the publication of which we commence to-day (p. 922). Next followed an illustrated lecture on "Acetylene," by Mr. W. W. Goodwin, which brought the day's proceedings to a close.

On the following morning, Mr. F. Egner, of Norfolk (Va.), started the business with an interesting paper on "The Storage of Oil at Gas-Works;" succeeded by one by Mr. E. G. Pratt, of Des Moines (Ohio), on "Bench Firing with Soft Coal." A paper by Mr. Irvin Butterworth, of Columbus (Ohio), on "The Ventilation of Gas-Lighted Rooms," completed the list of communications; and the "Question-Box" was opened with fruitful results. It was then agreed, on the recommendation of the Committee, to meet next year in St. Louis; and with the passing of the usual votes of thanks, the technical part of the business came to an end.

The following are the new office-bearers:—

President.—C. J. R. Humphreys, of Lawrence (Mass.).
First Vice-President.—Irvin Butterworth, of Columbus.
Second Vice-President.—C. H. Nettleton, of Birmingham.
Third Vice-President.—J. B. Crockett, of San Francisco.
Secretary and Treasurer.—A. B. Slater, jun., of Providence.

At the close of the second day's proceedings, the members visited the factories of the Welsbach Light Company at Gloucester City; a graceful acknowledgment of the presence of the ladies at the meeting being the presentation by the Company of a reading-lamp to each one. In the evening, there was a banquet. The third day was devoted to a trip to Atlantic City.

[Our usual abstract report of the technical portion of the proceedings at the meeting will be given in subsequent issues.]

Broken Fire-Bricks for Pavements.—The Engineer to the Commissioners of Sewers (Mr. D. J. Ross) has lately made a report on the existing experimental pavements in the City of London. In the course thereof, he mentions a pavement formed principally of broken fire-bricks, retorts from gas-works, crushed boulders from the seashore, a certain quantity of broken Portland, Robin Hood, and Bath stones, mixed with Portland cement, cast in a mould, and laid in slabs. This pavement was put down on the south side of Liverpool Street, next to Bishopsgate Street, in 1888; and it is now in good condition.

THE PURIFIER-HOUSE AT THE PRESTON GAS-WORKS.

(*For Description, see p.* 918)

THE COMMERCIAL VALUE OF PHOTOMETRY.

At the recent Annual Meeting of the American Gaslight Association, a brief notice of which appears in another column, Mr. A. C. HUMPHREYS read an interesting paper on the above subject, the principal portions of which are given below.

In the course of his introductory remarks, the author acknowledged that much has of late been written on photometry, and that it has been of a most conflicting character. He said he was also aware that the subject was one which could be better handled by a physicist than by a practical gas engineer. At the same time, in accepting the task of writing a paper, he hoped his efforts might result at least in shedding light on some of the dark corners, and in perhaps inciting more competent minds to take up the work and satisfactorily carry it through. He then briefly described the plan of his paper. He said he should first discuss the subject of illumination and photometry in general, and notice more or less specifically the points tending to show disagreement between candle power, illuminating power, and illuminating effect, and afterwards try to indicate which are the safer paths to be followed in photometrical work. He then proceeded to deal with his subject at length.

Illumination and Photometry.

It will be remembered by many of those now present that ten years and more ago, when the contest between the coal-gas and the water-gas advocates was at its height, the question was raised as to the relative illuminating values of coal-gas and water-gas flames of the same candle power. The claim was made that a "good" 16-candle coal-gas flame would give as much illumination as a 20 candle water gas flame. Again, the rivalry between gas and electric light interests brought up this question; and the photometer has at times been discredited by gas men when the figures seemed to tell in favour of electric light. And now, again, our friends in Great Britain have taken up the discussion; and, as with us, we find this question tacked on to another over which a contest is being waged—namely, the question of high *versus* low candle power gas.

In Great Britain, therefore, and in America, in both the cases above cited, these most fundamental and important questions of candle power, illumination, and photometry have been tacked on to questions necessarily partisan in their character. This is to be deplored, for the questions are sufficiently complex to merit most thoughtful and unprejudiced consideration. It only remains for those of us who may have reason to be prejudiced to be still more on our guard against this influence.

The first difficulty confronting us in this, as in all such discussions, is ambiguity of expression. But this is particularly a difficulty in this case, for the reason that we are not agreed upon a nomenclature to be employed. Not only are we not agreed as to the names for the units and quantities involved, but we are not agreed as to the functions involved in those units and quantities. For instance, how loosely do we employ the word "intensity," without specifying whether we have reference to the light-source or to the light-waves from that source, or to the illuminated surface.

M. Blondel has proposed a scheme of units, and a system of nomenclature in connection therewith; though I fear that the scheme is too elaborate for adoption by gas engineers. But at least we can make the proper distinctions between the various functions involved, and express ourselves accordingly. Let us, first of all, carefully distinguish between intensity of the luminous source and intensity of illumination. One refers to the cause, and the other to the effect. It is true that we measure the cause by the effect; but it is none the less necessary to keep the distinction clearly in mind, if we would avoid entanglement in our discussions.

We must also bear in mind the distinction between candle power and intensity of illumination. A 25-candle power light is of 25-candle power, whether measured at a distance of 1 foot or of 4 feet. But the intensity of illumination in the first case is sixteen times as great as in the second case. We must also agree as to the meaning of quantity of light and quantity of illumination. For instance, if we have a light-source of finite dimensions (as all our light sources are), and we can say it is giving a certain luminous effect for unity area of surface, the quantity of light emitted will be this intensity multiplied by the area of the source.

If this light is received upon an enveloping hollow sphere, the total illumination will be the illumination per unit of surface (namely, the intensity of illumination) multiplied by the area of the sphere's surface. The quantity of light emitted will be the same as the quantity received by the inner surface of the sphere, provided the sphere is filled with an absolutely transparent medium; and the quantity of illumination will be the same,

THE PURIFIER-HOUSE AT THE PRESTON GAS-WORKS.

(*For Description, see p.* 918.)

irrespective of the size of the sphere. But the intensity of illumination will vary inversely with the size of the sphere.

It might seem as if, to be strictly accurate, we should, when calculating quantity of light, also include the function of time, as we would in the case of the flow of gas or water. While light does not flow, it has a duration of effect; and if by intermittent action the effect upon the retina were the same as if the light-effect were constant, then, in valuing light by its effect upon the retina, in considering and comparing quantities, we should have to bring into our calculations the net time of light-emission. An intermittent light-source would have economical advantage by reason of the periods of rest. But while there is such a persistence of visual impression upon the retina, such an intermittent light-source is not to be permitted on hygienic grounds; and we may dismiss time as a practical function.

Often, in connection with the comparison of lights, we find the statement made that one light has intensity, while the other has quantity or value. Both have intensity, high or low; and both have quantity, large or small. If the two light-sources emit the same quantity of light, but have unequal intensities, then they have areas inversely proportional to their luminous intensities. It may be difficult, and even impossible, to directly measure their luminous intensities and the light-giving areas; but this relation must of necessity exist. But we can measure the relative light-giving effects by studying the relative intensities of illumination produced; and so measuring, we find that smaller areas of manifestly higher luminous intensities give the same intensity of illumination as larger areas of manifestly lower luminous intensity.

Illumination is an effect produced upon the retina of the eye. The eye cannot, simply by observation, form a correct judgment as to intensity of illumination. But by direct comparison between two illuminated surfaces, it can detect if one is more brilliantly illuminated than the other; though even then it cannot correctly estimate their relative intensities of illumination. By gradually increasing the illumination of one or decreasing that of the other surface, the eye can, with a narrow limit of error, decide when the two surfaces have been brought to the same degree of illumination. With a Rumford photometer, this difference need not be more than 1-64th. Under proper, but readily attainable, conditions, with fairly normal eyes, this difference need not exceed 1-100th, or 1 per cent.; by some physicists it has been reduced nearly to 1-200th.

In our photometrical work we are governed by two laws, which are generally stated thus: (1) The intensity of illumination on a given surface is inversely as the square of the distance from the source of light. (2) The intensity of illumination which is received obliquely is proportional to the cosine of the angle which the luminous rays make with the normal to the illuminated surface. These two laws could be combined in one statement: The intensity of illumination on a given surface is inversely as the square of the distance from the source of light, and directly as the cosine of the angle of incidence.

With the bar photometer, we are supposed to compare lights the rays of which are normal to the surface, which is the disc. Then the angle of incidence is zero, and the cosine 1; and so the second law can be neglected.

Referring to the first law, assume a light-source at O, fig. 1, placed at the centre of the concentric spheres A B C, A′ B′ C′, and A″ B″ C″. The total quantity of light emitted from the point O will be intercepted by the internal surface of the sphere A B C. If the sphere A B C be removed, the same quantity of light will be spread over the surface of A′ B′ C′. And if A′ B′ C′ be in turn removed, the same quantity of light will be spread

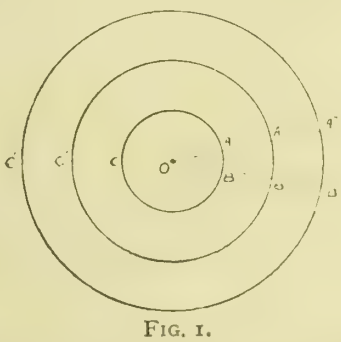

FIG. 1.

over the sphere A″ B″ C″. The quantity of light remaining the same, the intensity of illumination necessarily varies inversely with the areas of the spheres illuminated; and these areas will vary with the squares of the radii. Hence the intensity of illumination varies inversely as the squares of the distances. What is true of the spheres will be true of their

proportionate parts, as, for instance, the parts cut out by the cone A″ O B″.

The accuracy of this law, as applied to practical conditions, has been frequently disputed of late years; and as Mr. Chollar, in his paper "The Rule of the Inverse Squares," has been more than ordinarily definite in the statement of his objections, I will take his utterances as a text in this connection. He says the law as stated is not, as is sometimes supposed, "a natural law of light," but simply depends upon the geometrical principle that the surfaces of spheres are directly as the squares of their diameters. It is true that the law is based upon this principle. It is likewise true that the demonstrations offered are usually mathematical; also that scientists have for years demonstrated by experiment that the law holds good in practice.

The second, or cosine, law is also based upon a mathematical principle. A pencil of light meeting an oblique plane surface will be spread over a greater area than if meeting a surface of which the plane is normal to the rays. Mathematically, the intensity should vary inversely with the increase of area. As the area increases, the cosine of the angle which the ray makes with the normal to the surface will proportionately decrease, and therefore be a measure of the relative intensities of illumination. But in this case, applying experimental tests, it was found that the law was not strictly accurate, as the reflection increased with the angle. Thus we see that the scientific work of the laboratory which disproved the strict accuracy of the cosine law, confirmed the accuracy of the law of distances.

Mr. Chollar quotes Professor Tait's statement of the first law, and appears to be satisfied as to the accuracy of the law as thus stated—viz., "If the medium be *transparent*, the intensity of illumination which a luminous point can produce on a *white* surface *directly exposed* to it is inversely as the square of the distance." (The italics are mine.) Professor Tait here only states the law as generally understood and accepted.

Let us see if the specific statement of the limiting conditions in any way prevents us from working under the law in comparisons of light-sources. Manifestly, in such comparisons, we must agree upon what are to be considered normal conditions, just as we agree that in measuring the volume of gas we shall refer the measurements to the normal conditions, as to temperature and pressure—60° Fahr. and 30 inches barometer.

We must first assume a transparent medium. Otherwise the same light would show differing lighting values according to the medium present, and the same medium would differently affect the light from different sources. A little thought as to the passage of light from the stars will convince us that, in comparative tests, it is not difficult to meet the condition as to transparency of medium. Light moves with a velocity (say) of 180,000 miles per second. At this velocity, our earth could be encircled 7½ times in a second. Light from the fixed stars takes years to reach us; and yet it is then able to produce light-sensation on the retina. Can we not assume then, for all practical purposes, that the ordinary transparency of our atmosphere is sufficient to meet this imposed condition?

We next come to the limitation that the light-source must be a luminous point. Mr. Chollar evidently regards this limitation as a complete bar to the application of the law in the case of light-sources of finite dimensions. To demonstrate his proposition, he assumes a line as the light-source, and then shows rays from a certain number of points in the line, converging to, and intersecting at, a point taken outside of the line. Then he says: "Now, since light moves in straight lines, all rays starting from A D (the luminous line) in the direction of E (the point taken outside) must remain within the limits of the triangle A E D. Sections *e e* of A E D, therefore, parallel with A D, will represent aggregates of light-waves or quantities of light equal to each other, and equal to the total quantity emitted at A D."

He then goes on to say: "It appears, therefore, that, irrespective of intensity, the quantity of light from a luminous body at any particular point is independent of the distance of the body, and is in direct proportion to its diameter. If the above reasoning is correct, the total energy exerted by a light is represented by the product of two factors, one of which being increased, the other can be correspondingly reduced. The rule governing the value of lights, therefore, would be something like this: The light from a luminous body is inversely as the square of its distance, and directly as its projected area." It seems to me that Mr. Chollar is here confusing cause and effect. We measure the value of a light-source by its illuminating effect; and the law is so given even in the form approved by Mr. Chollar.

Suppose we have three points, O′ O O″ (fig. 1A) of equal luminous intensity, then, according to Mr. Chollar, there will be concentration of rays within the angle O′ A O″; and this will be true of all points outside of O′ O O″, except along the projection of the line O′ O″. This concentration is expected to compensate in part for the decrease of illuminating effect due to increase of distance.

But what is true of any one point, as O, is true of all points, and therefore of O′ O″. The light rays will, therefore, diverge equally from the points O′ O O″, and will spread themselves equally over their enclosing spheres; and the resulting intensity of illumination in each case will be inversely as the squares of the radii. The intensity of illumination at A will be the combined intensity produced by the rays OA, O′A, O″A. Now suppose the luminous points O′ O O″ were compressed into one luminous point at O, resulting in one point of a luminous intensity equal to the combined intensities of O′ O O″—that is, equal to three times the luminous intensity of O. Then we shall have the light emitted uniformly, and uniformly illuminating the inside surface of the sphere A B C, and therefore following the law of the inverse squares. But in moving O′ and O″ into O, the only change we have made with regard to A is to shorten

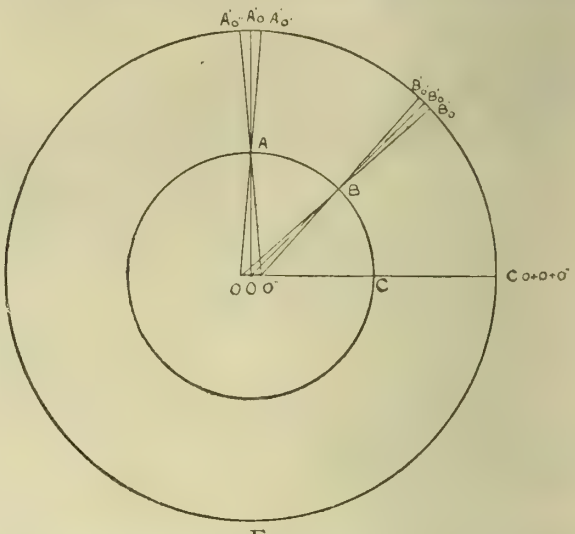

FIG. 1A.

the distances O′A and O″A; and to that extent the combined illumination from O′ O O″ will differ from the combined illumination from O′ O O″, as arranged in fig. 1A to represent a luminous line. At B and at C, O′B and O′C will be longer than OB and OC, and O″B and O″C will be shorter; thus tending towards compensation, and, within working limits, enabling us to take OB or OC as the average distance. As the point A is moved away from the light-source, the difference in distance decreases, and quickly becomes negligible. This we see when using two candles for a photometer standard. If the disc is very close to the candles, inequality of illumination is apparent, and the reading fails to check with the reading from one candle multiplied by two. But moving the disc away, we get a uniform illumination, and a reading which will check with the single-candle reading. As far as the law of the inverse squares is concerned, it makes no difference whether the illuminated surface at A gets its concentration of rays from one point or three, except the minor discrepancy due to difference in distances just referred to. Here I refer to effect. But if from the one point we are to obtain at A the same illuminating intensity as from three points of equal intensity, the one point must have three times that luminous intensity. Here I refer to cause.

Mr. Chollar says: "The *light* from a luminous body is inversely as the square of its distance, and directly as its projected area." The *light* from a luminous body will always remain the same, irrespective of distance, until it is absorbed by some opaque body. The intensity of illumination from a luminous body will vary inversely as the square of its distance. The light from a luminous body will be directly as its area (not its projected area), provided the light-source is transparent to its own rays and its luminous intensity is uniform over its entire area.

We come now to the condition that the illuminated surface must be white. No one familiar with photometry will object to this condition. In fact, it is always stipulated that the screen or disc should be white. Any deviation in this regard would be sure to work injustice to one of the lights compared, on account of the composite nature of all light. In practical illumination, the light will meet surfaces possessing all possible combinations as to absorption and reflection, and giving the consequent variety of colour effects. We cannot expect to compose light to suit this infinite variety of conditions; and we must therefore use a surface which will reflect all colours of the spectrum.

The last condition is that the surface shall be directly exposed to the light. This is necessary for the reasons just given. If the light were allowed to first fall on other surfaces, and we attempted to compare the diffused light from each source, we should be again met with the point that the light from one source will be absorbed to a greater or less degree, depending upon the surfaces and the composite nature of the lights.

I hope I have shown that, in accepting Professor Tait's careful statement of the law of the inverse squares, we do not have to abandon our belief in the previously accepted principles of photometry.

(*To be continued.*)

Russian Petroleum Exports.—According to a statement issued by the Finance Ministry of Russia, the exports of petroleum from that country to European countries in 1894 amounted to 24,923,840 poods, of which 5,959,032 poods came to England. Turkey took 236,000 poods more, and Austria 454,007 poods more than this country.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Street Lighting with "Welsbach" Incandescent Burners.

SIR,—Your contributor "Veritas" is mistaken, when, in your issue of the 29th of October (p. 873), he states that, in your previous article on the above subject, of the 27th of August, I condemn the "usual bye-pass arrangement." What I disapprove of is the chain and ring attachment to the tap lever; and I certainly think that the ordinary T tap, which is fixed outside and beneath the lantern in the usual way, and which is now being supplied by the Incandescent Gas-Light Company, is very much to be preferred.

Instead of condemning the bye-pass itself, the more experience I have with these burners, the more convinced am I that, not only for public, but for satisfaction and economy in most forms of domestic lighting, they are indispensable.

H. H. JONES.

Isle of Thanet Gas Company, Margate, Nov. 1, 1895.

The Limit of Time for Proceeding against Offenders.

SIR,—I shall be glad if you will allow me to state the following facts, and invite your opinion, and those of your readers, on the question of the liabilitiy to prosecution of a workman who becomes the instrument of a defendant found guilty and fined.

At the Aberdare Police Court, on Tuesday last, the local Gas Company sued a consumer of gas at a public-house for having, through his private gas-fitter, whose name and address he gave, inserted a bye-pass pipe from the inlet to the outlet of his meter, through which pipe gas had been fraudulently abstracted, unregistered, for about three years; gas being also passed at the same time through the meter, and registered in the usual way. The defendant admitted the offence, and was fined the maximum penalty of £5, to be paid to the Company, and costs; and £30, also to be paid to the Company, the estimated value of the unregistered gas abstracted through the surreptitious pipe.* The gas-fitter who fixed the pipe had been summoned to give evidence at the trial; but he failed to attend.

It is generally felt that this fitter was as much to blame, morally, as his employer (the defendant); but we are given to understand that, as he committed the offence at a date prior to six months ago, he cannot now be proceeded against; in other words, that an offence of this class is not actionable after the expiration of six months from its commission. Would not the law mean six months after the misdeed had become *known?* It was committed three years ago; but the fact was not known to the Gas Company until recently.

EVAN JONES,
Secretary and Manager, Aberdare Gas Company.

Aberdare, Oct. 31, 1895.

The Alcester Gaslight, Coal, and Coke Company, Limited, has been registered, with a capital of £2760, in 24 ordinary shares of £100 each, and 72 preference shares of £5 each, as the incorporation, under the Companies' Acts, of the Alcester Gaslight, Coal, and Coke Company, constituted by deed of co-partnership and deed of declaration, dated respectively Jan. 1, 1850, and July 9, 1851. All the shares were subscribed for on Oct. 16, 1895; and the full amount called and paid in respect thereof.

Prepayment Meters at Rotherham.—Complaints having been made at Rotherham as to the delay of the Corporation Gas Department in supplying prepayment meters, Mr. G. Gummer, at a meeting of the Town Council last Wednesday, asked the inhabitants to exercise a little patience in this matter. They had, he explained, 27 men engaged fixing the automatic meters at the rate of 54 per week; and they would very soon be able to meet the demand. They had already fixed 650 meters, and had applications for 295 more; so that by Christmas they would have about 1000 consumers more than they had previous to the introduction of this class of meter.

Additional Works for the Newcastle and Gateshead Gas Company.—The officials of the Newcastle and Gateshead Gas Company have been engaged for some time past in surveying land at Walker for the purpose of constructing new works, to enable them to supply the inhabitants of the now fast-growing district at the east-end of Newcastle. The land in question is about 80 acres in extent—the greater portion being on Lord Northbourne's estate, while the remainder is leasehold, and belongs to the Newcastle Corporation. The North-Eastern Railway Company's riverside line runs almost through the middle of the land; and a good river frontage is available.

Sales of Shares.—Last Tuesday, Mr. W. Emery sold by auction, at Guildford, 51 shares in the *Guildford Gas Company.* Nine £25 "A" shares (10 per cent.) fetched £62 10s. each; and three do., £63 10s. each. Eight £10 "D" shares (7½ per cent.) were knocked down at £19 apiece; and other shares of similar nominal value, but entitled to 7 per cent. dividend, realized £18 each.——Messrs. Cumberland and Hopkins, of Leighton Buzzard, have lately sold two lots of original (£21) stock in the *Leighton Buzzard Gas Company* for £49 each; also £1000 of new ordinary stock, in £50 lots, at prices ranging from £75 to £81 per lot.——Among some miscellaneous stock and shares sold at Leeds by Messrs. Hollis and Webb last Tuesday, was £200 of 7 per cent. *Calverley and Horsforth District Gas Company's* stock, which realized £347.——The sale by auction of the £15,000 of new ordinary stock in the *Wolverhampton Gas Company* which was recently advertised in the JOURNAL, resulted in an average price of £126 12s. 6d. per cent. The highest figure obtained was £131 10s.; the lowest, £124. The standard dividend authorized by the Company's Act of 1893 on this stock is 6 per cent., subject to the usual sliding-scale clauses.——Last Tuesday, £2500 of 7 per cent. stock in the *Lewes Gas Company* was sold for £3887. The prices ranged from £154 to £157 per cent.——Shares in the *Camborne Gas Company* were sold locally on Wednesday at £5 1s. 6d. and £5 2s.

* A report of the case is given in our "Legal Intelligence."—ED. J.G.L.

LEGAL INTELLIGENCE.

LIVERPOOL CITY SESSIONS.—Tuesday, Oct. 29.

(*Before Mr.* C. H. HOPWOOD, Q.C., *Recorder.*)

Appointment of an Auditor of the Gas Company's Accounts.

Three several applications were made to the Court to-day for the appointment of an Auditor of the Liverpool United Gaslight Company's accounts: (1) By two large trading firms in the city, who desired the appointment of Mr. William C. Spencer, the President of the Liverpool Society of Chartered Accountants; (2) by two other firms, who wished Mr. P. B. M'Quie to be re-appointed; and (3) by the Corporation and Aldermen Frederick Smith and Rathbone, who suggested the appointment of the Corporation Auditor, Mr. Richard Barrow.

Mr. HORRIDGE, who appeared in support of the first proposal, quoted the section of the Gas-Works Clauses Act under which, on the petition of two ratepayers who were not proprietors in the Company, the Recorder could appoint an Auditor to examine and ascertain the actual state and condition of the concerns of the Company. Mr. Spencer, whose nomination he supported, was President of the Liverpool Society of Chartered Accountants, a member of the firm of Banner, Spencer, and Co., and a Public Accountant of some twenty years' standing. He (Mr. Horridge) ventured to submit that it was never intended that the Corporation should be the party to check the accounts of the Company. Had that been the case, the Act would have expressly stated it. As for Mr. M'Quie, he now had no office in Liverpool as a Chartered Accountant, and he resided at West Kirby.

Mr. TOBIN, supporting the second petition, pointed out that for nineteen years—from 1874 to 1892—Mr. M'Quie had been the Auditor appointed to examine into the accounts of the Company; and he therefore had a ripe experience for the audit, which he again sought. When he was superseded in 1892 by Mr. Barrow, suggestions were, he believed, made that Mr. M'Quie's reports were too favourable to the Company, and that if Mr. Barrow were appointed by the Court, certain irregularities which had been overlooked by Mr. M'Quie would be found out by Mr. Barrow.

Mr. SEGAR (who appeared for the Company) said there was no suggestion made that Mr. M'Quie's accounts were wrong.

Mr. TOBIN said he never suggested that. As a matter of fact, Mr. Barrow had found nothing wrong in the Company's accounts; and he had simply followed the lines of Mr. M'Quie's reports, which were always most comprehensive. He asked his Honour, with confidence, to reinstate Mr. M'Quie.

Mr. COLLINGWOOD HOPE, for the Corporation, said that Mr. Barrow's appointment had been assented to by the Company. No objection whatever had been urged against him; and so far as he (Mr. Hope) knew, no suggestion was made against him now. The idea that, because there was some rivalry between the Company and the Corporation, no person interested in the Corporation ought to be appointed, was altogether wide of the mark. He respectfully urged there was no reason for such a suggestion, and said there had never been any complaint of Mr. Barrow showing any want of impartiality. He need hardly point out that at the present time the Corporation were not in the position of rival gas makers. A proposal stood on the books; but he understood nothing had been done about it, and nothing was intended to be done.

Mr. SEGAR said this was the first time they had ever opposed the appointment of any Accountant. They had always left it entirely to the discretion of the Court, and had taken no part in the proceedings, either in assenting to or opposing any nomination. They did not in any way suggest that Mr. Barrow was incompetent or failing in impartiality. He had made two reports, which showed distinctly that he was a competent man, and also that there was absolutely nothing from the beginning to the end of the Company's concern of which they need feel ashamed or desire to conceal. Now, however, the circumstances between the Company and the Corporation were altered. The Corporation proposed to obtain an Act of Parliament to take away the business of the Company; and therefore they were interested in getting to know as much about the business of the Company as they could. It was quite contrary to the ordinary principles of mercantile transactions that one business should have the opportunity of inquiring into the management of another business upon matters which were vital to the existence of one or both. Notwithstanding the tumult of abuse which had been showered upon the Company, they could always hold up their heads; and there was not a single act that had ever been done which any person could lay hold of. Everything had been raked up from the very bottom; and nothing had been discovered against the Company. He (Mr. Segar) submitted that it was quite clear the Recorder had no power to appoint a rival proprietor of gas-works to examine their accounts. At present the Corporation were competitors in the production of artificial light in Liverpool. They were already the proprietors of the Electric Supply Company, and were, therefore, practically in the position of a rival company.

Mr. HOPE: The Electric Supply Company have not yet been taken over.

Mr. SEGAR said it was going to be taken over; and, moreover, the Corporation had on their books a resolution (which surely was not a sham resolution) to start gas-works of their own. It was almost impudent of the Corporation—if a corporation could be impudent—to ask that their official should be appointed Auditor, seeing that they were now at "daggers drawn" with the Company. The Company objected to the Corporation interfering any further with their business; and they contended that it would be contrary to the spirit if not the letter of the Act of Parliament if Mr. Barrow were appointed. They did not object to Mr. Spencer, Mr. M'Quie, or anybody else; but they did not want the Corporation meddling with them any longer.

The RECORDER, in giving his decision, said he had no doubt that Mr. M'Quie performed his duties as Auditor very thoroughly; but there were reasons on the previous occasion, on which he had to base his decision in favour of Mr. Barrow, that again led him to the conclusion that he could not appoint Mr. M'Quie. The Corporation, with praiseworthy motives, were taking up this matter; and if the Gas Company

had acted fully up to their statements, and honourably by the public, they could not complain that the Corporation should desire to investigate matters to the utmost, and procure better terms, if possible, for those whom it was their duty to protect. It was clear to him (the Recorder) that a dispute had arisen between the Company and the Corporation; and he felt he would best comply with the spirit of the Act of Parliament if he secured the services of an unimpeachable nominee, who, while doing justice to the Company, would also watch over the interests of the community. He therefore accepted the nomination of Mr. W. C. Spencer.

HERTFORD COUNTY SESSIONS.—Saturday, Oct. 19.

(*Before Mr.* A. G. PAGE, *the Mayor of Hertford, Chairman, and a Bench of Magistrates.*)

Baker v. Hertford Gas Company—The Making Up and Supply of Annual Accounts.

As briefly recorded in the JOURNAL last week, the Hertford Gas Company were summoned before the Justices on the above-named day, on two informations laid against them by Mr. Alfred Baker, the ex-Mayor, under the Gas-Works Clauses Act, 1871. In the first case, the complaint was that the Company had failed to "fill up and forward to the Corporation of the Borough of Hertford (being the local authority of the district within the limits of the Hertford Gas Act, 1864), on or before the 25th day of March, 1895, an annual statement of the accounts of the said Company, made up to the 31st day of December, 1894, in the form and containing the particulars specified in Schedule B of the Gas-Works Clauses Act, 1871 (34 & 35 Vict., cap. 41);" in the second, that they "unlawfully did not keep and sell to Alfred Baker, who then applied for the same at the office of the said Company . . . copies of their annual statements of account made up to the 31st day of December in the years 1890, 1891, 1892, 1893, and 1894 respectively," as provided by the Act.

Mr. R. ELLIOTT appeared for complainant; Mr. C. E. LONGMORE represented the Company.

Mr. LONGMORE raised a preliminary objection to the second summons, on the ground that it contained no less than five separate offences. He said the Summary Jurisdiction Act of 1848, sec. 10, contained a provision that "every complaint shall be for one matter of complaint only, and not for two or more matters of complaint; and every information shall be for one offence only, and not for two or more offences." He submitted that, if an offence had been committed at all, it had been committed in regard to each separate year, for all of which offences it was open to Mr. Baker to institute proceedings; and therefore the one summons taken out included no fewer than five separate cases. But for a certain course which it would be competent for his friend to take, his objection was absolutely fatal to the summons as it stood at present. He cited a case in support of his contention; and, upon the authority thereof, he asked the Magistrates either to dismiss the summons, or ask his friend to elect which of the five years he proposed to go upon.

Mr. ELLIOTT said, of course, he could not complain that Mr. Longmore should make this formal objection. While not admitting that five offences had been committed, on the ground that application for the whole of the balance-sheets was made at one time, he was content to take only the year 1893. It made no difference as regarded this particular class of offence; and if the defendants were guilty for one year, he was quite satisfied.

The summons having been amended by striking out the years 1890, 1891, 1892, and 1894,

Mr. ELLIOTT proceeded to open the case. He said this was a prosecution instituted under the 35th section of the Gas-Works Clauses Act, 1871. The section provided that the undertakers (in this case the Hertford Gas Company) should forward to the local authority of their district, on or before the 25th of March of every year, an annual statement of account made up to the 31st of December next preceding, in the form laid down by the Act; and also that they should keep copies of the same for sale at a price not exceeding 1s. each. It further provided that a penalty of 40s. would be incurred for each day during which default was made. The position of the Hertford Gas Company, and similar companies, with reference to their accounts, was shortly as follows: Under the Gas-Works Clauses Act, 1847, all companies were required to deposit copies of their annual accounts with the Clerk of the Peace for the county in which their works were situate, before the 31st of January in each year; the copy so sent to be open to any person on payment of 1s. for each inspection. In 1864, the Hertford Gas Company were formed; and their Act of Parliament received the Royal Assent on the 23rd of June of that year. In this Act, the Gas-Works Clauses Act, 1847, was incorporated, together with other Acts of Parliament. The Hertford Gas Act, he wished to impress upon the Bench, did not contain any provision relating specially to the statement of accounts. It was most important that this should be borne in mind, because there were numerous gas companies throughout the country who were placed in a different position, in regard to their accounts, to the Hertford Company; for in their Private Acts they had special clauses affecting their statements of account, both as regarded the form in which they were kept, and the date when they should be presented. Numerous decisions which had been given proved that, in the case of companies having these special clauses, they were exempt from the operation of the Act of 1847; and they therefore stood in a different position from the Hertford Company. He did not know whether or not the Company had carried on their affairs, so far as the presentation of accounts was concerned, under the impression that they did not come within the provisions of the Act of 1847, and were in the same position as those companies who, by reason of special clauses in their own Acts, were exempt. He did not, however, for a moment suppose that Mr. Longmore would contend that there was anything in the Hertford Gas Act exempting him from the provisions of the 1847 Act. Section 49 of that Act provided that nothing contained in a Private Act should be deemed to exempt the undertakers from any General Act relating to gas-works, &c., even though the Private Act was passed in the same or in a future session of Parliament. In 1871, another Gas-Works Clauses Act was passed; and its first section provided that the Act of 1847 and that Act should be construed together as one Act, and that the provisions of the Act of 1871 should be held to repeal and supersede such of the provisions of the Act of 1847 as were inconsistent with it. Therefore they must take the Acts of 1847 and 1871 and read them together; and wherever the provisions of the former Act were inconsistent with those of the Act of 1871, they must take the latter as prevailing in the matter. The third section of the Act of 1871 specified that the Act should apply to every gas undertaking authorized by any Special Act passed or Provisional Order granted under the authority of the Gas and Water Works Facilities Act, 1870, save where provision was expressly made for exempting the undertakers from it. In the absence of any special provision in the Hertford Gas Act exempting the Company from the Acts of 1847 or 1871, their position was this—that, so far as their accounts were concerned, they were regulated by the Act of 1871. The 35th section of this Act provided that the accounts should be made up to the 31st of December, and copies of the balance-sheet deposited with the local authorities by the 25th of March next following, and other copies kept for sale. That was the section of the Act which governed the affairs of the Hertford Gas Company, because there was no special clause in their own Private Act exempting them from it. The accounts of the Company had, he should prove, been made up, not in March, having relation to the previous year ended the 31st of December, but in June; and therefore the Company had not complied in any sense with the terms of the section. Though it might be urged by Mr. Longmore that no very grievous wrong had been committed by a mere matter of three months or so, he was sure the Magistrates, in deciding the case, would agree that it was no question for them to determine why the Legislature had fixed the date they had. It was sufficient for their purpose that Parliament had laid it down as law that the accounts were to be presented on or before the 25th of March, having relation to the previous December. Mr. Baker would no doubt be able to furnish good reasons why he laid complaint in this matter; but it was sufficient for him (Mr. Elliott) to prove that the Company had rendered themselves liable under the section, and to ask the Bench to inflict upon them such a penalty as they thought proper to meet the offence they had committed. He was not without precedent in this matter; and he would call attention to the well-known case of *The Dudley Gas Company v. Warmington*,* which was on all-fours with the present one. In that case, the Dudley Gas Company, in the year 1880 and previous years, did not comply with the section providing that they should keep copies of their balance-sheet for sale. There the information was laid by the Town Clerk; and a fine of £50 was imposed. The Dudley Company were incorporated by Special Act passed in 1853. There was nothing in that Act which exempted them from the operation of the General Act of 1847; and they were therefore in exactly the same position as the Hertford Company. They appeared to have been under the impression—very much the same as he thought the Hertford Company had been—that they did not come under section 35 of the Act of 1871; and therefore they did not keep their accounts in the way prescribed by that Act. The Company appealed against the decision of the Justices; and the Judges in the High Court upheld the Magistrates' decision. Having indicated the legal position he took with regard to this matter, it was only fair that he should show how the Company had been approached by Mr. Baker. It appeared that the proceedings commenced by a letter, written by him on the 3rd of September last, addressed to the Secretary of the Company, in which he requested him to supply him with copies of the annual statements of account for the years ending Dec. 31, 1890, 1891, 1892, 1893, and 1894, for which he enclosed the prescribed fee—5s. To this the Secretary replied by sending the balance-sheets made up to June 30 in each year. Mr. Baker then wrote back returning the balance-sheets, and stating that he had applied for the accounts made up to Dec. 31, and not to June 30 as sent, in accordance with the provisions of the Gas-Works Clauses Act, 1871; and asking for the proper accounts by bearer. To this letter the Secretary wrote stating that the accounts of the Company were made up to June 30 in each year, and pointing out that the printed balance-sheets sent covered the periods asked for. Mr. Elliott was about to read another letter, when

Mr. LONGMORE objected, on the ground that it was an attempt to discuss the accounts of the Company.

Mr. ELLIOTT submitted that the Company had answered it; and therefore he thought he might read it.

Mr. LONGMORE said the question before the Bench, as Mr. Elliott had very fairly put it up to that time, was whether the accounts were made up to the 31st of December and delivered. He submitted that the Court had no power to go into the question of those accounts.

Mr. ELLIOTT said he did not for one moment wish the Bench to do so.

The MAYOR: That being so, the letter spoken to will not be read.

Mr. ELLIOTT, continuing his opening statement, said he was reading a letter dated the 6th of September, in which Mr. Baker said he had before him the Company's financial statement for the year ending June 30, 1895; and he found the following discrepancy upon comparing it with the accounts for the previous year, which, in the interests of the shareholders, required explanation. In the first case, the revenue account showed that the Company had received——

The MAYOR: I do not think this can be admitted; it has nothing to do with the case. You have already shown that Mr. Baker applied for balance-sheets. It is the opinion of the Bench that this letter should not be admitted.

Mr. ELLIOTT said they might take it, then, that there was correspondence between the Company and Mr. Baker, which resulted in these proceedings being taken. He had tried to make the matter as concise as possible; and he did not think the facts could be disputed.

A short consultation here took place between the learned gentlemen, at the close of which

Mr. ELLIOTT said he thought the Bench might take it that it was admitted on both sides that the account up to the 31st of December was not sent to the Local Authority on or about March 25; and he was willing to admit that subsequently they did send an account made up to the 30th of June.

* See JOURNAL, Vol. XXXV., p. 877; also Vol. XXXVII., p. 479.

Mr. LONGMORE said that was admitted on both sides.

In reply to the Magistrates,

Mr. ELLIOTT said that, with regard to the non-delivery of an account to the Local Authority, he was going on the year 1894; and on the summons for not keeping a copy to sell to the applicant, he went on the year 1893.

Mr. *A. Baker*, the complainant, was then examined by Mr. ELLIOTT. He said he first applied to the Company by letter on the 3rd of September for the balance-sheets; and on the 4th, he made personal application for them at the works. He applied for balance-sheets from 1890 down to the present time; and he paid 5s. for the copies. The Company still had this money.

Mr. LONGMORE intimated that he had no questions to put to witness.

Mr. ELLIOTT said this was his case.

Mr. LONGMORE then addressed the Magistrates on behalf of the Company. At the outset, he objected to the extraordinary course taken by the complainant in laying the information before the County Justices instead of those for the borough—a proceeding which, he said, was almost unprecedented. Coming to the case itself, he said that, in order to put it fairly before their Worships, he must trouble them with a short *résumé* of the law on the subject. The Gas Company, as he understood it, were, save in so far as the Legislature had made exception, in the same position as any other trader with regard to their accounts; and neither the Magistrates nor any Court had power to inquire into them. It was true that certain alterations in the law regarding gas companies had been made in the interests of the consumers. In the first place, it was provided that they should not make a profit exceeding 10 per cent. in any one year; and he could show them that for years and years the Hertford Company had not made anything like this profit. Next, the Legislature provided that, should they in any subsequent year make more than 10 per cent., they could put back into the preceding years' accounts a sum so as to make up for each year a profit of 10 per cent. In addition to this, the Company were entitled to put by a reserve fund of 10 per cent. upon their capital. With these exceptions, they stood upon exactly the same footing as anyone else with regard to their accounts. But in order to enable the public to see whether the Company were in fact making more than 10 per cent. profit, or were giving their shareholders more than 10 per cent., or had put by more than a reserve fund of 10 per cent., certain power was conferred with regard to the accounts. As his friend had properly stated, up to the year 1871 the Gas-Works Clauses Act, 1847, laid down that the accounts should be made up and sent to the authorities at a certain time each year. The accounts of the Hertford Gas Company were so made up and sent to the Clerk of the Peace. This was in order that, if anyone found that more than 10 per cent. had been made, or more than this sum put by, he would have been entitled to inquire into the matter through the Court of Quarter Sessions. But the Court was limited solely to inquiring into the previous year's accounts. Once they had let a year go by, they could not take proceedings with regard to that year. Then came the Act of 1871; and no doubt the Magistrates, after hearing the most lucid statement of Counsel, might have come to the conclusion that the accounts should have been made up to the 31st of December, and not to the 30th of June. But when he had drawn their attention to section 3 of the Act of 1871, they would see how easily an ordinary director, in reading the section, might have come to a contrary opinion, because it said: "The provisions of this Act shall apply to every gas undertaking authorized by any Special Act hereafter passed." There was the fact that the Hertford Gas Act was obtained in 1864, whereas the Act he had referred to, which was to affect any subsequent Act, was not passed until 1871, seven years later. It was true that, in the year 1881, the Judges in the Dudley case, which his friend had quoted, came to the conclusion that, notwithstanding these words, the Act of 1871 applied not, as the Legislature had said, to "any Special Act hereafter passed," but to any company, such as theirs, whose Act had been previously obtained. Any ordinary director, relying on his own reading of the law, would not unreasonably suppose that his accounts were properly prepared if they were made up to the 30th of June. He wished the Bench to clearly understand that the only real interest which the public had in these accounts was for the current year. The accounts of 1893 were merely waste paper now. His friend had them; but he had no interest in them, for they could not be re-opened in the least degree. It might be well for him (Mr. Longmore) to show what had led to the present unfortunate position of the Company. The management of the works was vested for some years in a family of the name of Brett. He believed they had been connected with the works nearly since their establishment; and they were most trusted servants in every way until the unfortunate events of this year. At the beginning of the year, his clients found the arrears were getting unusually large; and, not being satisfied, they called in an expert, in the person of Mr. Alfred Lass, whom he should call as a witness. Mr. Lass went into the matter, and reported that the arrears account was unusually large; and he advised that the accounts, before being sent out, should be checked with the books. The Bretts were told to make up the books; and, so far as he knew, those books were on the 15th of January at the office of the Company. That night they disappeared, and had never been heard of from that day to this. How they went, they could not very well say; but they could form a very strong suspicion. However, there the Company were—left on the 15th of January without any books. There was the law staring them in the face—they had to make up their accounts to the 31st of December. The Magistrates would not be surprised to hear that, these books having disappeared, the affairs of the Company were in a terrible condition. Large numbers of consumers disputed their accounts; and it was not until those for the quarter ending March 31 had been sent in that the Directors were able to ascertain in the least degree how they stood. He thought that, if any excuse were needed, this was abundant excuse for the accounts not being made up to the 31st of December last. Mr. Lass went carefully into the matter. The Bretts were discharged; and a new Manager was appointed, together with a new Collector, and a new Auditor; and every endeavour was made to put the Company in a proper financial position. He could truthfully say that, if they would allow them to go on under the new management, their affairs would be conducted in a satisfactory manner. His clients had done all they could to put themseves in a proper legal position; and they had failed in doing what was absolutely impossible. Whom did they have on the other side? Mr. Baker, who ever since the year 1881 had had the Dudley case burning in his brain; but not until the books were lost, and the accounts could not be made up, did he play his trump card. With the Company in their present unfortunate position, he said to himself: "Now is my time to punish them, and to drag them before the Bench." There was a section in the Summary Jurisdiction Act of 1879 which, he ventured to think, was admirably adapted to meet the present case. Section 16 provided that if, upon the hearing of any charge for an offence punishable on summary conviction, the Court thought that, though the charge was proved, the offence was of so trifling a nature that it was inexpedient to inflict any punishment, they might, without proceeding to conviction, dismiss the information. Was there, he asked, ever a case, since that Act was passed, to which the section more directly applied than the present one? In one summons, what was Mr. Baker's grievance? That there was no delivery to the Local Authority of the accounts made up to 31st of December last. Beyond the mere possession of that document, what advantage could be gained, because the sole question which could be gone into was whether or not, during the past year, the Company had made a sufficient profit to pay the shareholders 10 per cent., fill up the reserve fund, and pay off all arrears of dividend, which would require a sum of £15,000 to accomplish. They all knew the shareholders had nothing last year; and it was therefore absolutely futile for the accounts to be deposited. This, then, was surely a case where it was inexpedient to inflict any punishment at all. With regard to the complaint of not selling the accounts for 1893, what advantage to anyone would they be? The time for going into the question of that year's accounts was past and gone. Was not that again a case of so trifling a nature that it was inexpedient to inflict any punishment? He urged the Bench, on behalf of the shareholders of the Company, who had had no dividend during the past year, and also on behalf of the consumers, in whose best interest it was that the Company should be allowed to go on unharassed, and of a large number of inhabitants of the town, to dismiss the case under the powers they possessed in the section of the Act he had quoted.

Mr. Alfred Lass, F.C.A., was about to be called, when an opinion was expressed by the Chairman that it was unnecessary.

The Magistrates then retired for a short time. On their return,

The CHAIRMAN said: The Court has carefully considered this case so ably put before it by both the prosecution and the defence, and is unanimously of opinion that the Gas Company have committed two offences under the Act of 1871. But, as it is not shown that any injury of a public or a private character has been done, they will impose a fine of only 1s. for each offence, and the ordinary costs.

The fines—1s. and 9s. costs in each summons—were at once paid; and the proceedings terminated.

ABERDARE POLICE COURT.—Tuesday, Oct. 29.

(*Before Mr.* R. H. RHYS, *Chairman, and a Bench of Magistrates.*)

Defrauding the Aberdare Gas Company.

To-day Charles Rosser, landlord of the Freemasons' Tavern, was summoned for "laying or causing to be laid a pipe to one of the service-pipes of the Aberdare Gas Company, without their consent, and for allowing the same to be connected from the 30th of September, 1892, to the 3rd of October, 1895." He was also summoned for having unlawfully and fraudulently abstracted, by means of this pipe, a quantity of gas, the property of the Company; and he was further summoned to pay the sum of £51 15s. 2d., damage sustained by them by the abstraction of the gas.

Mr. C. KENSHOLE prosecuted; Mr. T. PHILLIPS defended.

Mr. KENSHOLE, in opening the case, said the defendant was charged with two distinct offences. The first was laid under the 18th section of the Gas-Works Clauses Act, 1847, under which defendant was liable to a penalty not exceeding £5 for the offence, together with a continuing penalty of 40s. a day. Under the Gas-Works Clauses Act, 1871, he was also liable to a penalty of £5 for abstracting the gas; and the Company were entitled to recover the amount of damage done to them by such abstraction. The circumstances of the case, which he would prove, were as follows: Mr. Rosser was a gas consumer; and his house was divided from the house of a Mr. Wilson, his brother-in-law, by a passage. Covering a portion of the passage was a store-room. The Company's mains were laid up through Wind Street in front of these houses; and the service-pipe ran into the passage, and thus under the store-room. Just inside the passage, a branch was carried into the cellar through Mr. Rosser's meter for lighting the house; and some distance farther on there was another branch into Wilson's premises. On the 3rd of October, Mr. Ashman, a meter inspector, went into the defendant's cellar for the purpose of ascertaining the quantity of gas burnt during the previous quarter; and in order to do so, he lit the gas. Having taken down the figures, he turned off the tap; but, to his astonishment, he found the gas still burning at the jet. He then watched the dial of the meter, and found that no gas was passing through. He at once went to see Mr. Rosser; but he was not in. Later in the day, he procured the key of the store-room above the passage, and discovered that a pipe had been connected at the outlet into Mr. Wilson's house, which ran back 20 feet to Mr. Rosser's premises. The result, of course, was that all the gas passing through this pipe—a 5-16ths inch compo. pipe—did not go through the meter, and none of it was registered. Later in the day, he saw Mr. Rosser, who insisted on two occasions that he knew nothing about the matter. But on the following Monday he sent for Mr. Ashman, and admitted that it was done by a man named Thomas, a gas-fitter, now residing at Hirwain, upwards of two years ago; and he expressed his regret that he allowed it. The Company had since ascertained that it was done in January, 1892. They had also found out that for two years prior to January, 1892, Mr. Rosser's average consumption of gas was 19,550 cubic feet per quarter. Since then it had fallen to 13,560 cubic feet per quarter on an average; being, as their Worships would see, a reduction of 6000 cubic feet per quarter. They would notice the claim was made for £51 15s. 2d. He and his friend Mr. Phillips had carefully gone into the matter, and it had been agreed

that the defendant should pay to the Company a sum of £30; and he asked for an order for this amount. That was independent of the offence. If he could make out a case under the 38th section of the Act of 1871, he would ask the Bench to impose such a penalty as they thought fit. He did not intend to proceed against Mr. Rosser on the charge of laying on the pipe, but only for abstracting the gas.

The CHAIRMAN: What is the effect of a conviction under that section?

Mr. KENSHOLE: It is simply a penalty, not a felony.

Mr. *Ashman* was then called, but

Mr. PHILLIPS intimated that they were prepared to admit all the facts set out in Mr. Kenshole's opening speech.

Formal evidence was then given; and the defendant was ordered to pay £30, as agreed, and also a fine of £5 and costs.

Attempt to Defraud The Gaslight and Coke Company.

At the Westminster Police Court last Saturday, before Mr. De Rutzen, James Barnes Amor, who described himself as of no employment, and living on his wife's means at No. 193, Victoria Street, Westminster, appeared to a judgment summons, to show cause why he should not be committed for a debt and costs of £20 17s. due to The Gaslight and Coke Company. The wife of the defendant recently met a distress levied on furniture of considereble value with the objection that it did not belong to the defendant, but to her trustees, under an ante-nuptial settlement made in 1882. The Magistrate stigmatized the proceeding as a "swindle." But the Company were subsequently advised that they had no legal status; and, after Mrs. Amor's trustees had presented a statutory declaration, the broker in possession was withdrawn. Mr. Arthur Dove, for the Company, now asked for the committal of the defendant, on the ground that the marriage settlement was a fraud on his creditors. Not only did it cover all property he had at the time of his marriage, but any he might thereafter become possessed of. Under the deed, he never could become possessed of any property. Defendant, who was examined as a witness, attributed his inability to pay to want of success in trade. During twenty years' trading in a large way, at various places, he had, he said, paid the Company between £12,000 and £15,000. The Company were very hard on him. Mr. De Rutzen: You mean you are very hard on the Gas Company. It is a most disreputable detence—a shameful fraud on the Company. The Magistrate adjourned the case for two months, to see if defendant kept a promise to pay the debt by instalments.

The Price of Gas for Public Lighting at Wrexham.—The Secretary of the Wrexham Gas Company (Mr. T. Walker) has informed the Lighting Committee of the Town Council that the Directors have resolved to reduce the price of gas consumed in the public lamps by allowing a further discount of 3d. per 1000 cubic feet from Jan. 1 next. This action of the Directors was quite voluntary; and the Council, at their meeting last Tuesday, decided to acknowledge the concession by a letter of thanks.

Stokers' Wages.—A discussion which took place at the last monthly meeting of the Dalton Gas Committee indicates how the wages of stokers vary in different parts of the country. A Sub-Committee reported their appointment of a second stoker at the works, at a salary of 22s. per week. Mr. Kay asked if this was a "living wage." Mr. Robinson said it was not, for seven days a week; and he moved that it be increased to 24s., which, he said, was little enough for the work. Mr. Holt seconded the amendment; saying that 22s. was too little for 84 hours' work a week. On a division being taken, it was found that the voting was equal. The Chairman gave his casting vote for the confirmation of the Sub-Committee's proceedings; remarking that the stoker could apply for an increase if he wanted it.

Accident at the Keswick Gas-Works.—On Monday evening last week, an accident occurred to three men named Forrester, Penrice, and Swindle, who were engaged in the construction of the new holder at the Keswick Gas-Works. They were standing on a scaffold inside the holder, about 18 feet from the bottom, and were hauling up a heavy iron beam, when by some means a chain which helped to support the scaffold snapped; and Forrester and Penrice were precipitated to the ground, bringing the scaffolding, &c., with them. Swindle, who had one arm over the side of the holder, had the presence of mind to cling to it; and he hung suspended until rescued from his dangerous position. Forrester was found to have sustained a comminuted fracture of the left leg below the knee; and Penrice was badly cut about the head. Two doctors were quickly summoned; and the injured men were removed to the Cottage Hospital, where they are now doing as well as can be expected. The sudden snapping of the chain has been attributed to the effects of frost, which was intense at the time.

A "Gas Car" at the Aldershot Carnival.—Last Wednesday evening, the town of Aldershot was the scene of a brilliant spectacle in aid of the local hospital. The place was brilliantly illuminated; and there was a grand procession. As showing the interest taken in the affair—the "Annual Carnival," as it is termed—something like 30,000 people, residents and visitors, were in the streets. We notice the matter here to mention that the Aldershot Gas and Water Company did not lose the opportunity of bringing the advantages of gas for culinary purposes under the notice of this great gathering. They had in the centre of the procession a "Gas Car," showing the past and the present method of cooking. The "past" was represented by an old-fashioned kitchen range, with sooty iron saucepans, and an ancient dame using a pair of bellows to get a small flame. The "present" was shown by a gas-stove (supplied by gas through a "penny in-the-slot" meter) whereon, in bright copper and tin cooking utensils, soup and vegetables were boiling merrily, and in the oven a leg of pork was being roasted. The car was decorated with coloured lamps, and further lighted by gas-brackets, cylinders charged with gas being carried for the purpose. Mr. W. J. Ball, a gas engineer, who sent the car, took charge of it; and he must be credited with not only making a pretty show, but also an effective advertisement as to the value of gas. The Judges highly commended the car.

MISCELLANEOUS NEWS.

DISASTROUS EXPLOSION IN THE STRAND.

Since the memorable explosion of gas which occurred in Tottenham Court Road in July, 1880, no accident of anything like so alarming a character has been attributable to this cause in London. Last Tuesday, however, two houses were wrecked in the vicinity of the Strand, and a number of persons more or less seriously injured—one fatally; and gas has been pretty generally charged with being the origin of the mischief. The scene of the disaster was New Church Court—a passage on the north side of the Strand, facing Somerset House, and running into White Hart Street, which connects Catherine Street with Drury Lane. Residents in London will doubtless know the place; and visitors from the Provinces, especially those of a literary turn of mind, will probably have been to the court, at the western corner of which formerly stood the office of the *Morning Chronicle*, with which the early efforts of Mr. Charles Dickens in newspaper work were associated. In fact, if we remember rightly, this was the "dark court" up which the great novelist went some sixty years ago to tremblingly drop his first contribution into the editor's box. The thoroughfare is about 80 yards long, and 12 feet wide at its broadest part. The houses consist mostly of somewhat dilapidated three and four storey buildings, occupied by porters employed in Covent Garden Market hard by, costermongers, and people of a similar class; but there are also some business premises, and the kitchen of a *restaurant*. About seven o'clock in the evening of the above-named day, the occupants of the court and the pedestrians in the more crowded Strand were startled by a loud report, followed by clouds of dust, an outburst of flame, and a terrible consternation. Communication was at once made with Scotland Yard and with the head-quarters of the Fire Brigade; the result being that a large body of police and firemen were quickly on the spot. On entering the court, they found that a house on the west side (No. 27) had collapsed, carrying with it portions of the walls and roofs of the adjoining houses. The excitement that prevailed may well be imagined. The work of rescue was promptly commenced; but great difficulty was necessarily experienced on account of the heat from the blazing ruins. An urgent message sent to the offices of The Gaslight and Coke Company in the Horseferry Road soon brought some of their men, who expeditiously cut off the supply of gas, which was conveyed into the court by a 4-inch pipe from the large main in the Strand. All the occupants of the damaged houses were rescued alive, and those who had sustained injuries were conveyed to the neighbouring hospitals and detained where this was considered necessary. There were certainly some marvellous escapes, one of which is sufficiently remarkable to place on record. When the house No. 27 collapsed, a woman who was on the top floor with her two children was borne to the ground with the building without injury; the only effect on her being a shock. While some of the Fire Brigade were engaged in searching the ruins, a portion of the upper part of one of the houses, which had been left suspended, gave way; burying two of the men, named Sells and Sprague. After about an hour's work, the former was recovered, and was found to be suffering from nothing worse than an injured leg. His comrade, however, was still beneath the mass of fallen material; and it was feared that he was dead. At midnight, the scene of the disaster was distressing in the extreme. The search for the missing fireman was proceeding with the aid of the ordinary lamps carried by the Brigade; but later a 6-inch gas-main entering the court from the north end was tapped, and some "flares" were set up. These greatly assisted the searchers, whose untiring efforts were eventually rewarded by the discovery of Sprague about five o'clock on Wednesday morning, after having been buried for nearly ten hours. He was removed in an unconscious condition to King's College Hospital, where his injuries were found to be of a very severe character. At first it was thought that these would not prove fatal; but the unfortunate man succumbed to them in the evening.

Among those who visited the scene on Tuesday evening were Lord Carrington, the Chairman of the Fire Brigade Committee of the London County Council; Mr. Anderson, the Chief of the Detective Department, and Chief Inspector Melville, of the Special Department, at Scotland Yard. The Gas Company's Distributing Engineer (Mr. G. F. L. Foulger) was also present on Tuesday night, superintending the operations of the Company's workmen. The next morning an examination of the spot was made by Colonel Majendie, C.B., the Chief Inspector of Explosives. The following is from the official report of the Chief Officer of the Fire Brigade (Captain Sexton Simonds): "Nos. 26 and 27, New Church Court, contents severely damaged by explosion and fire, and fallen down; 27 persons injured by shock, contusions, cuts, and bruises, and taken to hospital. The supposed cause of the fire was an explosion of gas. No. 25, part of side and front blown out; rest of the building and contents severely damaged by explosion. No. 24, building and its contents damaged by explosion. Nos. 329 and 330, Strand, side, front, and ground floor and contents severely damaged by explosion and dirt. No. 331, Strand, window-glass broken; No. 332, Strand, roof, sky-lights, and window-glass damaged by explosion and breakage; No. 333, Strand, back damaged by explosion; rest of the building and contents slightly damaged by breakage and dirt. Four houses in Angel Court, back part of the buildings and contents damaged." As far as we can learn, no gas was used in the wrecked houses; and how any could have found its way into the basements, which we believe were unused, and become ignited, is at present unexplained. Colonel Majendie has made further examinations of the spot; but he will probably make a more minute investigation after the wreckage has been cleared away. It may be pointed out that no definite cause of the explosion is given in the report of Captain Simonds.

The inquest on the unfortunate fireman—happily the only victim of the disaster—was opened at the St Clement's Danes Vestry Hall yesterday, before Mr. Troutbeck, the Coroner for Westminster. After a number of witnesses had been examined, the proceedings were adjourned for a fortnight. In the meantime, the pavement in the court will be removed in the presence of representatives of the Gas Company, the New River Company, and the London County Council; and then further evidence will be given.

THE GAS QUESTION IN LIVERPOOL.

At the Meeting of the Liverpool City Council on Monday, the 28th ult.—the final gathering prior to the municipal elections—the action of the Corporation on the question of the gas supply of the city was the subject of an animated discussion.

Alderman Bowring having moved the adoption of the general proceedings of the Finance Committee,

Sir A. B. Forwood said that, at the last meeting of the Council, a resolution was passed instructing the Town Clerk to do all that was necessary to establish and maintain a competitive gas supply. He should have expected to find in the proceedings of the Finance Committee some reference to this resolution, and some explanation offered as to why they had not given effect to it. However, he thought they knew the reason. It was perfectly clear that legally the Corporation had no power to promote a Bill in Parliament for competition, either against a gas or a water company. He thought that, if the Council had known all the facts both as to the law and as to what had transpired between the Corporation and the Company, they would not have committed themselves to such a resolution, especially in view of the fact that a letter had been received from the Company which was not mentioned to the Council, stating that, pending the result of immediate investigations into the matter, they considered it advisable to defer arrangements for another interview with the Special Lighting Committee. It was very unfortunate that the Council, by passing a resolution to which they could not give legal effect, should have established a state of friction and tension between the Corporation and the Company, and so have prevented free and friendly communication between the Committee and the Directors, by which they might very possibly have found a way of modifying the relations between the two bodies, and benefited the community at large.

Alderman Bowring said the Finance Committee were advised that there would not be time to prepare a Bill for next session, and that moreover there were difficulties in the way of getting it passed. He would ask the Town Clerk to state exactly what was the legal position of the Corporation, and the reasons which led the Committee not to carry out the orders of the Council.

Alderman T. Hughes pointed out that if, at the time the resolution was passed, the Town Clerk had been asked to state his views, they would have been saved all this trouble and inconvenience. He could not help feeling that there were some gentlemen in the Council when the resolution was carried who knew exactly what the Town Clerk's opinion was; and he thought it was somewhat of a dereliction of duty that this opinion was not asked then instead of now.

The Town Clerk explained that, on the 2nd of October, he was instructed by the Council to do all that was necessary to enable the Council to promote a Bill in Parliament to obtain powers to establish and maintain a competitive gas supply. To do this, it would have been necessary for him to have a scheme of competitive gas supply prepared. Of course, he did not feel capable of doing this himself; and he would have had to employ experts to prepare one—to tell him where the works were to be situated, and to describe the land it was necessary to buy—and he would have had to engage a staff of referencers to prepare a book of references and the plans to be deposited. To his mind, it was quite impossible to have this done in time to give the necessary notices for the forthcoming session. Furthermore, he was obliged to tell the Finance Committee that the Borough Funds Act did not authorize the expenditure of money out of the rates for the purpose of promoting a Bill to compete with the Gas Company, and that it would be necessary for the members of the Committee personally to undertake the responsibility of paying the expenses. (Laughter.)

Alderman F. Smith: So they are. (More laughter.) Proceeding to address the Council, he said the position of Sir Arthur Forwood and his friends was one of laughter at the position of the Liverpool gas consumer. ("Hear, hear," and great laughter.) Sir Arthur knew nothing about the gas question. (More laughter.) Even an eminent authority like Alderman Thomas Hughes tried to count-out the Council when the gas question was coming on; and then, not succeeding, he deliberately deserted the Council Chamber. He (Alderman Smith) was aware of the fact that the fiat had gone from Sir Arthur Forwood and Alderman Thomas Hughes that his (Alderman Smith's) hand must be stayed in this gas matter; but they were quite powerless to stay it. (More laughter.) It was all very well for them to smile. But when they had ceased smiling, they would come to look at the matter from a sensible, calm, and ratepayers' point of view; and when they did so, they would recognize that it was free from the interests of party. He contended that it was time the law of the land was altered so as to prevent the Gas Company paying what had been called "the phenomenal price of 20s. 7d. a ton for coal." He hoped the new Council would not allow this subject to drop.

Mr. A. Taylor said he still maintained that the price paid for coal by the Company was "phenomenal;" but that was no reason why the Council should rush into a wholly impracticable and absurd position. He was willing to give Alderman Smith all the credit that he could get for his initiative with regard to the gas question; but he could only regret that he had shown himself so completely incapable of carrying it to a logical and proper conclusion. He did not believe in fighting with the weapons Alderman Smith had used in this contest. He did not see that anything was to be gained either by going to the press, appearing on public platforms, or coming to the Council and charging men of stainless reputations with either being present or using influence in the Council to benefit companies and concerns with which they were connected. He pointed out that, in the arbitration as to the price of gas to be paid by the Corporation for street lighting, the Corporation were completely ruled out of court; and yet the Company were willing to give the Corporation a rebate of 10 per cent. Alderman Smith was nothing if he was not in a hurry; and he (Mr. Taylor) maintained that his action in proposing the resolution for a competitive gas supply served to show more clearly his entire lack of practical procedure and straightforward and amicable conduct of negotiation.

Alderman T. Hughes, replying to the observations of Alderman Smith, said he deliberately left the Council at the former meeting because he felt it to be a complete waste of time to listen to the Alderman's observations upon the motion which was afterwards passed. He had previously expressed this opinion to one of the Liberal leaders in the Council Chamber, and suggested to him the advisability of consulting with the Town Clerk, in order that the proceedings, if found to be useless and impracticable, might be shortened. He (Alderman Hughes) was not going to remain in the Council knowing that the whole discussion was a *fiasco*. Had his advice been taken, a great deal of trouble and inconvenience would have been avoided; and the ratepayers of Liverpool would have been in a better position for negotiating with the Gas Company. Long ago he told Alderman Smith that the best way of securing an improvement would be to get rid of the obsolete rule requiring gas of 20-candle power. The price of coal was altogether dependent upon this obsolete requirement. The Company had challenged them to do away with it, and then they would be prepared to manufacture gas as cheaply as any other community. The Council had made themselves a laughing-stock by passing Alderman Smith's resolution. They could not expect the Company to reopen negotiations so long as this resolution remained on their minutes. They would be bound to rescind it. He believed that the dividends paid to the shareholders, and other matters in connection with the Company, required revision; but let the Council at all events see that common sense guided their actions. It was ridiculous for them to attempt impossible measures in their desire to bring about a remedy. To suggest that the Directors of the Company were men whose characters should be viewed with caution, was not the way to open friendly negotiations.

Mr. R. D. Holt said he did not in the least object to the Council being the laughing-stock of the Company. He believed that the controversy which had been evoked by Alderman Smith's motion would be highly beneficial. If the Council had unfortunately passed a resolution which they were unable to carry out, then, as honourable men, they had no other course but to go back upon it.

The Lord Mayor (the Right Hon. W. H. Watts) said it had been suggested that those who voted for Alderman Smith's motion did so in ignorance. Certainly this was not his case. He was informed by the Town Clerk that the motion was illegal; and he put this question: "Do I understand you to say that, if the facts as stated are true, we are buying coals at 10s. per ton more than we could buy them at, and that, whatever extravagance may go on within the walls of the Gas Company, we have no redress?" The Town Clerk said: "I am afraid that is so." "Well, then," he replied, "I for one, at all events, will vote that we try that matter in the House of Commons." He thought it was perfectly scandalous that the Council should be in such a position; and no considerations of his being likely to be called upon to pay his fair quota for contesting that position in the House of Commons would have deterred him, nor did he think it would deter the citizens of Liverpool. If the statement was correct, as he believed it to be, that they were paying one-third more for their gas than they ought to pay, he thought they had a right to go to Parliament and ask them to redress that iniquity. Several gentlemen had stated that the Company must buy other and different coals in order to be in a position to reduce the price of gas. During his year of office, he had visited the Walton Workhouse, and saw a gas apparatus at work. He was told that they were there producing gas of a better quality than that supplied to the city of Liverpool, and that it cost, he believed, less than 1s., but certainly not more than 1s., per 1000 cubic feet. If this were so, they were not acting in a very out-of-the-way fashion in passing a resolution; and while he had the greatest possible respect for the opinion of the Town Clerk, he found that opinions differed. During the past few days, a legal gentleman connected with one of the largest corporations in the country called upon him, and expressed the opinion that, if the Council were to take the matter to Parliament, they would get redress. He (the Lord Mayor) voted for the resolution with his eyes wide open; and he was quite prepared to be called one of those who were unwise in so doing.

A whispered conversation here took place between the Lord Mayor and the Town Clerk, at the close of which his Lordship said he had been charged with misquoting; and he therefore asked the Town Clerk to correct him if he was wrong.

The Town Clerk said that, assuming the Corporation could prove that the Company were paying an absurdly exorbitant price for their coal, that they were wasteful in administration, and that consequently the gas consumers of Liverpool were being mulcted to an extent which they ought not to be under the Acts of Parliament, he thought the Corporation would have the right to go to Parliament to amend the Company's Acts in such a way as to force them to cease spending or wasting the money. He, however, had stated from the commencement—and it was what he had intended to convey to the Lord Mayor—that he did not think the right procedure was to promote a competitive gas supply. To his mind, when they were satisfied with their case, the proper course was for the Corporation to promote a Bill to amend the Company's Acts—not to establish a competitive gas supply.

The proceedings were then confirmed.

At a subsequent period, Alderman F. Smith, in moving the adoption of the Lighting Committee's proceedings, said that on the 24th of June the Gas Company had all the facts before them to which the Committee required an answer. None was received by the 23rd of September; and a report was then placed in their hands. No investigation was commenced till the 2nd of October; yet on the 9th of that month the Company replied that the matter had been thoroughly gone into. He need scarcely inform the Council that to this moment the Committee had received no detailed reply to the detailed statement respectfully put before the Company.

Sir A. B. Forwood said he rose, in the first place, because the Council, at their last meeting, were led to adopt a resolution which had evidently made the Company feel that there was a hostile attitude entertained towards them; and they had consequently declined to communicate with the Lighting Committee on the subject. The point he started off with was this—that the Chairman of the Committee did not bring to the notice of the Council the fact that the report signed by himself, and containing very voluminous figures as regarded the comparison of the price of gas and the cost of manufacture in various towns, dated the 23rd of September, had been sent to the Company, and that, on the 30th of September, the Company

wrote back, in a very courteous manner, saying that this statement should have their immediate attention. Yet, in spite of this communication, the Chairman of the Committee, "off his own bat," brought forward that resolution, to which the Council could not give legal effect, and made no allusion, as far as he could see in the report of his speech, to the fact that only eight days before they had sent that important report to the Company. He could not conceive, whatever feeling there might have been in the minds of members of the Council towards the Company, that they would have thought it wise to take the very drastic step of promoting a Bill in Parliament until they had had that reply from the Company. This was the gravamen of his complaint against the report of the Committee; but the Chairman carefully avoided any allusion to it in his reply. They had heard a good deal about the price of coal; and they were asked to believe that the Company paid 20s. 7d. per ton, when they could have obtained it for probably 14s. or 15s. a ton. No one in his senses would believe that the Directors would be guilty of such an act as that. He asked the Chairman of the Lighting Committee to state whether it was not a fact that the period during which he said 20s. 7d. per ton was paid for coal was the half year of the coal strike, when the price of coal varied from day to day, and when it was not so much a question of the price as obtaining a supply. He believed that Sheffield was not affected in anything like the same degree as Liverpool by the coal strike. Sir Arthur referred to the high price which had to be paid for the cannel and Australian shale used in the manufacture of gas, in order to bring it up to the required candle power; and he thought it probable that the 20s. 7d. quoted by Alderman Smith was the average price of shale, cannel, and coal. If this were so, it was very unfair to lead the public to believe that he was giving the price of the ordinary coal used by the Company, which the public knew was only about 14s. or 15s. per ton. As to the illuminating power of the gas supplied, Sir Arthur said that required in Liverpool was 20-candle; whereas in Sheffield, about which so much had been said, it was 16½-candle. The results obtained on a visit to Sheffield by Mr. Bellamy were stated to be 20·40 candles; but he (Sir Arthur) pointed out that the Chairman of the Sheffield Gas Company stated that 1150 tests made during the six months ended June 30 gave an average of 17·86-candle power. He believed that, without going to Parliament in a hostile spirit, they could, by approaching the Company and treating them as, and believing them to be, honest men, get them to agree to provide the minimum candle power which they were bound to give, and also some security for direct representation from the Council on their Board.

Alderman Smith, in reply, quoted figures to show that the price of coal at the pit's mouth during the year in which the strike occurred was only 2d. per ton more than in the previous year; whereas the Company had paid an increase of 2s. With regard to Mr. Bellamy's tests, he said they had never been disputed by the Company.

The discussion then ended.

EDINBURGH AND LEITH GAS SUPPLY.

Proposed Adoption of Water-Gas Plant—The New Chimney.

On Monday of last week, at a Meeting of the Edinburgh and Leith Gas Commission (Lord Provost M'Donald in the chair),

Bailie Kinloch Anderson, the Convener of the Works Committee, said the Committee had had a special meeting that morning, at which they had considered two very important subjects. The first was with respect to the introduction into the Edinburgh works of a carburetted water-gas plant. It would be within the recollection of the majority of the Commissioners that, more than a year ago, the Works Committee reported on the oil-gas enrichment process, and that the Commission generally approved of the report, remitting it back to the Works Committee to have the installation proceeded with. Shortly after that, and while the Committee were still negotiating with Mr. Young's Company, some change took place in the process, which was commonly known as the Peebles system. The new process was recommended by the patentee for large installations; and the old one, for smaller installations. The Committee re-visited the works at Peebles, and saw a miniature they had there on exhibition, showing the new system. The altered process suggested to their Engineers that it was somewhat like a different one which they had seen—the carburetted water-gas system—and they reported so to the Committee and to the Commissioners. The Committee, under the circumstances, thought they should see the latter process in its entirety. The result was that they went to the Belfast Gas-Works, and saw the carburetted water-gas process of Messrs. Humphreys and Glasgow in full operation there. They had before them a very elaborate report by Mr. James Stelfox, the Engineer; and it appeared to them that they should recommend the system to the Commissioners, as being a great advance in the process of manufacturing gas. He understood that this was really the first departure from the original method of making gas. Oil gas was a change, but the old retorts were employed; this was a new process, in which there were no retorts used, but cylinders. The Committee were highly impressed with what they saw at Belfast; and they waited to have further experience of the results of the working there. They wanted not to be too quick about the matter; and they were well rewarded; for while they got the experience at Belfast, they had the opportunity of seeing the process at work elsewhere, and to get independent reports. All these reports went to confirm the opinion formed by the Committee—that a carburetted water-gas process was the right thing to adopt. But in their inquiries in connection with the subject, they came upon another patentee, who produced the gas practically in the same way, but by a different plant. When they were in London last summer, visiting the Tottenham Gas-Works, they saw Mr. Westcott, of the Economical Gas Company. He then had only the drawings of his system, but he told them that it was at work in America in some 17 or 18 gas works. He had then no plant at work in this country to show them, he had only the system on paper. At that time, he had concluded a contract with the Blackburn Corporation to put a first instalment of the Company's plant into the gas works there; and he cordially invited them, if the matter would brook delay at all, to wait till that plant was in operation, as he was quite satisfied that the results he had obtained elsewhere would be fully realized in this country. The Committee agreed that they should see this plant at work, as they wished to secure the better system of the two. He was not going to say what was the opinion of the Committee upon the one as against the other. They were both good; but he wanted them to approve of the introduction of an installation of water gas in the Edinburgh works, and to remit back to the Committee to correspond with both of the patentees, and to ask them for specifications and detailed estimates of their respective systems. They would, in some measure, be guided by those specifications and estimates as to the one they would adopt.

Mr. Eunson asked if it was wise to incur such a cost at this time. There was a great demand for electric light; and it was rumoured that the whole city would get that light by-and-bye. He thought they should be cautious.

Bailie Kinloch Anderson remarked that Mr. Eunson might have concluded in his own mind that the Committee did consider everything. They had made several successful innovations at the gas-works; and he almost prophesied that this would be another, and that by it they would be able to compete better with the electric light.

Mr. Kinnaird thought they should have an oil-gas plant erected in the Leith works.

Bailie Kinloch Anderson said they wanted to try the system in the Edinburgh works first; and then, if they were satisfied with it, they would introduce it at Leith too.

The proposal was then agreed to.

Bailie Kinloch Anderson said the other subject the Committee had before them was the acceptance of an offer for the erection of the new chimney at the Edinburgh works. They had had the estimates before them; and they recommended acceptance of the offer of Messrs. Robert Bruce and Sons, of Edinburgh, at the total sum of £3450, with extra rates of 6s. 6d. per square yard for rock, and £10 per vertical foot for excavations beyond the specifications. There was another offer which was lower in the principal sum, but it was much higher in the extras; and they thought, on the whole, Messrs. Bruce's tender would be the cheaper.

The offer was accepted.

Inauguration of Retort-House Machinery.

On Wednesday last, an installation of mechanical stoking plant was inaugurated in the Edinburgh Gas-Works. When the Commissioners erected a new retort-bench, space was left on each side for the working of machines, should they resolve to introduce mechanical stoking. These have now been introduced, and applied to 480 out of 660 retorts. The system adopted is the Arrol-Foulis; and four charging and four drawing machines have been procured. To provide power, a pair of hydraulic pumping-engines are employed, which keep an accumulator at a pressure of 400 lbs. per square inch. An arrangement has been made whereby the exhaust water, other than what is sprayed on the bar of the rake, is collected, and used over again. In connection with the stoking plant, there have also been fitted up four coal-breakers, each driven by its own engine. From the breakers, the usual arrangement is made of elevators, which carry the coal to large hoppers, capable of holding 20 tons each, situated on the top of the retort-stack. These are made to deliver coal at both sides of the bench into the hoppers of the charging-machines, which, as in other installations of the plant, are made to hold 5 tons each. Steam for the driving of the engines is furnished by two Babcock and Wilcox boilers, fired with breeze. The total cost of the new plant is a little over £7000; and it is expected that its working will effect a saving of about 1s. per ton. The plant has been erected by Sir William Arrol's firm, under the superintendence of Mr. R. Mitchell, the Engineer of the Edinburgh works.

The Gas Commissioners and a number of friends assembled in the retort-house, and witnessed one oven drawn and charged by the machines. Bailie Kinloch Anderson operated a machine in the drawing of one retort. Thereafter the company adjourned to the workmen's dining-hall, where luncheon was served—Lord Provost M'Donald presiding.

The Lord Provost said that when, some years ago, the Corporation took over the gas undertaking, some people said it was a bad thing to do. Since then the works had been re-modelled to a large extent, and they had had considerable expenditure on street mains. But, notwithstanding all this, they had been able to show a splendid balance; and they had also been able to reduce the price of gas. He never believed that the electric light would affect the gas consumption. At present, they had a fair amount of electric light in the city; and, according to their own returns, the demand for gas was never greater than now. They had been exceedingly fortunate in the choice of the Committee. The Convener had taken the trouble to go and see the latest improvements and appliances in other places; and the result was that they were now introducing two very remarkable machines—machines that did work which no human being should be asked to do. Sometimes trades union people objected to the introduction of machines; but he did not think the most rigid trades unionist in the world would object to machines for doing that kind of work. The Commissioners had thought they should not let the day pass without in some way recognizing the services of the Convener of the Committee. He had the greatest pleasure in presenting to Bailie Kinloch Anderson a small memento of his public work.

The gift was in the form of a silver punch-bowl, and bore an inscription which stated that it was presented by the Commissioners in testimony of their esteem for Bailie Kinloch Anderson, and as a small memento of the introduction of improved mechanical appliances into the gas-works there.

Bailie Kinloch Anderson said this was the first recognition he had ever received for any public services he had rendered; and he could assure them that he appreciated it very greatly. He esteemed it an honour when the Commissioners, five years ago, appointed him to be the Convener of the Works Committee. When he was appointed, the price of gas was at the very high rate of 4s. 6d. per 1000 cubic feet; but now it was 3s. Between the first year of the Commission and the past year, there was an increase of 216 million cubic feet of gas. They had 480 retorts set upon the regenerative principle; and they had also

introduced a high-level railway, by which they had increased their storage for coal. They had, in providing the hall in which they were met, done something also to improve the condition of their workmen. They were now paying their workmen £7500 a year more in wages than was paid by the old Gas Companies; and he thought the men were all thoroughly satisfied with their position. By the introduction of carburetted water gas, which they had resolved upon, they expected to be able to reduce the price of gas by 3d. or 4d. The saving in labour by mechanical stoking would be very considerable; but that did not weigh with the Commissioners. The great relief to the workmen was what had led the Commissioners to think of introducing mechanical appliances. He had much pleasure in accepting the gift. It would always be a pleasure to him to reflect upon that day.

Among the toasts honoured was the health of Bailie Kinloch Anderson and that of the officials of the Commission—Mr. R. Mitchell responding for the latter.

GAS AFFAIRS AT MANCHESTER.

The Working Up of Residuals—Housing of the Workmen—Prepayment Meters—The Sale of Gas-Stoves.

Two or three matters which will have an important bearing upon the future of the gas undertaking, claimed the attention of the Manchester City Council at their meeting last Wednesday. It was mentioned by the Chairman of the Gas Committee (Alderman Gibson), in moving the adoption of their minutes, that the Gas Committee were desirous of obtaining statutory powers to enable them to undertake the manufacture of residual products. This statement did not attract notice; but Mr. M'Cabe opened up a discussion by complaining that the Gas Committee had declined the application of the Sanitary Committee to purchase a plot of land and property adjoining the gas-works in Rochdale Road, for the purpose of aiding their workmen to have better dwellings. He thought the district was entitled to some compensation from the Committee for the damage done to it. Many hundreds of thousands of pounds profit had been made there, and spent in the improvement of other parts of the city; and he considered it not an unreasonable thing to ask the Gas Committee to do something for the locality which they had done so much to foul and make nasty. It was moved by Mr. Boyle, and seconded, that the portion of the minutes alluded to by Mr. M'Cabe be referred back for consideration. Alderman Gibson replied that the matter had been most carefully considered by the Sub-Committee and Committee. They could not at all see their way to the purchase of this property. As a matter of fact, they had no money which they could legally use for such a purpose. Alderman Walton Smith remarked that the Gas Committee employed a large number of people at their works; and he had certainly thought the Committee would enter sympathetically into the project. Alderman Clay supported the Gas Committee in the action they had taken. The relief asked for in this case, he said, would be a relief not of the tenants but of the property owners. Two other members having supported the amendment, Alderman Sir John Harwood said he had great sympathy with the work of the Sanitary Committee; but they were now proceeding upon mistaken lines. The workmen employed by the Gas Committee had the eight-hour day; and they were well paid. It was all to their advantage, and that of their families, that they should live in a healthy neighbourhood, two or three miles from the horrible slum district in question. The amendment was negatived, and the proceedings of the Committee were approved.

During the progress of the above discussion, Mr. Saxon asked if it were true, as stated in an election address, that working men were being swindled by being charged 3s. 4d. per 1000 cubic feet for gas supplied through the penny-in-the-slot meters. Alderman Clay and the Lord Mayor (Alderman Lloyd) protested against the use of the word "swindled;" and Mr. Saxon having explained that it was only a quotation from an electioneering address, the matter for the time dropped. Later on, however, it was referred to by Alderman Gibson, who declared that the "slot" meter gave very good value, and was an undoubted boon to the public. The answer to the charge of swindling was that the people were continually asking for more of the meters. He described the various appliances of which the purchasers of gas in this way had the advantage, and stated that the collectors of the Corporation brought in during the previous week more than £300 in pennies. He hoped they would soon have 15,000 customers.

The question of the sale of gas-stoves by the department was next introduced by Alderman Gibson, who moved the rescinding of the resolution of the Council passed on Feb. 15, 1893, approving a resolution of the Gas Committee to the effect that no gas-stoves should be sold by the Committee, except to those customers who had them fixed on hire, and then only at list prices. Alderman Higginbottom seconded the resolution, which was opposed by some of the members on the ground that it meant unfair competition with tradesmen. Alderman Higginbottom said the Gas Committee merely proposed to follow the example of other towns, and to fall back on the position of eighteen months ago. The more gas-stoves the Corporation sold, the more work would there be for the plumbers in the way of fixing them, and so on. The Corporation would sell at such a price that the tradesmen who sold stoves were left a margin of 15 or 15½ per cent. Alderman Gibson thought that many people, if they could not buy their stoves from the Corporation, would not buy them at all. He maintained that the very fact of the Corporation selling stoves, made the business twice as brisk for tradesmen. The proposal of the Committee to rescind the resolution of 1893 and to give the Committee power to sell stoves was agreed to.

Cape Town District Water-Works Company, Limited.—The report of this Company for the year ending June 30 states that the net profit is £4737, making, with the amount brought forward, a total of £5406. The Directors propose to place £2000 to depreciation of mains, machinery, and buildings, and to pay a dividend of 3 per cent.; carrying forward £1006.

FURTHER GAS-WORKS IMPROVEMENTS AT WALLASEY.

Local Government Board Inquiry.

Last Thursday, an inquiry was conducted at Wallasey by Mr. R. Walton, on behalf of the Local Government Board, with reference to an application by the District Council for powers to borrow £22,000 for the extension of the gas-works. The Clerk to the Council (Mr. W. C. Danger) stated that all the last loan of £50,000 on gas-works account had been expended, except £1700; and the Engineer (Mr. J. H. Crowther) now found that he was unable to utilize the works which had been erected without further extension of plant, &c. It was therefore proposed to provide, among other improvements, a new gasholder at a cost of £15,700. In addition, £2200 was required for extensions of gas-mains, and a similar amount for water-mains. Mr. W. G. Ellery gave evidence to the effect that in 1871 the gas made exceeded 31 million cubic feet; in 1881 it amounted to 66 millions; in 1891, to 147 millions; and in the year ended March 31 last, to 182 million cubic feet. The consumption of gas had thus more than doubled in ten years. The present storage capacity was only 753,000 cubic feet; and it was proposed to provide a new holder, having a storage capacity of 750,000 cubic feet, which would bring the storage up to 1,500,000 cubic feet. In answer to the Inspector, Mr. Danger said the population of the district was increasing at the rate of 1200 a year. They hoped that the present application would meet all the wants of the district for eight years. Mr. Crowther having explained the details of the scheme, the proceedings closed with an intimation from the Inspector that he would report as early as possible.

RETFORD CORPORATION GAS AND WATER SUPPLY.

Annual Reports.

The annual report of the Retford Corporation Gas Committee shows that the capital expenditure during the year has been £1376, of which sum £1275 is the amount paid during the twelvemonth on account of the cost of renewing and enlarging one of the gasholders. The amount now over-expended on capital account is £1451; and the Committee propose to provide for this sum by transferring to the capital account £1500 from the amount now standing to the credit of the net revenue account. The gross profit for the year is £2841, exceeding by £156 the gross profit of the preceding year, which was then the largest made since the undertaking passed into the hands of the Corporation. The net profit, after paying all dividends, interest, and sinking fund, is £1385, which, with £1641 brought forward from last year's account, makes the amount now standing to the credit of the net revenue account £3026, out of which it was proposed to transfer £1500 to the credit of the capital account, as mentioned above. The net profits for the year are £489 in excess of the net profits for the preceding year. This is in part accounted for by the fact that, in consequence of the rearrangement of a large portion of the loans, the undertaking has in this particular year had to pay considerably less for sinking fund and interest. The total loans raised for the purpose of the undertaking amounted to £36,500; the rate of interest being 4 per cent. The sum of £5000 has been paid off by means of the sinking fund. During the year, £28,000—a further portion of the £36,500—has been paid off; and a new loan of the like amount has been obtained from the Yorkshire Penny Bank, at 3¼ per cent., which will effect a saving of £210 per annum. The cost of this transaction was £210, and has been paid out of revenue. The £3500, the balance of the £36,500, cannot be dealt with at present, the term for which it was borrowed not expiring until April 29, 1897. The Committee consider the works to be in a more perfect and satisfactory condition in all respects than they have ever been since they came into the possession of the Corporation.

The Water Committee report that £18 only has been expended on capital account during the year; leaving £99 as the balance still unexpended of the £21,500 raised. Of the £21,500, £6737 has been paid off by half-yearly instalments, leaving £14,763 as the amount still outstanding. During the year, £9579—the balance of the loan remaining due to the Public Works Loan Commissioners, for which interest at the rate of 3¾ per cent. per annum was paid, has been paid off, and reborrowed from the Yorkshire Penny Bank at 3¼ per cent. The Committee have also given notice to the Northern Counties Investment Trust, Limited, of their intention to pay off £3935 remaining due to them on Jan. 1 next. This loan bears interest at the rate of 4 per cent., and can be re-borrowed at 3¼ per cent. The water-rents for the past year amounted to £2284, as compared with £2128 in the preceding year; and notwithstanding the extra expenditure caused by the long and severe frost of last winter, and the expenses of transferring the loan from the Public Works Loan Commissioners to the Yorkshire Penny Bank, the net profit for the year, after paying the interest on the loans and the instalments on account of principal falling due during the year, amounts to £233, as against £192 in the previous year.

THE DUBLIN CORPORATION AND THE GAS AND WATER SUPPLY.

The Improvement Bill to be Reintroduced.

A Special Meeting of the Dublin Municipal Council was held last Saturday week—the Lord Mayor presiding—"for the purpose of considering what steps should be taken during the ensuing session of Parliament for the purpose of obtaining legislation on matters the necessity for legislation on which was of the most pressing importance."

The Lord Mayor, in opening the proceedings, said the history of their doings last year, when they sought to obtain powers which they were now seeking (with some other powers in addition) was past; and he did not now care to revive it. They were then, he believed, prevented from obtaining what they considered useful legislation by agitation

which was got up in the city—partly, he believed, through want of knowledge of their real purpose, and partly because they embraced in their Bill a number of objects which more or less invited opposition. The questions which were to be dealt with now were considered by their Committee ones on which there should not be among ratepayers any divergence of opinion—matters of vital importance. They should limit the Bill to obtaining powers to adjust the relations between the Corporation and the out-townships with reference to the water supply. Then another provision proposed to endeavour to settle the "horrid wrangle" which had taken place between the local authorities and the Gas Company in reference to the supply of gas, the price of gas, and the quality of gas. They sought also other powers. The present Bill differed from the former in that they omitted certain clauses in reference to the water supply. But he thought they were entitled, in justice, to demand from the townships payment for any supply of water over 20 gallons per head. The other question of great importance was that of gas. Now he approached this question always with great regret, because he was sorry to find the Corporation in conflict with such a body as the Gas Company; and he earnestly trusted some means might be devised by which, while giving the Company the utmost limit of fair play, and not depriving the shareholders of one penny to which they were entitled, this Bill might put an end to these disputes, and some *modus vivendi* might be arrived at by which they should continue to exist in harmonious relations with the Company. They said that the price of gas was too high; and he wished there were some tribunal nearer home than London to which they could submit the question. After explaining the other provisions to be incorporated in the Bill, he moved: "That an Improvement Bill be promoted in the next session of Parliament for the following objects, and that the expenses be charged on the Borough Fund: 1. To alter and modify the existing arrangements for the supply of water by the Corporation to certain of the adjoining townships. 2. To alter and modify the existing arrangements for the supply, price, and testing of gas in the city. 3. To further extend the provisions of the Local Officers' Superannuation Act, 1869, so as to include labourers and other servants in the employment of the Corporation of Dublin. 4. To enable the Corporation to make charges for wayleaves, and to fence vacant lands. 5. And, to make increased provision for Fire Brigade purposes out of the Public Water-Rate."

Alderman MEADE, seconding the motion, said that the Committee of the Whole House had gone most carefully into the clauses of the Bill of last year; and they omitted the contentious clauses of that Bill, so that they could now promote a Bill which would meet the requirements and desires of the citizens as citizens and ratepayers. Of course, they knew that, so far as the Gas Company were concerned, the Bill would be contentious; but the citizens of Dublin were entitled to get gas at a lower price and of a better quality. At the same time, the Corporation were prepared to meet the Directors of the Company in every fair way, while determined to put an end to the bickerings and expense which had been going on in years past. In Dublin, the Corporation were asked to take gas that was tested by an antiquated instrument; and when they sought to have it tested by a modern instrument, they were told that they were bound by their contract. They certainly were entitled to have the gas tested by a proper instrument. As to the water question, the Corporation were prepared to carry out their contract with the townships; but the townships had no right to use an excess of water for which they did not pay.

After an ineffectual attempt to introduce some very contentious clauses to alter the municipal franchise—the proposal being ruled out of order by the Lord Mayor—the motion was carried unanimously.

THE GAS-WORKS PURCHASE QUESTION AT SOUTH MOLTON.

A Special Meeting of the South Molton Town Council was held last Thursday—the Mayor (Mr. A. E. Shapland) presiding—for the purpose of receiving the report of Mr. H. A. Willey, of Exeter, who had been consulted with reference to the proposed purchase by the Corporation of the undertaking of the Gas Company. The document stated that the works were generally in very good working condition; and the apparatus was capable of producing a maximum quantity of 6 million cubic feet of gas per annum. The retorts were of modern design and yielded good results. The condensers, scrubber, purifiers, station meter, and governor were of ample size, and equal to new. With regard to the storage, this was adequate for all present purposes. The tank was a good, sound one; and the holder was in fair working condition. He was quite satisfied that the distributing mains were sound, and would, if undisturbed, endure for many years. He considered the Council would do well to accept the offer of the Company by purchasing the property for £3300, particularly having regard to the fact that the Council were large consumers of gas. There was not a shadow of doubt that, in the hands of the Council, the undertaking might be successfully and profitably managed at a considerable reduction in the price of gas. The Mayor said he considered the report was in every way satisfactory, and bore out all his previous statements. He thought it was a fitting termination to his Mayoralty that he should have been instrumental in bringing this question of buying the gas-works before the Council. He considered the majority of the burgesses of the borough were in favour of the proposal. If another £500 was added to the amount of the purchase-money, still the Corporation would have a bargain. He moved that the Council enter into a provisional contract with the Directors for the purchase of the works for £3300. Mr. Pearce seconded the motion. Mr. Moor, a Director of the Company, said he felt sure this was one of the best investments which the Council had ever entered upon. Mr. Eldridge, also a Director, gave a list of accounts, showing that within the last ten years the sum of £958 odd had been laid out by the Company in repairs only. He favoured the purchase of the works. The resolution was carried *nem. con.* The draft provisional contract for the purchase was read; and on the motion of the Mayor, it was adopted.

AUSTRIAN INCANDESCENT SHARE COMPANY, LIMITED.

The First Annual General Meeting of this Company was held last Wednesday, at the Cannon Street Hotel, E.C.—Major-General G. D. BERESFORD in the chair.

The SECRETARY (Mr. L. de Fonblanque) having read the notice convening the meeting, the report and accounts, to which reference was made in the JOURNAL last week, were presented.

The CHAIRMAN, in moving the adoption of the report, said that when, in February last, the prospectus of the Company was issued, it was scarcely anticipated that there would be such a highly satisfactory report to submit eight months later as it fell to his lot to present at that meeting. They foreshadowed that the Vienna Company would be able to pay a dividend of 75 per cent.; and they were actually able to pay 100 per cent., after writing off a further 500,000fl., and without touching the profits realized on the sales of patents and licences. Following the policy of past years, the Vienna Company had only declared a dividend of 80 per cent.—the balance of 20 per cent. having been carried to next year's profit and loss account; so that the dividend of 1896 would be increased by this amount. The 80 per cent. declared by the Vienna Company put at the disposal of the Austrian Company the sum of £51,000, out of which was recommended a payment of 15 per cent., free of income-tax. This they considered to be thoroughly satisfactory, more especially when it was taken in conjunction with the actual financial position of the Vienna Company. Looking at the profit and loss account of that Company, it would be found that the profit on trading and the receipts for licences amounted to more than 2,000,000fl. for the past year. The way they had to consider this was from the general position to-day, as well as the future, of incandescent gas lighting throughout the world. For the year ended March 31 last, the English Company had sold about 300,000 of their burners. Since the 1st of April they had sold that number; and they had the best months of the year before them. Approximately, the Foreign Companies had proportionately increased to the same extent. This bore most importantly upon the business of the Vienna Company, who supplied the fluid to make the mantles. The sale of 300,000 burners for the year 1894-5 for England alone meant that for the year 1895-6 about 1,000,000 mantles would be required for the upkeep alone of those 300,000 burners. But, in addition to this, must be taken the large number of burners thrown out before, which raised the output very considerably. At the present time, the Incandescent Gas-Light Company were manufacturing at their works in Westminster from 14,000 to 15,000 mantles a day; and they were arranging to increase this output to 20,000, which would barely suffice to meet the demands. If they were putting out 20,000 mantles a day, and if for the year 1895-6, as was anticipated, they threw out 750,000 burners, how very greatly increased would the mantle output be next year, when it was taken into consideration that an average of three mantles per burner per annum were required, and that, in addition to the large number of burners now out, there would have to be reckoned all those thrown out in the current year. The business of the London Company was developing by leaps and bounds. At the general meeting of the Company in June, 1894, the Directors were able to announce, with great satisfaction, that the sales for the year had amounted to about 100,000 burners. This was a little more than a year ago. But to-day they were in a position to announce that the sales for one month—viz., October—had approximately reached this figure; and October was by no means the best month of the year for them. As a matter of fact, they were only at the commencement of the business they had to do; and the possibilities of its development were simply limitless. There was every indication that the system would be generally adopted for street lighting; and this field alone was sufficient for a business several times larger than that which the Company were now doing. Moreover, the system had hitherto been confined to coal gas. But there were many other uses for it; and the development of these would lead to its extension on a large scale. There was one other point upon which he would touch before concluding. Those present had doubtless heard that litigation was pending with respect to actions brought by the Incandescent Gas-Light Company against certain other companies for infringement of patents. It was not for him to dilate upon these matters; but he might say that the Directors of the Company awaited the result of these actions with the most complete confidence.

Major C. JONES seconded the motion, and it was carried.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Tuesday, at the London Offices, No. 30, Gracechurch Street, E.C.—Mr. CHARLES GANDON in the chair.

The SECRETARY (Mr. S. Wood, F.C.A.) read the notice convening the meeting; and it was agreed to take as read the report and accounts, which were referred to in the JOURNAL for the 15th ult.

The CHAIRMAN was very sorry to say the report and accounts did not show any appreciable improvement upon those which were put before the shareholders at the previous meeting. On that occasion, he expressed the hope that the reduction which had been made in the price of gas to the private consumers would result in a satisfactory increase both in the consumption and in the number of consumers. Unfortunately, so far, this had not been the case; but, at the same time, he thought perhaps there was some amount of consolation for them in finding that they had more than maintained their own. The gas and meter rental showed a small increase upon the preceding six months. Then as to the profit, that would have been considerably greater than it really was, but for exceptional circumstances. On this occasion, he thought it would be better to compare the figures with those for the December half year, because that was the first one in which there was no revenue from the public lighting; and, so far as making the comparison in other respects was concerned, this was of little importance, as the demand for gas in Georgetown was about the same all the year round. Looking at the revenue account, it would be found that coal had cost £13 less in the past half year. The price per ton had been

slightly lower than in the preceding six months; but the reduction was principally due to a smaller quantity of coal having been used, although more gas had been sold. This, he thought, was a satisfactory point so far as it went. The cost of purifying and wages was a little less. Repairs and maintenance figured at £54 higher, which was owing to more than usual having been written off for depreciation of stocks. Although they were unable to show any very brilliant results in working, yet the Directors were anxious to keep the stocks and so forth at their proper value. Therefore, they thought it better to write off a larger sum. Salaries and wages stood at £67 more. The amount under this head would have been less than previously; but they had charged to this account the whole of the expenses of the visit of their Manager (Mr. T. B. Younger) to England this year. As this visit only occurred at intervals of five years, it might have been thought that the expenses could have been put to a suspense account, and only a portion written off each half year; but they considered it better to "take the bull by the horns," and charge the whole of it this half year. Rents showed a small decrease; and the item of Directors' and Auditors' fees, £50, because the Directors had voluntarily agreed to reduce their fees from £300 to £200. Trade and general charges had been reduced by £41. This was not a large amount; but they had endeavoured to economize in every way. On the credit side of the account, the revenue from gas and meter rental was £33 more, which, though small, was satisfactory, as it showed they were not decreasing. Residual products had decreased by £32, which was due to small items. The prices received for coke and tar had not been quite so large as in the previous half year; but, as they used less coal, they had had a smaller quantity of residuals to sell. The result of the half-year's working was a total income of £2434, as against £2433; and the profit was £299, as compared with £291. As he had said, the profit would have been greater but for the amount written off for maintenance, and the expenses of their Manager's visit to England. Since his return to Georgetown, Mr. Younger had been exerting himself to reduce the expenses there. He had effected several notable economies; and it was hoped he would be able to do more in this direction. On the whole, they might look forward to considerable improvement in the results of the current half year, and for several half years to come. He mentioned at the former meeting that they had been endeavouring to introduce the system of prepayment meters at Georgetown. It had been making slow, but steady, progress there. He found for the month of April last the result from the prepayment meters amounted to £8, while in August it was £14; so that the system seemed to be finding favour there. He thought that, if it did not produce them new consumers, it would at all events be the means of avoiding the loss of some of the present ones. The Directors had now sent out upwards of 100 meters. They were not all fixed; but it was hoped they would be soon, and that they would be the means of increasing the income. He concluded by moving the adoption of the report and accounts.

Mr. H. W. Andrews seconded the motion, which was carried unanimously.

A dividend was then declared at the rate of 8 per cent. per annum on the preference share capital, and at the rate of 2 per cent. on the ordinary share capital, both less Income-tax, except upon dividends payable to local shareholders.

The vacancy which had occurred during the half year by the retirement of one of the Auditors (Mr. J. Manwaring) had been filled by the appointment of Mr. H. J. Hartley; and this was confirmed.

The usual complimentary vote was passed to the various officials, and afterwards to the Chairman and Directors.

The Chairman, in responding for himself and colleagues, remarked that, although he was very much disappointed at the results of the past few years, he had considerable hopes that the Company would be restored to their former prosperity. With reference to the action of the Directors in voluntarily giving up their fees, he thought it was quite their duty to do so, because they had to ask the officials to bear a portion of the reverses that had fallen upon the concern. If the Directors had not set the example, they could not, with very good grace, have asked the officials to forego anything.

This concluded the proceedings.

ELECTRIC LIGHTING NOTES.

At the Meeting of the St. Pancras Vestry last Wednesday, their Chief Electrical Engineer (Mr. S. W. Baynes) presented a report which is practically a defence of his high-voltage theory. It appears therefrom that the original incandescent Swan lamp was worthless for central station distribution—its voltage being only 50; but when, in 1881, Mr. Edison inaugurated his system with lamps of 100 voltage, the era of higher voltage began. "At this present date," says Mr. Baynes, "the old 50-volt lamp is obsolete, and a number of first-class lamp makers are producing lamps of 8, 16, and 32 candle power and upwards at various voltages up to 250." After referring to the progress made in America since he first introduced the higher voltage movement some two years ago," Mr. Baynes says: "When commencing my duties in St. Pancras, I found that a number of premises had been wired ready for connection to the mains from the King's Road station; and I learned that no instructions had been issued to the wiring contractors as to the subdivision of the circuits so as to enable a supply to be given on a five-wire system. Experience elsewhere has shown that no service line should carry more than from 10 to 15 ampères; and it has become the rule to run the five services into the majority of the houses. In this way a *potential difference of 440 volts frequently exists in the buildings;* but, so far, no trouble has been experienced by the consumer from this cause. Our customers, having their premises already wired, could not readily comply with the requirements consonant with the five-wire system, neither could we call upon them to re-arrange their wiring; but we could supply them with increased voltage, which would only need two service lines, and suit the arrangements already made." Further on, Mr. Baynes claims that a great advantage is the economy in the cost of house services, and that his now famous circular has saved the Vestry something like £5000, inasmuch as the Westinghouse Electric Company, Limited, claim a royalty on Hopkinson's patent, and the money paid on the Stanhope Street mains did not cover the use of a five-wire system over the area supplied by the existing mains; and that, had the five-wire extensions been connected to the old system, and run together, some thousands of pounds would have been demanded. Figures showing the alleged saving are produced; and the writer maintains that, by the introduction of high voltage, more can be done free from royalty than by a conversion of the mains into a five-wire system. Besides all this, Mr. Baynes, in furthering his project, declares that a station delivering current at 220 volts to the lamps will possess the following advantages over that delivering at half pressure: (1) The area that may be covered by the high voltage station is 16 times greater than that of the low, because "with the same expenditure in copper four times the lighting on the mains can be done, or the same amount of lighting at four times the distance with the same percentage loss; (2) there is no reduction of light owing to excessive fall of pressure, because at 220 the variation is so slight; (3) no further transformer sub-stations will be required; (4) the capacity of the Stanhope Street mains may be increased fourfold, but "whether these mains are augmented by the increased voltage or converted into a five-wire arrangement, the risk of breakdown to earth, both on the consumers' premises and on the mains, is unaltered;" and (5) the plant at the higher voltage, being identical with that for electric traction, would afford excellent facilities for combining lighting with electric traction throughout the parish, without any extra generating plant. In conclusion, Mr. Baynes quotes the words of the Provisional Order—section 27 (*e*)—to prove that a pressure of 300 volts is authorized by the Board of Trade; and he adds that, as required by section 27 (*d*), the "standard pressure on the mains" is unaltered, and will remain so. After the Vestry had digested this lengthy document—the foregoing is but a brief epitome of it—the Committee reported that they had received an application from the Engineer's Department of the London County Council, stating that, before they are able to make a final report on the balance (£18,900) of the £75,000 loan applied for, it was absolutely necessary that a plan should be furnished on a 5-feet scale of the whole of the mains laid in the parish. This little job will necessitate the employment of a draughtsman at a salary of two guineas a week—an appointment which was sanctioned.

The Hampstead Vestry were last Thursday called upon to "pay the piper"—in other words, Mr. W. H. Preece presented his little bill for past services rendered to the Vestry as Consulting Electrical Engineer. The various items were jotted here and there over the agenda; but the first of them comprised (A) £1841 15s. 8d., "commission on Messrs. Yerbury's and Siemens's contracts" (£1789 5s. 8d.) and "report, plan, and estimate for general extension of mains" (£52 10s.), less £645 received on account—making a total of £1196 15s. 8d. Another item (B) was for commission on an account of Messrs. Siemens Bros. and Co., Limited, for arc lamps and posts—viz., £7 2s. 10d. on £142 18s. gross; and a third (C), for "plan and detailed estimate of the extension of high and low pressure mains, and arc lighting plant and mains to the High Road, Kilburn, and West End Lane—ordered by the Committee and submitted—2½ per cent. on £6000—£150." Of these items, the first was recommended for payment by the Finance Committee; the second, though passed by the Lighting Committee, was recommended by the Finance Committee to be referred back for further consideration; and of the third, the Finance Committee recommended the Vestry to refuse payment.

The discussion on the first was in respect to the £52 10s., which was questioned by several members; and Mr. Boyse moved that the matter be referred back to the Electric Light Committee for consideration and report. Mr. Greenhill said the Committee were driven to take the course recommended; and, in answer to the Chairman of the Vestry (Mr. H. Hashen, J.P.), the Chairman of the Electric Light Committee (Mr. Thwaites) declared that this item had been thoroughly investigated by his Committee, who agreed that it was a just and proper charge. Mr. J. Aitcheson dissented; declaring that a large minority were of a different opinion. Eventually the motion for reconsideration was lost; and a cheque for £1196 15s. 8d. was ordered to be drawn in favour of Mr. Preece, and another for £11,167 11s. 3d. for Messrs. Siemens's final instalments under Mr. Preece's certificates.

As the two items comprised in (B) were recommended for reconsideration, the Chairman asked what reason the Finance Committee had in refusing payment on Mr. Preece's own certificate. He held, in fact, that the matter could not go back. Nevertheless, Mr. Sharpe moved the rejection of both the items; and Mr. Adams seconded the motion—the latter gentleman explaining that a part of Messrs. Siemens's contract price had been kept back to provide a guarantee in case the work did not turn out well. It had not turned out well, and ought not to be passed. Mr. Greenhill said he personally knew that these arc lamps often went out, and kept flickering; and, since Mr. Preece's certificate had been given, facts had come to the knowledge of the Vestry which proved that these lamps were not working properly. Why should they be passed? If a member ordered gas-fittings, and was assured that they were all right, would he pay for them when he found they were valueless? This contention was supported by another member. The Chairman tried to stem further discussion by hinting at the consequences of "standing the racket of an action." Mr. Thwaites said the certificate was given when the lamps were burning well; but the "strong weather" had affected them. Messrs. Siemens had sent engineers down, and agreed to put them right free; but they "would not undertake any responsibility." Mr. Hanhart contended that perhaps there might be cause for a counter-claim for indemnity against Messrs. Siemens; and he thought it would be wise to withhold payment. Mr. Aitcheson maintained that the Vestry would have to pay. Let the Vestry accept Messrs. Siemens's offer by all means; but the time would come when these lamps would give serious trouble. Major-General Young said if the cheques were not drawn it would be necessary to go to arbitration or law. He moved that they be drawn; and after some further rather sharp discussion, this was done.

On the 2½ per cent. commission claimed by Mr. Preece as being half that to which he was entitled, there was another long wrangle. The item is (C) enumerated above. Mr. Sharpe moved its rejection; and Mr. Aitcheson seconded the motion. The latter described this £150

as the most extravagant charge ever brought before the Vestry. Mr. Preece said he was entitled to 5 per cent., and only charged 2½ per cent. (£150). He only ought to have charged 20 guineas. This would have paid him exceedingly well; and his bill should be returned to him with a request for reduction to a reasonable amount. The Chairman here raised the question of the propriety of one Committee refuting the decisions of another—a practice which he thought was an intolerable nuisance. Mr. Preece was fully entitled to one-half the ordinary commission, if the work was not carried out. This question was discussed with some heat; and Major-General Young advised the Vestry to draw a veil over the past. Mr. Thwaites moved, and Mr. Elliott seconded, that the cheque be drawn. Mr. Johnson considered the Vestry should not pay an amount which it was exceedingly shabby of Mr. Preece to charge. Mr. Ryalls thought the Vestry had better "pay and look pleasant;" and though there had been a vast amount of improvidence in connection with the electric lighting, they must forget it, and hope for a better future. In the end, the motion to pay the amount was lost; and an amendment proposed by Mr. J. Aitcheson, to the effect that the bill be referred back to Mr. Preece, was carried by 24 votes to 17.

Subsequently, without one minute's discussion, the Vestry agreed that the bankers be asked to advance the sum of £19,500 to the electric lighting account, as a temporary loan. After this quick bit of finance, the Committee reported that the cost of the works completed and in progress amounted altogether to £59 400; and that, as only £29,400 had already been obtained, a further loan of £30,000 was required. The Vestry thereupon agreed to apply to the London County Council for their sanction to borrow this sum; and, if granted, to obtain the money at the lowest possible rate of interest.

Colonel Ducat recently attended at the Town Hall, Wolverhampton, to inquire into an application by the Corporation for the sanction of the Local Government Board to the borrowing of £5000 for electric lighting purposes. The Town Clerk (Mr. H. Brevitt) stated that, on July 8, the Corporation agreed to enter into contracts for plant to the amount of £4225; and they required £775 for extending the mains as fresh applications were received. Their object was to enlarge the area of supply. The capacity of the present plant was 8000 8-candle power lamps; and they had already connected 7936, leaving only a margin of 64 lamps. They had 102 customers, representing, inclusive of public lamps, the 7936 lamps. The capacity of the new plant included in the application was nearly 3000 8-candle power lamps. The Inspector afterwards visited the works.

A movement is on foot in Bangor among influential ratepayers to organize a strong opposition to what is known as "the fad" which has been adopted by the Council of establishing an electric light and power plant in the city. Already the rates of the city reach close on 8s. in the pound; and it is feared that, if the Corporation secure the powers they now seek, the rates will be increased.

In the last volume of the JOURNAL, some comments appeared in our "Electric Lighting Memoranda," upon the opposition which had arisen in the electrical trade to the fitting up of the interiors of houses for electric lighting by local authorities owning electric supply works; and special mention was made of some trouble in this respect at Leicester. At a recent meeting of the Corporation, a petition was presented by the electric fitters of the town, urging the Council to withdraw their sanction from the Gas and Electric Lighting Committee doing fitting work. For some twelve or thirteen years, the Committee have undertaken gas-fitting; and they naturally took up the work in connection with the electric light, being desirous that it should be done as well as it possibly could be. The petition alluded to was referred to the Committee for consideration; and, having carefully considered it, they reported at last Tuesday's meeting of the Council that they could not recommend any alteration in the present practice. There was some opposition, but the Committee's decision was upheld.

Some difficulty is being experienced in connection with the transfer of the Exeter electric light undertaking to the Corporation. In answer to the Corporation's inquiry respecting an Order, the Board of Trade point out that it will first be necessary to get the Local Government Board's sanction to the necessary loan, and to conform to all the usual preliminaries. This the Corporation are, of course, prepared to do; but the delay, which had apparently not been contemplated, is attended by serious consequences. New machinery is said to be absolutely necessary to the continuance of the works; and, as things are, neither the Company nor the Corporation have a free hand in ordering it. At a meeting of the Council last Wednesday, it was reported that, since the provisional agreement was entered into, new machinery or appliances to the value of £250 had already been ordered; and the City Surveyor had said that these were not quite the thing he should have obtained had the matter been in his hands. The Council are naturally anxious to get control of the electric light undertaking; but they must, of course, comply with the existing legal formalities as to notices and so on.

The Wimbledon District Council seem determined to have their electric lighting scheme if they can get it. Last Friday, the Local Government Board inquiry into the application of the Council for sanction to borrow £32,000 for the purpose was conducted by Major-General Phipps-Carey, R.E. The case for the Council was conducted by Mr. Fletcher Moulton, Q.C.; the application being opposed, on behalf of the Ratepayers' Association, by Mr. Castle, Q.C., and Mr. Fordham Spence. Mr. Arthur Preece, Assoc.M.Inst.E.E., gave an outline of the scheme; and his evidence was endorsed by Mr. Manville, M.Inst.E.E. Mr. W. H. Preece, C.B., supported the proposals of his son; expressing the opinion that Wimbledon could be lighted far more effectively than at present by means of the incandescent electric system at only a slight increase of cost. Mr. W. Santo Crimp, M.Inst.C.E., said he was strongly in favour of the scheme. On the other hand, Professor Silvanus Thompson—an unquestionable authority—described it as crude. Mr. W. G. Cooke, the Chairman of the Ratepayers' Association, gave his reasons for opposing the project; and one of the oldest ratepayers expressed the opinion that the majority of the residents were satisfied with the existing system of lighting. He said the electric light cost him three times more than gas; and therefore he had given it up. Mr. Moulton having addressed the Inspector, the inquiry closed.

A DANGER OF GAS SUPPLY IN LARGE CYLINDERS.

An accident of a most startling character (the *Cambridge Chronicle* reports) took place, on Monday evening last week, at the Great Eastern Railway Station at Ely, fortunately unattended with personal injury. It is the custom of the Company to send large cylinders containing gas to various stations on their line, for the purpose of being drawn off into smaller receptacles for carriage lighting. Two of these were lying on a long truck in a siding on the east side of the station. The method of extracting the gas is by a flexible tube, to one end of which there is attached a male screw; the receiving sunken screw being within the cylinder itself. The operation of inserting the screw was being conducted by, our contemporary is informed, a man whose general occupation is wheel-tapping or testing, who by misadventure got the screws cross-threaded; the consequence being that the pressure of gas (150 lbs. to the square inch) at once blew out the male screw, knocking the man down, and the gas ignited by contact with his lamp. The situation was critical in the extreme. The orifice gradually became larger through fusion of the softer parts surrounding the inner screw-work. The flames mounted higher and higher, eddying round in the upper air as the gas ascended, in a most remarkable manner. There was no fear of explosion from the cylinder, its contents having ample vent; but the danger rested with the neighbouring one, containing many thousand cubic feet of gas. This became heated almost to whiteness, until it was evident that the gas was greatly expanding, and an explosion was imminent. Suddenly, a bright flame shot up high in the clouds with a sullen roar and concussion that shook the earth for a mile around. The wood-work on the eastern platform was much scorched; and there was great wreckage of windows. The truck also upon which were the gigantic cylinders was destroyed; but it is marvellous that a greater catastrophe did not occur by fire. Nearly half the exploded cylinder (¾ inch thick, and of great weight) was projected about 150 yards into some gardens.

METROPOLIS WATER SUPPLY.

Dr. Frankland's Report on the Quality of the Water in September.

The returns furnished to the Registrar-General by the London Water Companies regarding the water supply in the Metropolis during September, show that the average daily supply amounted to 226,334,331 gallons, as compared with 194,121,301 gallons in the corresponding month of 1894. The number of services being 820,880, the rate was 276 gallons to each service. Of the entire bulk of water sent out, 119,468,764 gallons were drawn from the Thames, and 106,865,567 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: New River and Kent, 0·6; Colne Valley and Tottenham, 1·2; East London (deep well), 1·3; Grand Junction and Lambeth, 2; and Chelsea, West Middlesex, Southwark, and East London (river supply), 2·1. The unfiltered river waters contained the following proportions: Thames at Hampton, 3·6; New River Cut, 1·7; and the Lea at Angel Road, 3·5. The Thames at Hampton was, on Sept. 23, turbid and pale yellow in colour; but it was, as raw water, of good chemical and bacterial quality. As delivered by the five Companies drawing from this river, it was in every case efficiently filtered, and of excellent chemical and (with one exception) bacterial quality for dietetic purposes. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 99·19; West Middlesex, 99·46; Southwark, (No. 4 filter well) 99·73, (No. 9 filter well) 92·97; Grand Junction, (general well at Hampton) 98·11, (general well at Kew Bridge) 99·19, (South filter well at Kew Bridge) 98·92; and Lambeth, 98·65. The New River Cut, before entering the subsidence and storage reservoirs, was, on Sept. 25, turbid and very pale yellow in colour. It was, for unfiltered water, of excellent chemical quality; but bacterially somewhat inferior to the Thames at Hampton. By passing through the storage reservoirs, the number of bacteria was reduced to less than one-fourth; and, after efficient filtration, the water was delivered to consumers in excellent chemical and bacterial condition for dietetic purposes. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 97·88; No. 9 well, 98·82. The water taken from the Lea by the East London Company at Angel Road on Sept. 25 was turbid and pale yellow in colour. Chemically it was of nearly the same quality as the Thames at Hampton, but bacterially much inferior. It was passing through the storage reservoirs without detention, and actually arrived at the Lea Bridge works with an increased number of microbes per cubic centimetre. After efficient filtration, however, it was delivered in excellent chemical condition for dietetic purposes; while the bacterial improvement was represented by the following percentage numbers: No. 1 Essex well, 96·96; No. 2 Essex well, 99·53; and Middlesex well, 99·3. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes; but the East London samples were slightly turbid, owing to repairs in the well. The Colne Valley Company's water had been softened before delivery, and thus rendered suitable for washing. Seen through a stratum 2 feet deep, the Kent, Colne Valley, and Tottenham waters were clear and colourless; the East London (deep well), slightly turbid and colourless; the New River, clear and nearly colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters before and after storage, and the supplies delivered by the various Companies and

collected on the 23rd, 24th, 25th, and 26th of September, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw and Stored River Waters.		
Thames at Hampton, Sept. 23	1480	15·0
Thames at Hampton, after storage for 14·7 days (Chelsea Company), Sept. 23	220	16·3
West Middlesex Company's water (supplying filters 1–5), Sept. 24	200	15·3
Grand Junction Company's water arriving at Kew from Hampton, Sept. 24	240	16·4
Grand Junction Company's water at Kew, passing on to filters Nos. 2, 3, and 4, Sept. 24	340	16·3
New River Cut, before passing through reservoirs, Sept. 25	1700	15·2
New River Cut, after passing through reservoirs, just before filtration, Sept. 25	380	14·7
River Lea at Angel Road, Sept. 25	2480	16·5
River Lea, after passing storage reservoirs of East London Company, Sept. 25	3420	16·4
Filtered River Water as Supplied.		
Thames—		
Chelsea Company's general filter well, Sept. 23	12	16·2
West Middlesex Company's general filter well, Sept. 24	8	15·2
Southwark Company's No. 4 filter well, Sept. 23	4	14·4
Southwark Company's No. 9 filter well, Sept. 23	104	14·3
Grand Junction Company's general filter well at Hampton, Sept. 23	28	15·1
Grand Junction Company's general filter well at Kew Bridge, Sept. 24	12	15·7
Grand Junction Company's south filter well at Kew Bridge, Sept. 24	16	16·3
Lambeth Company's general filter well, Sept. 23	20	15·5
Lea—		
New River Company's general filter well, Sept. 25	36	15·0
New River Company's No. 9 filter well, Sept. 25	20	14·9
East London No. 1 Essex well, Sept. 25	104	15·8
East London No. 2 Essex well, Sept. 25	16	16·1
East London Middlesex well, Sept. 25	24	16·1
Deep Well—		
Kent Company's new well at Deptford, Sept. 26	4	11·3

EASTBOURNE AND ITS WATER SUPPLY.

Municipal Water-Works Proposed.

Consequent on some very serious allegations being made in regard to the impurity of the water supply at Eastbourne—mainly due, it is said, to the abnormal amount of salt found in the water—there has been submitted to the Town Council by the Sanitary Committee a report suggesting the establishment of works in competition with those belonging to the Eastbourne Water-Works Company. This report was presented at the meeting of the Council on Monday of last week; and it gives particulars of the action being taken by the Company to remedy every possible cause for complaint. The Company have consulted Dr. Edward Frankland, F.R.S., and Mr. Whitaker, the eminent Geologist; and already one spring containing "an excess of common salt" has been discovered, and works have been commenced to exclude the water of this spring from the Company's wells. Mr. F. K. Bamber, F.I.C., one of the analytical advisers of the Company, tested a sample of water taken from the town supply on the 14th ult., and found that, although it contained an excess of salts, "the water is not at all injurious to the health of those who drink it." Replying to a communication from the Town Clerk, the Secretary of the Company (Mr. F. A. Currey) wrote: "With regard to your statement that there are wells in the town which are supplying good wholesome water, it is important your Committee should understand that the consumption of water in Eastbourne approaches 2 millions of gallons per day; and the wells referred to would only yield a very small fraction of that quantity. The Directors are taking steps to obtain water immediately from the springs at Holywell. Orders have been given for the supply of the engines and machinery required for this purpose; and they will be erected, and set in operation, with as little delay as possible." This was the state of affairs on the 22nd ult., when a meeting was held of the Eastbourne Schoolmasters' Association, who unanimously passed the following resolution: "Having learnt from analyses of samples of water submitted to the County Analyst, that, whereas on or about Sept. 27, 48 grains of chlorine—so called—per gallon were found to be present, on Oct. 19 this amount had risen to 73 grains, this Association, representing as it does all the boys' boarding schools in Eastbourne, begs to inform the Sanitary Committee that the members are altogether dissatisfied with such steps as the Water Company may have hitherto taken to improve the condition of the water. The Association strongly urges the Sanitary Committee to request the Water Company at once to take such steps for the improvement of the water as will satisfy the Committee; and in default to declare that the Committee will at once demand a Local Government Board inquiry, and further will apply to Parliament for powers to deal with the water supply of the town." A deputation from the Association subsequently attended before the Committee, and urged them "to take prompt measures to secure a supply of proper water." The Town Clerk was thereupon instructed to get Counsel's opinion as to the powers of the Corporation; and the following extract from the Committee's minutes gives the result of his action:—

The Town Clerk reported his conference with Counsel, Mr. Shiress Will, Q.C., M.P., who stated that he was now of opinion that the Company had failed to take the steps they ought to have taken to improve the water supply, as required by the Town Clerk on behalf of the Sanitary Committee, and the Council ought to proceed for a Bill (in preference to proceeding under section 52 of the Public Health Act, 1875) for power to provide a water supply for the town. It was resolved unanimously—

(1) That the Committee are dissatisfied with the measures taken by the Water Company to deal with the complaints addressed on their behalf to them, and are satisfied that the water now being supplied to the inhabitants is not a proper supply within the meaning of the Public Health Act, 1875.

(2) That the Council be recommended at once to promote a Bill in Parliament authorizing the Council to provide a supply of pure and wholesome water for the inhabitants, and to instruct the Town Clerk to take the necessary steps in the matter.

(3) That the Council be recommended to appoint an engineer and geologist to prepare plans for the required works, and to advise them upon the sufficiency of the Water Company's proposals.

(4) That the Chairman be requested to make a statement to the Council of the steps which the Committee have been taking during the past few weeks to secure a proper supply of water, and that the Town Clerk inform the Eastbourne Medical Society and the Schoolmasters' Association of these resolutions.

On the above matters coming before the Town Council on Monday last week,

Alderman Strange moved the confirmation of the Sanitary Committee's proceedings. He said it would be in the recollection of the Council that some years ago a resolution was brought forward for the purchase of the existing Eastbourne Water-Works; and he thought the time was now fully ripe, and that the Council should rise to the occasion, and go to Parliament without a moment's delay. They should promote a Bill to authorize the Corporation to provide a supply of pure water to the inhabitants. All these vested interests and these monopolies caused a great deal of waste of time by being in the hands of private companies. He thought it would have been to the interest of the Eastbourne public generally if the water supply had been in the possession of the Corporation. He hoped they would get a unanimous vote, so as to be empowered to promote the Bill in the next session of Parliament. It would not only be to the interest of the inhabitants of the town, but to the "fair fame" of Eastbourne, if the supply of such a necessary of life as water were placed in the hands of the municipal authorities.

Mr. Wenham seconded the resolution. He regretted the Corporation had not purchased the water-works when the matter was last under their consideration, as they would have then been in a position to have grappled, without delay, with the serious evil that now threatened the town, and not have been inclined to spend months in experiments. It was natural that the Company would mainly look at the commercial aspect of the question; and that their chief concern would be as to how much they could save by maintaining the present arrangements. If, however, the supply of water were in the hands of the Corporation, they would at once have gone for a fresh and altogether new supply.

Mr. Towner protested that a matter of such magnitude should not be passed without full consideration—seeing that the Council were asked to pledge themselves to an outlay of an enormous amount of money. It must not be forgotten, he said, that the present Water Company had been in existence for the last 40 years; and until now they had given the town every satisfaction. They had always prided themselves on having a very fine supply of water night and day; but, unfortunately, the Company had lately come across some salt spring, which had upset all their calculations. Notwithstanding that the Company were taking steps to remedy the trouble, the Council were now asked to agree to the promotion of a Bill to enable competing works to be established. He did not, however, think there was the slightest chance of such a Bill being passed—at all events, they must be prepared to face a stern fight on behalf of the Water Company, who had a lot of money behind them. Seeing the enormous outlay that would in any event be involved, the matter should be thoroughly well considered; for, of course, there was the alternative suggestion (which he regarded as a better scheme) of getting powers to buy the present Company's undertaking outright. To enable the question to be calmly considered, he proposed, as an amendment, that consideration of the matter be deferred for one month.

Mr. Bradford seconded the amendment, thinking it was not necessary for the Council to rush with impetuosity into different schemes that might involve them in an outlay to the extent of some thousands of pounds.

Mr. Hillman supported the resolution, as he thought that the right time to approach the Water Company with a proposition in regard to acquiring their plant and undertaking would be when the Council had obtained the parliamentary powers for which they intended to apply next session.

Mr. Duke also supported the recommendation of the Committee, though when the water-works purchase question was last brought forward he was not in favour of it, seeing that he considered they would be involved in an expenditure of a lot of money without attaining the end they all desired, which was to get a good supply of water as quickly as possible.

Alderman Strange, in reply, said the Committee had taken the very best advice in this matter; and he did not think it right for them for one moment to consider the expense involved. Eastbourne was now only on the fringe of the prosperity to which it would attain; and it behoved everyone connected with the town to take all possible means to foster its development. Certainly, he considered that the supply of pure and wholesome water was an essential. Without it, all the educational establishments, for which the town was famous, would suffer; and in this way the whole district would be the poorer. He was strongly of opinion that the Council ought to embrace the present opportunity to promote the Bill suggested by the Sanitary Committee.

The Town Clerk having pointed out that, if the amendment were carried, it would mean a delay of twelve months in promoting the Bill—seeing that the necessary Parliamentary Notices must be given before Nov. 30.

The amendment was put, and lost by 5 votes to 22; and the resolution was then carried.

SHEFFIELD AND THE LITTLE DON WATER QUESTION.

Barnsley Invited to Join in the Sheffield Scheme.

The question of the rival projects of water supply from the watershed of the Little Don has been advanced another step by an important communication from the Town Clerk of Sheffield (Mr. H. Bramley) to the Town Clerk of Barnsley. Agreements—the nature of which has been previously stated in the JOURNAL—have been entered into with respect to this matter between the Sheffield Corporation and Rotherham and Doncaster; and now the first-named authority are endeavouring to induce Barnsley, who have a Bill pending before Parliament, to come into the arrangement.

In his letter (which was written by direction of the Water Committee), Mr. Bramley mentions that the Sheffield Corporation have decided to seek powers in the forthcoming session of Parliament to deal with the old watershed of the Little Don in the manner which they are advised, and believe, to be the most economical and advantageous in the interests of the public. The Water Committee, he says, do not admit the right of Barnsley to any supply from the Little Don area; and they are especially opposed to the Barnsley Bill (1) as proposing to use a large portion of the best and purest top waters of the Valley in a wasteful manner, and (2) upon the ground that no new water area should be granted to Barnsley until the remainder of the waters of their present Scout Dyke Valley has been properly brought into use. The Committee are strongly of opinion that, in view of the urgency with which all the remaining resources of the Don Valleys are being sought by the great populations near, any scheme, whether at Ingbirchworth or on the Little Don, which furnishes compensation water for the use of millowners from the pure upper portions of the gathering-grounds, instead of the equally available but less pure areas below, is wasteful; and therefore contrary to public interest, and greatly to be deprecated. The Committee contend, and will (the Town Clerk writes) urge with all possible force, that the waters of the Little Don Valley should be dealt with by one complete and comprehensive scheme to be carried out by the Sheffield Corporation, and that water should be supplied in bulk to the authorities of the other towns in the Don Valley who are seeking to obtain further supplies. So strongly are the Sheffield Committee impressed as to the necessity of thus using the water resources to the best advantage, and as to the general economy and efficiency which will attach to dealing with the Little Don area by one comprehensive scheme in this way, that they feel themselves able, and are willing, if Barnsley will adopt that course, to waive their opposition to Barnsley having any water supply from the Little Don. The Town Clerk was therefore directed, upon that condition, to offer that Sheffield shall undertake to include the requisite powers in their Bill of 1896, and shall, if such Bill be passed, supply to the Corporation of Barnsley, into a tank to be constructed by the latter near Wortley, such a quantity of water as may be agreed, or as Parliament may direct, and either upon terms similar to those set out in the Sheffield agreements with Rotherham and Doncaster, or on such terms as Parliament may determine. This offer, of course, is upon condition that the powers sought by Barnsley to establish works in the Little Don Valley shall not be proceeded with. But, the letter adds, it will be urged that (1) until the waters of the Scout Dyke have been properly utilized, an increased price ought to be paid by Barnsley for any water supplied from the Little Don Valley; and also (2) that as the Lords Committee decided that certain districts mentioned in the Barnsley Bill should not be supplied with water by the Corporation of that borough, a reduction proportionate to the population of such districts should be made in the quantity of water proposed to be acquired by, or supplied to, Barnsley out of the Little Don watershed. The views of the Sheffield Water Committee as expressed in this letter will be laid before the Parliamentary Committee; and the letter will also be relied on as an offer to furnish a supply of water in bulk to Barnsley. The Committee have communicated with the Barnsley Corporation on this subject in sufficient time to enable the latter to apply to Parliament in the next session, should they think fit, for powers to construct works for dealing with the remainder of the Scout Dyke water.

WATER-WORKS EXTENSIONS AT WAKEFIELD.

A Special Meeting of the Wakefield City Council has been held for the purpose of considering recommendations by the Water Committee that a duplicate line of mains should be laid from Ardsley to Wakefield—a portion 18-inch, and the remainder 24-inch—and also that instructions be given to the Engineer (Mr. H. Rofe) to proceed with the preparation of plans, specifications, and estimates for the construction of the Booth Dean and Oxygrains reservoirs. Alderman Booth, the Chairman of the Water Committee, moved the adoption of the recommendations. He said the duplicate mains were necessary in order to provide a better pressure of water for the consumers on the south side of the city, from some of whom there had been many complaints as to a short supply. The motion was seconded by Mr. Bolton. An amendment, referring back the minutes, with the exception of that relating to the duplicate mains, was proposed by Mr. H. Smith, who thought such an important scheme should be left to the Council to deal with after the elections. In the course of a long criticism of the proceedings of the Water Committee, he stated that they were now constructing works at Green Withens which were estimated to cost £150,000; and the Council were now asked to sanction works involving another £150,000. It was believed that, when they decided to go on with the Green Withens scheme, their difficulties would be practically at an end, and the rate-in-aid very much relieved. Mr. Rofe now reported that the total yield of the Green Withens scheme would be 1,241,000 gallons per day, of which 649,297 gallons would be compensation water, leaving 591,703 gallons for disposal in Wakefield. It would appear that for the sake of securing half a million gallons for sale, they were to expend £150,000. The total yield of the undertaking, according to Mr. Rofe, would be 5 million gallons per day, of which about 2 millions were compensation water. The total outlay on the new scheme, leaving out the cost of the old water-works, was roughly £700,000; and the cost of the old works was £210,000. The expenditure for the first part of the scheme, in round figures, was £400,000; and for the second part, for supplying compensation water, about £300,000. He understood that the probable cost of the remaining reservoirs might not be as great as that of the previous ones, as not so much masonry was likely to be required. He entered into a long calculation as to the expenses connected with the undertaking; and said that, with an estimated revenue of £24,000 next year, there would be a deficiency, when working expenses and the contribution to the sinking fund were met, of £19,659. The great incubus of the undertaking was the purchase of the old water-works, involving an expenditure of £7893 a year for 2 million gallons of water. The amendment was seconded by Mr. Riley. Alderman Booth, in his reply, dealt at length with Mr. Smith's arguments. Mr. Rofe, he said, had told them that he did not anticipate any material increase upon the parliamentary estimate for the two new reservoirs, because the work was of a known character. Mr. Smith had said that the principal cost of the Green Withens reservoir was £150,000. But the contract was let for £120,000; and the Clerk of Works had informed the Committee that day that the extras would be more than provided for by the works which would be left undone. The Committee decided that it would be best to proceed with the construction of the two reservoirs. The question had been very deliberately entered into, and very carefully considered. They were urged to defer the matter for the new Council to deal with; and, at the time the construction of the Green Withens reservoir was recommended, it was opposed on the same plea. Unfortunately, this was agreed to; and the result was that the work was delayed. On being put to the vote, the amendment was lost, and the minutes were adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Carburetted water gas, as stated in a report on another page of this issue of the JOURNAL, is about to be introduced into the Edinburgh Corporation Gas-Works. This was not unexpected; but nevertheless there are elements in the process by which the Gas Commissioners have arrived at their decision which might almost fitly be described as staggering. The Commissioners have had the subject of introducing some method of enriching coal gas before them since the beginning of 1893. They were in no hurry in the matter; and it was not till July of 1894 that they made up their minds upon it. Then the resolution—a unanimous one—was to adopt the Peebles process. Shortly afterwards they had carburetted water-gas processes put before them—first one and then another. The first one they inquired into, inspected it at work in a number of places, and were pleased with it. The second one they were asked to delay coming to a decision upon till they should have an opportunity of seeing it at work. This they agreed to do; and now they seem to be all for it, if the owners will offer it cheap enough. There have been practically three steps in their search for the best enriching process—first one forward, when they resolved to adopt an oil-gas method; then one to the right, when they all but made up their minds that the first carburetted water-gas process would be suitable; and then one to the left, when they have almost decided in favour of the process which they inquired second into. This, in the physical world, would bring them back to the spot they occupied when they took their first step. Were it only for one circumstance, I would be inclined to say that this is, in reality, the position of the Commissioners to-day. The circumstance I refer to is that they have only two processes in view, and that they are now in a hurry to get one of them adopted and introduced. The systems are those owned by Messrs. Humphreys and Glasgow and the Economical Gas Apparatus Construction Company respectively. The Commissioners are not without knowledge that there is another process in existence—that worked by the second form of plant invented by Mr. W. Young, of Peebles; for Bailie Kinloch Anderson, on Monday, directly referred to it. But they do not take that system into account; and I think it will strike most of your readers as strange that they should, after having adopted the Peebles process in its first form, because the inventor improved it, throw the whole thing overboard, and fix upon a system which, according to Bailie Kinloch Anderson, their Engineers regarded the Peebles process to be somewhat like. If the process did resemble a carburetted water-gas system, it surely should have had somewhat similar treatment. Has it done so? The Peebles process, according to its second form, is not yet in use anywhere except at Peebles. But neither was one of the other processes in use; and the Commissioners waited for it from February till now—that is, for eight months. Surely they could wait for a few months longer to give a trial to a process which is looked upon as being nearer the ideal than the other two. This may appear a strong statement; but here are the grounds for making it. On Feb. 16 last, Mr. F. T. C. Linton, the Engineer of the Leith works, reporting upon the relative results of the working of the original Peebles plant and the Humphreys and Glasgow plant, said he was "of opinion that a combination of the special advantages of the two processes would ultimately be found the best." On July 25 last, Mr. A. Wilson, of the Dawsholm works of the Glasgow Corporation, speaking as President of the North British Association of Gas Managers, said, in relation to a carburetted water-gas process: "When the apparatus is being employed in making gases of high illuminating power, a considerable amount of tar is produced. . . . From experiments made, there is no doubt that a considerable amount of illuminating value is left in this tar or heavy oil; and the system will never be complete until this illuminating value is completely utilized." Now, the second Peebles plant does combine the special advantages of the two processes; and it also completely utilizes the illuminating value of the tar and heavy oils. The Commissioners could scarcely have been more directly pointed towards the Peebles second plant than they were by Mr. Linton, who is one of their own Engineers, and by Mr. Wilson, who at the time was the nominal head of the

organized gas industry in Scotland. They have passed it by, unless they should yet resolve to moderate the haste which they now display, and take up the position which I indicate above—and which their resolution of Monday is not inconsistent with—of having academically agreed to do a certain thing, but left their minds open as to how they are to do it. I am an advocate of the Peebles system; and I frankly admit it. My justification is, in the first place, that it was through my instrumentality that the process was first brought under the notice of gas engineers in the pages of the JOURNAL; and, in the second place, that wherever it has been adopted—the first form of plant—it has given satisfaction. I am satisfied that the second arrangement of plant would give equal satisfaction. Not having any interest in the process except what I have stated, I am unable to explain why the Company who own the patents have not the second one working yet. I do not say that the Edinburgh and Leith Commissioners should have adopted it; all I contend for is that, taking all the circumstances into account, they should either themselves give it a fair trial, or, if they are too cautious for that, wait, as they have done before, till someone else tests it, and then they could, with their eyes open, select the best process in the market, whichever it was.

At the Commissioners' meeting on Monday, Mr. Mallinson, a workingman representative, endeavoured to get the Commissioners to fix a principle upon which to proceed in granting retiring allowances to all their employees. He thought it was not fair that only those who applied should be considered; and when told that the Commissioners had no power to institute a pension fund, but were always willing to look into any case which might come before them, he said he should advise them all to apply. The subject may come up again.

On Monday afternoon, Provost Blair, of Dumbarton, performed the ceremony of turning on the gas to a new holder of 125,000 cubic feet capacity which has been erected at the gas-works there. A large company, which included a Member of Parliament and the local Sheriff, assembled to witness the event. Mr. James M'Gilchrist, the Manager of the works, who was also Engineer for the new holder, showed his visitors over the works; and the report says that he made some interesting remarks at each department. That, in Mr. M'Gilchrist's hands, may be taken for granted. Provost Blair, before performing his task, addressed the company on the success which had attended their management of the gas-works. When they took the undertaking over in 1873, he said, the make of gas was about 15 million cubic feet a year; and it was now 50 million cubic feet. The price of gas was then 6s. per 1000 cubic feet, with 2s. for meter-rent; it was now half that sum, with no meter-rent. After the ceremony, there was a luncheon in the Elephant Hotel, at which the Contractors for the new holder (the Barrowfield Iron-Works, Limited) presented Provost Blair with a silver loving-cup, bearing an inscription.

On the 30th of October, Mr. Fleming, Treasurer to the Glasgow Gas Trust, reported to a meeting of the Sub-Committee on Finance, that at the close of the preceding month the revenue derived from the sale of residual products during the past four months of the financial year amounted to £27,120, as compared with £28,644 for the corresponding four months of last year. There was thus a decrease of £1524.

The failures of the Glasgow gas consumers to pay up their accounts after falling due must surely be on a very small scale, much to the credit of Mr. Treasurer Fleming and the collectors acting under him. As may be remembered, when the last annual balance-sheet for the Corporation gas undertaking was made up, it was found that at the 31st of May, the close of the financial year, the gas-rents then outstanding were set down at £69,718. This sum has now been more than recovered; for at the 9th of October, when Mr. Fleming made his last report on the subject, there had been paid into the gas treasury the sum of £71,906; so that there had thus been recovered over the estimate not less than £2188.

The hire and sale of gas-stoves, &c., by the Glasgow Corporation Gas Committee continues to make progress. At the end of the month of September of this year, there were in use 12,684 stoves and kitchen range-fittings from the stove-hiring department; and up to that date there had been sold no fewer than 18,250 stoves, range-fittings, gas-fires, burners, &c. It may here be worth while to mention a few statistical data regarding the stove account for the last financial year, as they may be of interest to many Corporation Gas Committees who carry on a similar business. The year began with a stock of stoves, &c., on hire and in store of the value of £22,951; and it ended with a stock which was valued at £26,125, from which there was deducted a sum of £1045 for depreciation. The disbursements during the year included the following sums: For stoves, &c., £2278; for wages and fittings, £1897; as expenses chargeable to repairs, &c., £2949—making a total of £7124. Then, the other side of the account, there were the receipts, including £909 for stoves, fittings, &c., sold; and £4085 in the shape of rents for stoves and range-fittings. The accounts when worked out gave a balance of £1045, which was set down as profit on the year's transactions.

A meeting of the inhabitants of Brechin was held on Monday night, on the subject of the alleged bad quality of gas which the Gas Company have been supplying for the past three months. It was a curious gathering. In the first place, it was a crowded meeting in the town hall; in the second place, it was presided over by Provost Vallentine; and, in the third place, the Provost assumed that the meeting had been got up to try to frighten the Gas Company, in view of the proposal that the town should take over their undertaking. That was very candid, and does not say much for the honour of the public men of the town. The first resolution was a protest against the bad quality of the gas, and a pledge to use every means in their power to have the evils complained of rectified, whatever that may mean. The speaker indulged in what looked very like chaff for a time; but ultimately settled down to state the old grievances about the Gas Company raising the nominal value of their capital from £5 to £10 per share, and paying dividends which were equal to 35 per cent. He also spoke of the canker of greed for large dividends eating into the souls of the Directors. In the second resolution, Dean of Guild Scott proposed that the consumers should not pay their gas accounts, except under a deduction of 33⅓ per cent. He said that some time ago he wrote to the Manager (Mr. J. B. Terrace) complaining about the bad quality of the gas. He received a reply stating that they had a large stock of third-class cannel on hand, for use along with oil gas; and it was possible that the men had been using that coal too freely. A third resolution called for the establishment of a gas-testing station in the town. All the resolutions were adopted unanimously. Two of the speakers were honest enough to say that Mr. Terrace was in no way to blame for the quality of the gas; but the Directors were, for not giving him good material to work with. One speaker said the gas was now greatly improved; and that that was the worst thing the Gas Company could have done, as it showed how easily they could give good gas if they wished to do so. In the same way, I should say that if this indignation meeting was really held with a view to frightening the Gas Company, it was about the worst thing which could have been done, as this showing of their hand will not help the Town Council should they ever come to negotiate with the Company.

There are several incidents at municipal election meetings which I had reserved to write about; but these Notes are already too long. I will only refer to one. At Kilsyth, on Monday night, the ratepayers held a meeting, at which the principal subjects discussed had reference to the Corporation gas administration. There were two complaints—one that the Gas Commissioners went on an excursion from Kilsyth to Aberdeen, at a cost of £14, which was paid out of the gas revenue, but was not entered in the accounts; and the other that during the time of the strike of miners last year, while the people of Kilsyth were being charged 20s. for coal, the Gas Commissioners, along with an order for coal for the gas-works, sent one for a waggon-load for themselves, which they got for 9s. or 10s. per ton, and did not share that coal with the community. I fancy the speciality of the grievance, in both cases, was that the Commissioners were getting something which outsiders did not get. There was some very hot discussion over the matters; and the expressions "not exactly thieves but very near it," and "liars," were used. The meeting seemed to be quite pleased with the action of the Commissioners in the coal incident. With regard to the Aberdeen excursion, it transpired that a ratepayer wrote to Mr. Alex Smith, the Engineer and Manager of the Aberdeen Corporation Gas-Works, asking if the Commissioners visited and inspected the gas-works there; and that Mr. Smith sent the letter to the Gas Manager at Kilsyth, and did not reply to it. Provost Hamilton defended the excursions of the Commissioners to various places, on the ground that they thereby saw what was being done in other gas-works. The excuse was not a particularly strong one; but it seemed to satisfy the general body of the ratepayers, and so long as the charges for these outings is not unreasonable, there can be no objection to them. I think everyone will approve of Mr. Smith's conduct. He could not have done better.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 2.

Sulphate of Ammonia.—The quieter tone last noticed has prevailed throughout the week; and in the absence of demand (covering of October contracts being completed), prices have further receded. No doubt considerable buying will be necessary to cover November contracts; but, so far, the buyers seem mainly occupied in depressing the market, with the view, of course, of making more favourable purchases later. The closing quotations are: £8 17s. 6d. f.o.b. Hull; £8 15s. f.o.b. Leith; and £9 f.o.b. Liverpool. Since the spot market has eased off, there is less disposition to buy ahead at prices that would recently have been paid, although, within the last few days, up to £9 10s. f.o.b. Hull, January/March, was obtainable.

Nitrate of Soda is unchanged. On spot, fine quality may be had at 7s. 9d. per cwt.; while refined cargoes for autumn shipment are worth fully 8s. per cwt.

LONDON, *Nov.* 2.

Tar Products.—The increased production has not so far seriously interfered with the value of pitch; but it is undoubtedly a little easier. The present demands of buyers are being supplied; and there is not the same urgency to purchase as existed some little time ago. A good business is being done in benzols; and the improved values continue—50's being dearer. Solvent naphtha is also moving off freely at former rates. Naphthalene salts keep steady, with a good deal of inquiry for forward delivery. A satisfactory business in anthracene is being done at prices quoted below. There is an excellent inquiry for next year's delivery. The tar bases are also receiving some attention; pyridine, notably, being now quoted at 4s. A moderate demand exists for carbolic acid; but no improvement in prices has yet been obtained. Prices realized during the week are as follows: Tar, 19s. to 23s. 6d. Pitch, 35s. west coast; 38s. east coast. Benzols, 90's, 1s. 3½d.; 50's, 1s. 3d. Solvent naphtha, 1s. 2½d. Toluol, 1s. 3½d. Crude, 30 per cent., naphtha, 5d. Naphthalene salts, 25s. to 40s., according to quality. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 6d.; 75's, 1s. 9½d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia.—This market has been very irregular during the week, business having been noted at one port at as low as £8 12s. 6d.; while at others the ruling price was at least £9. A fair amount of business is being done, and to-day's value may be taken at £8 15s. to £9, less 3½ per cent. at all ports. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—With the near close of the year, the wages question is attracting a good deal of interest in the coal trade here, as the time is now approaching when the men will, if they consider the state of trade and prices warrant it, be in a position under the Conciliation Board agreement to demand, not only a return of the 10 per cent. reduction which was put in force last year, but to ask for a 5 per cent. advance. The miners have, however, as yet taken no definite steps in this direction; and it seems scarcely probable that anything will be done in the matter until the annual conference of the Miners' Federation, which is to be held in Birmingham in the second week of the New Year, when no doubt the Lancashire Federation, as well as other

districts, will bring forward the wages question. The past summer, it may be added, has been an exceptionally trying period for the miners. Not only has it been one of the worst they have ever experienced as regards restricted employment, but there have been numerous disputes on wages questions and alleged breaches of the Conciliation Board agreement, which resulted at one time in nearly a couple of thousand men being out on strike in various parts of Lancashire. Fortunately these have mostly been settled, or are dying out; and there are now only 300 men on the strike-list of the Lancashire and Cheshire Miners' Federation. Although the men are hoping that trade will sufficiently improve before the end of the year to justify them in asking for better wages, the present position scarcely encourages such a prospect. During the past week or so, it is true, there has been a considerable briskening up in the demand, especially for domestic consumption, with most of the house-coal pits now on practically full time; but prices show no actual general quoted advance. In south-west Lancashire, some of the collieries are making advances of 6d. per ton upon medium qualities; but these are chiefly where under the full market rates was previously being quoted, and the heavy stocks that are held, with short time still very prevalent, stand in the way of any general upward move at present. At the pit mouth, best Wigan Arley remains at about 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; and common house coal, 7s. to 7s. 6d. per ton. Common round coals meet with a rather more active, but still only moderate demand, for general manufacturing purposes, and, with supplies plentiful, continue a drug upon the market. Extremely low sales are made to clear off quantities; the average pit prices being 6s. to 6s. 6d. per ton. With the increased business doing in house coals, there are necessarily larger supplies of engine fuel offering on the market; but these meet with a fair sale. Although surplus supplies are here and there offered at a trifle below full rates, generally prices are steady at about 3s. and 3s. 6d. per ton for common sorts, to 4s. 6d. and 5s. for best qualities of slack, at the pit mouth. Only the most limited business is reported for shipment, and prices continue excessively low; ordinary steam coal being readily obtainable at 7s. to 7s. 3d. per ton, and best qualities from 7s. 6d. to 7s. 9d., delivered at the Garston Docks, or the High Level, Liverpool.

Northern Coal Trade.—There has been increased depression felt in the coal trade of the North during the past week, as far as steam and bunker coals are concerned. The shipments to the Baltic are now low to what they were; and this affects the steam coal collieries greatly—some, indeed, having only worked about half-time during the last week or two. Naturally, this has had an effect on prices, though nominally the alteration has not been great; but there has been more bargaining for cargoes and concessions made by those of the coalowners who wished to secure fuller work at the pits. Best Northumbrian steam coals are steadier at 8s. 3d. per ton f.o.b., because the slight reduction in the price has brought forward some buyers. Second-class steam are lower in sympathy; and steam smalls are rather scarce, and firm at 4s. per ton. Gas coals are now in large demand, both on account of the consumption being increased, and also in order to allow some of the great gas companies to enlarge their stocks for the still heavier demand that arises later in the year. The price that is generally quoted for best Durham gas coals varies from 6s. 6d. to 7s. 3d. per ton f.o.b.; but the latter is simply quoted where collieries have only a limited amount of coal that is not contracted for, and thus they can command better prices for that little. Manufacturing coals are being now sold freely for next year; and while in a few instances a slight advance is obtained on current year's prices, generally the contracts are just renewals in regard to price. Coke is in larger production, but is very firm; and with an enlarged consumption both in the Furness district and locally, and with shipments that are fully an average, the price is maintained at from 14s. 6d. to 15s. per ton f.o.b. for the best Durham kind. Gas coke is steady; and though the production is now large, the local companies are able to keep down the stocks through the continuance of heavy shipments for the Continent especially. There is no alteration in price this week.

Scotch Coal Trade.—No change falls to be reported. The cold weather has had the effect of increasing the domestic consumption; and coalowners issued their usual notice at this season of an advance of prices by from 6d. to 1s. per ton. There is, however, a prospect of a lock-out in the shipbuilding trades on the Clyde, which would throw large quantities of coal on the market; and the notices have been withdrawn till that dispute is settled. For commercial purposes, there is a fairly large demand—or rather consumption, for much of it is under contract, and prices do not rise. The demand by foreign purchasers is improving slightly; but there again there is no movement in prices. The quotations are: Main, 5s. 9d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 180,761 tons—an increase on the preceding week of 31,986 tons, and as compared with the corresponding week of last year of 73,999 tons. For the year to date, the total shipments have amounted to 6,108,888 tons—an increase over the corresponding period of last year of 2,043,577 tons, but a decrease as compared with the same period in 1893 of 403,965 tons.

The Little Don Water Schemes.—The Rotherham Town Council sat in Committee a short time ago, to consider the question of the water supply of the borough, and what steps should be taken in view of the Water Bills likely to be promoted in the forthcoming session of Parliament. It is understood that a decision was arrived at whereby the Corporations of Sheffield, Rotherham, and Doncaster enter into a mutual arrangement to oppose the Bills of the Barnsley Corporation and the Dewsbury and Heckmondwike authorities; and, further, to promote a Bill in Parliament for the acquisition of the sources of supply in the watersheds of the Little Don and Porter for the future use of the inhabitants of the large centres of population mentioned as parties to the agreement. The arrangement entered into includes terms that each borough should pay in proportion to the water consumed. The Sheffield Corporation have also undertaken, until the powers are obtained and the necessary works completed, to supply Rotherham with any water required from their present reservoirs; the price to be charged being about 5d. per 1000 gallons.

Reduction in the Public Lighting Charge at Wrexham.—The Wrexham Gas Company have informed the Town Council that they have decided to reduce the price of gas consumed in the public lamps by allowing a further discount of 3d. per 1000 cubic feet.

Extension of the Abingdon Water-Works.—At a meeting of the Abingdon Town Council last Tuesday, the question of extending the water-works was discussed. Mr. C. Hawksley reported that he had made an inspection of the works at Wootton, and approved of the construction of two additional adits in connection with the reservoir, so as to facilitate the collection of water from the surrounding spongy rock and also add to the storage capacity. It was resolved to carry out the work.

Water-Works Extensions at Tamworth.—Last Thursday, Major Tulloch, one of the Local Government Board Inspectors, held an inquiry at the Town Hall respecting a joint application for sanction to borrow £1200 for works of water supply; £760 being repayable by the Rural District Council, and £440 by the Town Council. Mr. Shaw, the Clerk to the Joint Water Committee, explained the constitution of that body, and said that, owing to the large number of houses which had been recently erected within the water area, it was necessary that the mains and services should be greatly extended. Some of the work had already been carried out. The application was not opposed.

The Godalming Water-Works Purchase Question.—The proposal of the Corporation of Godalming to purchase the works of the Frith Hill, Godalming, and Farncombe Water Company has been met on most sides by a strong feeling of opposition. This being so, the Directors of the Company have thought well to advise the shareholders to refuse to confirm the resolution they previously passed agreeing to the transfer. The present is regarded as an unfortunate time to bring forward the scheme, as the rates are high, owing chiefly to the action of the Local Government Board in regard to the main drainage; and ratepayers, looking naturally at the question from that point of view, are somewhat reluctant to agree to a scheme which, they consider, is likely to add to their already heavy burdens.

The Suggested Purchase of Falmouth Gas-Works by the Corporation.—The proposal of the Falmouth Corporation that they should purchase the gas-works has been carried a step farther. In answer to an inquiry made at the instance of the Corporation, the Company have written that they have no desire to sell their works, but they will afford every facility for an inspection of the plant by an expert representing the Corporation. This reply was laid before a meeting of the Town Council on Thursday last, with a recommendation by the Gas and Water Committee that Mr. Silverthorne be appointed to go over the works. Some discussion ensued; and it was eventually decided that the matter should be referred to another meeting of the Council, at which there would be a larger attendance than on Thursday.

Extensions at the Workington Gas-Works.—Last Thursday Colonel A. G. Durnford, one of the Local Government Board Inspectors, held an inquiry at Workington, into an application by the Corporation for sanction to borrow £2100 for the purposes of erecting new regenerative retorts and sulphate of ammonia house and plant at the gas-works. The Town Clerk gave the usual facts concerning the rateable value of the town, and the expenditure connected with the gas-works. He mentioned that the total number of consumers was 1899; and the price charged for gas 2s. 6d. per 1000 cubic feet. There were 487 lamps, which were charged to the rates at £2 per lamp. The amount of coal carbonized last year was 6090 tons; and the quantity of gas manufactured was 56 million cubic feet. The profits for the last three years, after making provision for interest and sinking fund, were: 1893, £1286; 1894, £1231; 1895, £1106. They asked that the loan might be extended over a term of twenty years. Mr. Johnston produced plans of the proposed extensions, and explained that some of the old plant was condemned. The retort-settings were on the old system of firing, and were not economical. The application was unopposed.

The Proposed Purchase of the Fylde Water-Works by Local Authorities.—The terms for the purchase of the Fylde Water-Works by the Local Authorities have been agreed to by the Joint Committee, and will shortly be laid before the respective Councils concerned. If a decision is arrived at to purchase, the Joint Committee will approach the Directors of the Company, with the view of avoiding parliamentary proceedings and attendant costs. The authorities concerned in the proposed purchase include the Blackpool Town Council, the Urban Councils of Fleetwood, Lytham, St. Anne's, and Kirkham and the Rural Councils of the Fylde and Garstang. The present capital of the Company is £360,319, divided as follows: "A" stock, £60,000; "B" stock, £158,976; preference stock (1891), £63,000; and debentures, £9251. The loans amount to £60,219; and the balance to £8868. The last report gives the cost of the works up to February at £359,388. The receipts for the last half year amounted to £17,526; and interest, working expenses, &c., totalled to £4614; leaving a profit of £12,912. For some years, the dividends have been 10 per cent. on the "A" stock, 7 per cent. on the "B" stock, and 4 per cent. on the preference stock.

The Bolton Corporation Gas-Works.—Addressing a meeting of the Bolton ratepayers last week, Alderman Miles, J.P., the Chairman of the Gas Committee of the Corporation, gave some interesting particulars as to the department of which he has charge. He pointed out that the works were acquired from the Gas Company in 1872. At the end of the first year's working by the Corporation, they had produced 359 million cubic feet of gas; and the capital expended was £379,556. Last year, after upwards of twenty years' working, they made 777 million cubic feet; and the capital only stood at £523,959. In the first year that the Corporation worked the undertaking, the capital per million cubic feet of gas produced was £1056; and this had been so reduced that in 1894 it stood at £674 per million. The capital had been reduced by more than £70,000; and, in addition, money borrowed for the acquisition of the works to the extent of £34,794 had been paid off. Last year the Gas Department was in a position to hand over £23,000 in relief of the rates; and this being so, a reduction of 2d. in the price of gas was made—bringing it down to 2s. 6d. net. A reduction of 2d. meant a loss to the department of £8000 a year, £1500 of which went to consumers outside the borough. The use of gas-stoves had greatly increased of late. The total number hired out was 1736 cookers, 1705 gas-fires, and 1912 grillers.

The Water Supply of Portway (Staffs.).—At a recent meeting of the Rowley Regis District Council, the Sanitary Committee reported that they had had under consideration the inadequate water supply at Portway and The Throne, and had requested the South Staffordshire Water-Works Company to lay their mains in these districts. The Company, however, declined to take their mains to Portway, saying that the revenue would not remunerate them for the outlay. The Committee considered that it was a grievous matter that parts of the Council's district were without the Company's water; the whole of the Council's district being within the area of the Company. The Committee recommended the Council to inform the Company of this expression of opinion.

Additional Storage and Pumping Plant for the South Staffordshire Water Company.—The South Staffordshire Water Company, who have an unusually large area of supply, are about to construct a service reservoir in accordance with plans prepared by their Engineer (Mr. H. Ashton Hill, Assoc.M.Inst.C.E.). It will be 300 ft. by 140 ft., and 18 feet deep; and it will contain 4¼ million gallons. It is situate in the parish of Shenstone, about 1¼ miles from the Brownhills Station of the London and North-Western Railway. The contract has been let to Mr. Lovatt, of Wolverhampton, who will commence the work forthwith. The Company are also having a duplicate engine for their Fradley pumping-station, near Burton. It is being made by Messrs. Hathorn, Davey, and Co., of Leeds.

Durham Water Supplies.—A Local Government Board inquiry was held last Wednesday, concerning an application by the Rural District Council for permission to borrow £2000 for works of water supply for West Auckland, Evenwood, and Barony. It is proposed that the water shall be taken from the Weardale and Shildon Water Company, whose Engineer (Mr. R. Askwith) said the length of mains required would be about 5¼ miles; and a reservoir would be erected to contain three days' supply. The total cost would be upwards of £4000; but the Company accepted £2000 in view of taking over a fresh source of revenue, and also in recognition of a moral obligation to serve the district. The Inspector subsequently visited the Company's pumping-station, and the district to be served from it.

Arbitration in Connection with the Nidd Water Scheme.—In the JOURNAL for Sept. 3, it was mentioned that arbitration proceedings had been instituted in regard to a claim made upon the Corporation of Bradford by Mr. T. E. Yorke, in respect of an easement, seven or eight miles long and six yards wide, for the new pipe-line from the Nidd Valley reservoir through his estates. The claim is for a sum of about £45,000. The Umpire is Mr. C. Oakley; and the investigation was opened on the 15th ult. at the Surveyors' Institution, Great George Street. Mr. Balfour Browne, Q.C., and Mr. Waugh appeared for Mr. Yorke; Mr. Cripps, Q.C., M.P., represented the Corporation. The inquiry occupied the attention of the Umpire till the 19th ult., when the proceedings were adjourned till the 12th inst., on which day Counsel will sum up the case for their respective clients.

New Water-Works for Rhyl.—At an adjourned meeting of the Rhyl District Council on the 19th ult., the question of the proposed new main and water-tower for Rhyl was discussed on reports presented by Mr. F. Storr, the Engineer, and Mr. L. G. Hall, the Council's Water Engineer. After some discussion, it was proposed that the Council accept Mr. Storr's estimate, and calculate the maximum requirements of Rhyl at 650,000 gallons a day. This was agreed to; and it was then resolved that an 8-inch main be provided. With regard to the main from Pen-y-Cefndy to the centre of Rhyl, it was decided that it should be a 14-inch one. Some discussion took place as to the proposed water-tower; and it being decided that the work be proceeded with at once, the Clerk was instructed to apply to the Local Government Board for power to borrow the required sum—£8254.

The Ghastly Discovery at Beckton.—With reference to the paragraph on the above subject given in last week's JOURNAL on the authority of the Central News, we learn that the facts are as follows: The remains were discovered by some coal trimmers lying on the top of the coals in one of the retort-houses. They were by the wall, and immediately under the platform of the coal railway which runs through the house. The house had been out of action since May last, and was started again early in October. It is assumed that the man, taking advantage of the house being idle, had climbed up the end face of the coal, and laid himself down to sleep in this quiet, out-of-the-way spot, and was, during sleep, overtaken with some fatal illness, and died there. It appears that the man was not under the coals at all; and he was evidently, from the condition of his boots, a tramp, who had made his way into the works in the hope of getting employment.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 917.)

Issue.	Share	When ex-Dividend.	Dividend or Int. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	24–25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	10	16–17	..	4 8 3
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	..	4 11 9
200,000	5	1 May	6½	Bombay, Limited	5	7¼–7¾	..	4 3 10
40,000	5	,,	6½	Do. New	4	5¼–5¾	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253–258	..	4 13 0
180,000	,,	,,	9	Do. New	100	207–212	..	4 4 11
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227–232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125–130	..	3 16 11
320,000	20	27 Sept.	11¼	British	20	54–55	..	4 1 10
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½–23½	..	4 17 10
51,510	10	,,	8½	Do. 7 p. c.	10	18–19	..	4 9 5
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	8½–9	..	4 8 11
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102–104	..	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	31–33	..	5 0 0
550,000	Stck.	26 Oct.	13½	Commercial, Old Stock	100	313–318	..	4 4 11
165,000	,,	,,	10½	Do. New do.	100	237–242	+5	4 6 9
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143–147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	280–285	+2	4 11 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215–220	..	4 11 10
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125–130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25½–26½	..	4 3 0
354,060	10	,,	11	Do. Partly paid	7½	17–18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100*	292–296	−1	4 6 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107–112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c.Pf.	100	282–287	..	3 9 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135–140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200–205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193–198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282–287	..	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167–170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135–140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145–150	..	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	202–207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	245–250	..	4 16 0
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6–6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113–116	..	4 6 2
541,920	20	12 June	5	Monte Video, Limited	20	18–19	..	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	7¼–7¾	..	5 3 2
60,000	5	12 Sept.	7	Ottoman, Limited	5	5–5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½–2½	..	8 0 0
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	105–110*	+½	5 9 1
500,000	100	4 June	6	2nd Do.	100	102–107	..	5 12 1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11–12	..	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370–375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	308–313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325–330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175–178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230–235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	294–299	+1	3 6 10
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	223–228	..	3 1 5
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157–162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118–122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	307–312	..	3 16 11
1,043,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	251–256	−7	2 18 10
406,200	100	,,	7½	Do. 7½ p. c. max.	100	208–213	..	3 10 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143–148	..	2 13 4
500,000	100	14 Aug.	12½	New River, New Shares	100	385–395	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143–148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	147–152	..	2 12 7
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140–145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	293–298	..	3 7 1

*Ex div

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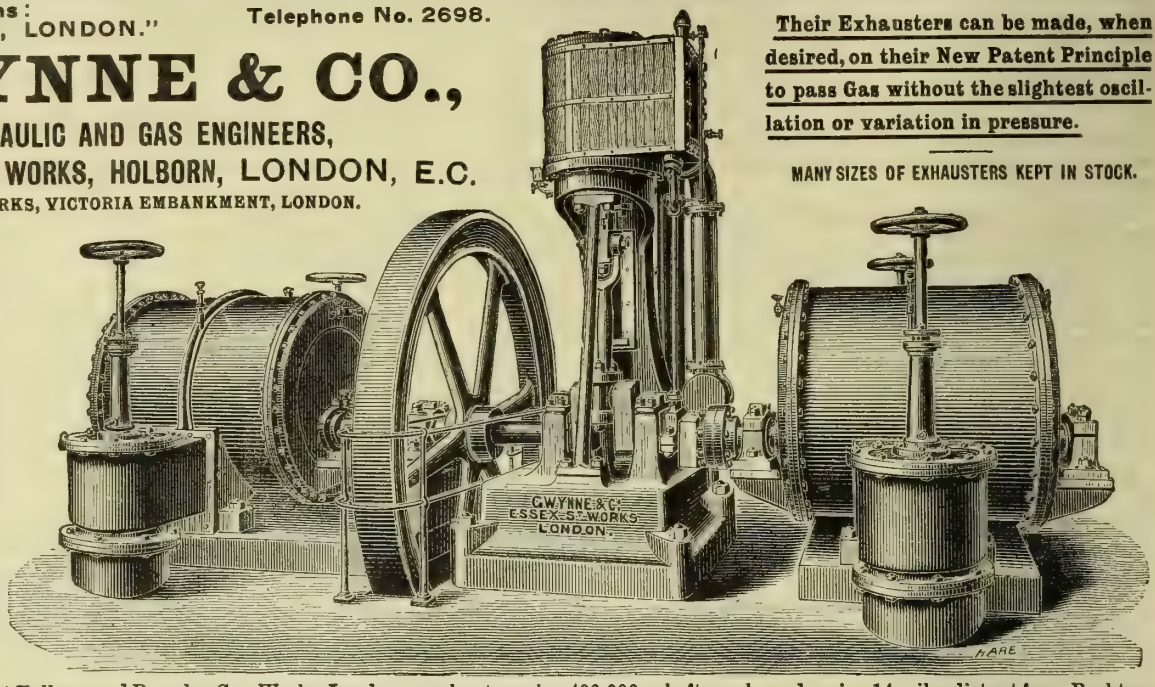

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TO CORRESPONDENTS.

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Telegraphic Address: "GASKING LONDON."
Telephone Number, 65,121.

EDITORIAL NOTES.

The Belfast and Clyde Strike and Lock-Out.

It is not surprising that the dispute in the shipbuilding and engineering trades of Belfast and the Clyde should attract general attention. It is not very wonderful that some of Messrs. Harland and Wolff's workpeople should entertain an opinion as to the rate of wages they ought to be paid which is not shared by their employers, nor even that they should accentuate their ideas by a strike. What is noteworthy and in the highest degree interesting is the development that has sprung from this apparently insignificant and ordinary occurrence. The employers quickly proceeded to exhibit to the world proof that they attached enormous importance to this outbreak; and a combination of the shipbuilding and engineering interests of Belfast and the Clyde forthwith disclosed itself to the astonished gaze of the rest of the country. The Clyde employers declared their "solidarity" with the Belfast firm by dismissing one-tenth of their working engineers; and the men's Society promptly retaliated by withdrawing the remainder. There has been nothing like the situation thus created in the whole history of industrial disputes. We frankly confess that we cannot understand it. Several newspapers have published condemnations of the action of the associated employers; and, of course, certain public men who are nothing if not "popular" have denounced them as guilty of a "penal act of terroism!" If this is so, it is nothing more than trade unionists have done over and over again. But we admit that this is no answer to the charge. Two blacks do not make a white. We cannot blame any employers for meeting combination among their workmen by combining themselves. But, on the face of it, a lock-out "for sympathy" is neither more nor less legitimate, as an operation in industrial warfare, than a strike "for sympathy." We should like to hear what the Clyde employers have to say for themselves; for it is absurd to suppose that they have no better case than that of the hare-brained socialistic agitators who have before now organized strikes "for sympathy," always with disastrous results. Mr. Frederic Harrison discusses the subject in an article in Saturday's *Daily Chronicle*, which certainly arraigns the Clyde employers in strong, but not objectionable terms. He refers in the course of it to the case of the gas stokers, who, he says, in 1872 "were "sentenced to one year's imprisonment for attempting to "'coerce' their employers by organizing a general strike. "This ferocious sentence," he goes on to state, "was "inflicted on the ground of the injury to the public which "the strike might inflict;" and he implies that the Clyde shipbuilders are acting a worse part than these misguided victims of the outraged majesty of the law.

We have discussed, in an article which appears on another page, the analogy, such as it is, between the case of the shipbuilding trade of Belfast and the Clyde and the gas industry. There is a degree of analogy, it appears to us, between the work of an arsenal, albeit a private one, and that of a gas-works; but we have attempted to show that it would not be to the advantage of trade unionists to stretch it very far. Gas making must be carried on, if possible, without intermission; and it is part of the duty of those who are responsible for the maintenance of this continuity to avoid as completely as they can all risks of breaking it. One such risk is recognition of the principle of Trade Unionism. The strike is the indispensable weapon of the Trade Union. To take away this weapon is to render a Union impotent; and then it may as well cease to exist. So long, however, as the Union remains in possession of its weapon, so long must the employers be left in possession of their only valid means of defence against it, which is the power of locking out. There is no possible way out of this position. Strike and lock-out are inseparable; and, indeed, where one is, the other is also. Of many of the greatest labour disputes, it would be difficult to say to which category they properly belong; for what one side calls a strike, the other regards as a lock-out. What, then, would those philanthropists do who are clamouring for Government or somebody to put an end to the Belfast and Clyde performances, in the interest of the nation? Shall an Act of Parliament be passed next session rendering it felony to either strike or lock-out when the building of a warship is in hand? This would be a logical, but hardly a sensible, proceeding. Let

us hope that the speedy termination of the dispute by agreement of the parties concerned may remove the difficulty in the only natural way.

The Curious Case of the Hertford Gas Company.

THE very remarkable case heard at the Hertford County Sessions, and fully reported in last week's JOURNAL—when the unfortunate Hertford Gas Company, whose recent deplorable experiences are known to our readers, were prosecuted and fined for two technical offences under the Gas-Works Clauses Act, 1871—is well worthy of passing comment. The case itself is interesting; but there is even more general interest attaching to the light which it sheds upon the inter-dependence of the General Acts of 1847 and 1871 and of the Company's Special Act. The Company were prosecuted, at the instance of the ex-Mayor of the town, in circumstances which, to say the least, did not favour the defence. Early in the year, the Company's books were mysteriously lost; so that it became impossible to deliver to the Local Authority, as required by law, a copy of the accounts for the previous year. The complainant pounced upon this omission, and also upon the inability of the Company to sell him copies of their accounts for previous years made up to Dec. 31. The facts were not denied; and in the event the Bench—who appear to have thoroughly understood the business before them—fined the Company two sums of 1s., with 9s. costs, for each summons. With regard to the omission to file accounts for last year, there is nothing to be said. As to the other complaint, it raised the old question of how far a Company with a Special Act incorporating the Act of 1847 are bound by the Act of 1871. The Hertford Company's Act is dated 1864; and it does not contain any provision relating specially to statements of accounts. This being so, the Company were unquestionably bound to follow the directions in this regard of the Act of 1871. As a matter of fact, they did not do so, but continued to make up their annual statements of accounts as they had been accustomed to prepare them under the Act of 1847—taking the year ending on June 30, and forwarding copies to the Clerk of the Peace. The Company's representative at the magisterial hearing could not deny that, after the decision in *The Dudley Gas Company v. Warmington*, his clients were in error; and so he confined his efforts to appealing for a merciful sentence, in which he was successful.

A correspondent has written to draw attention to the judgment in the case of the *Leamington Priors Gas Company v. Davis*, which appears to conflict with that in the Dudley case, inasmuch as the Court held that the Act of 1871 did not apply to this Company, who had also a Special Act incorporating the Act of 1847. If our correspondent—whose inquiry is welcomed as affording an occasion for clearing up what looks like an ambiguity of ruling—will turn to "Michael and Will," fourth edition, pp. 62, 63, he will find a note which deals with this very point. The Leamington variation on the Dudley rule was due to the fact of the Company having a special provision relating to accounts in their own Private Act, which the Dudley Company had not. Hence, they only came under the provisions of the 1847 Act where these were not inconsistent with those of their Special Act. Consequently, the provisions as to accounts contained in the 1871 Act did not touch them. This point is quite clear. Where a Special Act does not mention accounts, it is to be construed as accepting the provisions in this regard of the Act of 1847, and therefore of the Amending Act of 1871. Where special provisions as to accounts are contained in a Private Act which otherwise incorporates the 1847 Act, the former will prevail. "Michael and Will" also remarks (p. 52) that "a *general* Act of Parliament does not "repeal a previous *particular* Act, unless there are express "words, or unless the two Acts are necessarily incon-"sistent. . . . Where a General Act of Parliament is "incorporated with a Special Act, if there is any contra-"diction between them, the Special Act is to prevail." These references fully meet and overcome the difficulty raised by our correspondent. It is quite certain that, in default of special statutory provisions, the requirements of the Act of 1871 with regard to gas companies' accounts must be fulfilled.

The Imperial Continental Gas Association and Sir Julian Goldsmid.

THE half-yearly ordinary general meeting of the Imperial Continental Gas Association, held on Tuesday last, was memorable as the occasion of the distinguished Chairman—the Right Hon. Sir Julian Goldsmid, Bart.—taking formal farewell of the proprietors of the great undertaking over which he has presided for 21 years in this capacity, and 27½ years as a Director. It would be impossible to adequately express here what the Association and the communities served by it owe to Sir Julian Goldsmid's eminent services. As he told the proprietors, the late Chairman was very much more than the mere figure-head of this important corporation. From the day of his election to the chair, he has taken his position very seriously—working for the Association as he has never worked for anything else. This is a good deal for such a personage as Sir Julian Goldsmid to say; but the words are no idle vaunt, for it is not too much to declare that during the whole period of his tenure of office, the Chairman has been the guiding spirit of the Association. The duties and the responsibilities of the position must be onerous and delicate in a very exceptional degree. To occupy it only without giving offence to the susceptibilities of the authorities and organizations with whom the daily business of the Association has to be carried on—to preserve the prestige and prosperity of an essentially British trading corporation drawing its revenue from the denizens and rulers of cities and towns of every grade of political and commercial importance, scattered over many lands where jealousy of foreign enterprise is endemic—is a charge which the ablest administrator and diplomatist might well find heavy enough to bear. To have done this, and more—to have the satisfaction of seeing both prestige and prosperity grow under one's handling; to have increased the number of friends at home and abroad; to feel that, in relinquishing such a charge, one is leaving the multifarious interests composing it in better condition than they were when it was taken up, and that those upon whom the important charge will devolve inherit with it the stimulus of a great example and the guidance of a worthy tradition—this is the reward that Sir Julian Goldsmid takes with him into his well-earned retirement, which we sincerely hope, notwithstanding its cause, he will live long to enjoy. So far as the record of the last half-year's working of the Association reflects the condition of European trade and the fortunes of the gas industry during this period, the report read at the meeting is eminently reassuring and satisfactory; and the same may be said of the circumstances of the undertaking itself. An increase of 3·6 per cent. in the output of gas, and of exactly the same proportion upon the number of lights connected, constitute the best evidence of the vitality of gas lighting all over the European Continent. The Association now pay 12 per cent. upon a capital of £3,800,000; and the fortunate proprietors of this stock have the comfort of knowing that it is as likely to go on paying well in the future as it has been at any time in the history of the Association.

Who is Responsible for the Proper Care of Highways?

JUDGMENT was given last Saturday in the Lord Chief Justice's Court, in the important appeal case preferred by the South Metropolitan Gas Company against the decision of the County Court Judge for Lambeth, casting them in damages in respect of injuries caused by the Southwark Bridge explosion in February last. The details of the matter were published in the JOURNAL at the time. The County Court Judge found that the Company had been guilty of negligence; and he gave the plaintiff £12 as damages for the injuries he had sustained from the explosion. The question raised on appeal was whether there had been any negligence on the defendants' part; and this, in view of the circumstances, was a highly important point requiring to be settled by the Superior Court. Sir Edward Clarke appeared for the appellants, and urged that the Company had no liability unless there was distinct proof of negligence. It was admitted that the ground underneath the fractured main from which the gas that exploded escaped had been disturbed, but not by the Gas Company, whose negligence, if any, must consist in their remaining ignorant of the circumstance, and consequently omitting to take the necessary measures to render their main safe. In his judgment, the Lord Chief Justice laid stress upon this aspect of the matter; remarking that it seemed a serious omission in the statutory enactments that there was no compulsory provision to compel any public body, when taking up the highway, to give notice to all the other bodies who had pipes or mains there. Yet he went on to observe that it was not really

imposing a very onerous duty on the Gas Company that they should be vigilant in seeing that, when any other body had reason to excavate near their pipes, these were left in a safe condition. In this particular instance, it was held that reasonable care and diligence on the part of the Company's servants would have led to the discovery of the injury to the main. It certainly does seem, as the Lord Chief Justice admitted, anomalous that a highway authority should be free to do what they like, without notice, to a roadway containing pipes for the safe condition of which other people are responsible. The position here is decidedly one-sided. Section 8 of the Gas-Works Clauses Act, 1847, and the subsequent sections, are very stringent upon the matter of the breaking up of roads by gas companies; and it is hard to see why the highway authorities themselves should have a perfectly free hand for executing works liable to imperil gas-mains, and even be absolved from the consequences of actual carelessness in the carrying out of such works. It is to be hoped that the South Metropolitan Company will not rest satisfied until the highest legal authority has had the opportunity of pronouncing upon the actual state of the law in this regard. If the result should prove unsatisfactory, there will be clear ground for invoking the aid of the Legislature for putting the responsibility for conserving the interest of public security upon the right shoulders, which are, surely, those of the parties to any improper treatment of the highway. The real question at issue is more than a mere matter of gas-pipes.

Gas Residuals and "Rings."

A curious piece of intelligence comes from Manchester, to the effect that the Corporation Gas Committee have determined upon setting up products works, to counteract the machinations of an alleged "ring" of local manufacturers. If the statement in this regard attributed to Mr. Alderman Gibson, the Chairman of the Committee, is to be credited, the manufacturers of sulphate to whom the Manchester ammoniacal liquor has usually gone, have so far forgotten the traditions of the local school of Free Trade as to organize a "knock-out" against this product. They must have been singularly artless in carrying out their designs, if, as alleged, the whole scheme was betrayed through the appearance of only one tender for the last Manchester liquor contract. For surely, a very infantile degree of craftiness would have suggested the sending in of two or three nicely graduated tenders, if only to save appearances. It is not for us to say whether there is or is not such a "ring" of sulphate manufacturers in the Manchester district as Alderman Gibson's fancy has pictured. There have been such things before; and the "same old game" will often be played again, even in the home and nursery of Free Trade. We would venture to remind Alderman Gibson and the Manchester Corporation Gas Committee, however, that if they fondly think to escape all troubles of this character by the simple expedient of working up their own residuals, they will be rudely awakened, in the fulness of time, to a very different reality. Converting the residuals of gas manufacture is only half the battle; and by far the easier half to carry through satisfactorily. There remains the selling of them, which is a mighty delicate and risky business, as at present conducted. Will the Manchester Gas Committee succeed in a commercial operation in which so many gas-works administrators have so far conspicuously failed? Perhaps they may, if they do not try to be too clever, and set themselves to manipulate the market. If they will sell all their products by auction, in concert with the actual consumers of the commodities, they will possibly keep clear of the "rings" which are frightening them into an untried course of action. But unless they are well guided in this regard, they will early learn that it is as easy to "knock out" sulphate as the raw material.

A Banker on the Glut of Gold.

At the first meeting for the present session of the Institute of Bankers, the Hon. H. Dudley Rider, the President, delivered an Inaugural Address which, although in the main technical, contained some observations of interest to people other than bankers who have to do with the investment or employment of capital. He remarked that there is no more significant financial feature of these times than the accumulation of gold in banking centres, and particularly in the Bank of England. The total holding of gold of the banking head-quarters of England, France, Germany, and the United States on Sept. 30, 1885, amounted to £120,620,000; whereas on the same date of the present year the store had increased to £185,936,000—the increase for the ten years being thus no less than £65,316,000. These figures, the speaker admitted, are very remarkable; and he offered several explanations to account for them. The first was the increased production of gold. It was suggested that the reserve of gold to be kept by the Bank of England should be maintained at a higher figure than the level which Mr. Walter Bagehot, writing in 1873, called the "apprehension minimum"—say, at not less than 15 millions sterling. Another consideration arising from the plethora of gold is that its further increase, which is not unlikely, may bring about the prevalence of an "entirely "new set of economic conditions. Might they not be "justified in asking," said the President, "whether it was "not possible that capital would gradually become still "less loanable? Would interest continue to fall, and, "correspondingly, would they see Consols at 125, and the "price of all gilt-edged securities rising in like proportion?" This question touches directly upon the future value of gas stocks, and also upon the redemption of municipal loans. Evidently, the more capital that can be kept out in safe and reasonably profitable employment, the better. Municipal gas undertakings ought to keep out of the way of saving, by selling gas as cheaply as they can. This is no far-fetched comment upon Mr. Dudley Rider's observations; for the financial circumstances of such public bodies as the London County Council establish the connection. This particular local authority partakes with others the liability to repay its capital borrowings. But it has the greatest difficulty in finding a proper use for the money which it raises out of the ratepayers for this purpose. Hence it has been asserted by one of its own members that the County Council are only too glad when the parochial and other Metropolitan authorities which it finances want to borrow money from it for electric lighting or other purposes, because these are outlets for the unmanageable accumulations of its treasury. It has been pointed out that this state of things is not without danger, and that, in point of fact, the financial operations of the different Metropolitan authorities are fast getting to resemble the uneconomical procedure that has been described as "feeding a dog with his own tail." It is a curious reflection that at one and the same time the members of a self-governing community should be groaning under the burden of the rates, and yet be perplexed as to what to do with their accumulated savings. Paradoxical as the situation may appear, however, when presented in this light, the essential features of it, as indicated rather than described by the President of the Bankers' Institute, are too real to be altogether pleasant. We should like to hear from other financial experts on the same subject; for, though the theory is intelligible enough, it is not so easy to form a trustworthy opinion about the practical issues.

Personal.—Mr. Frank Wright informs us, with reference to the purchase of his penny-in-the-slot meter by Frank Wright's Prepayment Gas-Meter Corporation, Limited, that the photometrical, experimental, and consulting business of Messrs. Alexander Wright and Co. still remains his property, and will be carried on by him as formerly.——Mr. W. A. Laker has been appointed a Director of the Redhill Gas Company, in succession to the late Mr. W. Stenning, J.P.——M. Berthelot, the eminent chemist, has been appointed Minister of Foreign Affairs in the new French Cabinet. He was Minister of Education in the Cabinet of 1886-7.——Among the distinguished scientists who have been recommended by the President and Council of the Royal Society for election into the Council for the ensuing year are Mr. W. Crookes, F.C.S., Lord Kelvin, Professor A. B. W. Kennedy, and Professor A. W. Rücker, M.A. Professor Crookes has been for some years one of the Analysts who report monthly on the quality of the Metropolitan Water Supply on behalf of the Water Companies, and Professor Rücker is one of the Metropolitan Gas Referees.——The honorary degree of LL.D. was conferred upon Mr. Lawrence W. Adamson, J.P., the Chairman of Messrs. John Abbot and Co., Limited, of Gateshead, and a Director of the Newcastle and Gateshead Gas and Water Companies, on the occasion of the recent celebrations in connection with the Aberdeen University.——Mr. J. Tweedale, the Chairman of the Gas Committee of the Leeds Corporation, has resigned the position, and retired from the Council.——Mr. E. Wigglesworth, Engineer and Manager of the Perth (Western Australia) Gas Company, is now in England on leave of absence.——Mr. F. Hyland has been appointed Chairman of the Ashford Gas Company, in place of the late Mr. J. U. Bugler; and Mr. R. Parkes has been selected to fill the vacant directorship.

WATER AND SANITARY AFFAIRS.

A YEAR ago, sanguine in their expectation that the Transfer Bills by which possession of the property of the Water Companies was to be secured would receive the sanction of Parliament, the County Council abstained from carrying out their resolution of the previous July in favour of obtaining legislation to raise the limit of height to which the East London Water Company are required to give a supply. The Council desired a height of 70 feet from the level of the nearest pavement, in place of the present limit, which, according to the East London Water-Works Act of 1853, is 20 feet above the level of the pavement for "ordinary service"—any supply going higher than this being designated a "high service." Although the members of the Parliamentary Committee of the Council are understood to include a majority of Moderates, the Committee presented a report at the last meeting of the Council, stating that, while they considered it was "inexpedient" to proceed with a Bill for raising the height of the East London supply simultaneously with a Bill for buying up the undertaking, they had now "fully considered the "matter," and had decided on the form of a Bill dealing with the East London Company to be brought forward in the coming session. The original scheme is so far modified that the present proposal is to place the Company under the provisions of section 35 of the Water-Works Clauses Act of 1847. This section, instead of specifying a certain number of feet, requires that a supply of water shall be constantly laid on at such a pressure as will make the water reach to the top storey of the highest houses within the limits of supply. Such at least is the reading that is given to the section by the Parliamentary Committee. But they have failed to add certain important words which immediately follow this requirement, whereby a condition is introduced which says, "unless it be "provided by the Special Act that the water to be "supplied by the undertakers need not be constantly laid "on under pressure." Moreover, it is expressly stated that the supply in question shall be for "domestic use." That which calls for special notice in regard to this matter is the obvious circumstance that the Council had no idea of submitting themselves to section 35 of the Act, supposing they had succeeded in acquiring the undertaking of the East London Company. Now that the Company are secured in possession, the Council are prepared to enforce the most stringent conditions with respect to the supply. When the recommendation of the Committee came before the Council last week, it was adopted with only a slight attempt to get the report referred back. The Parliamentary Agent is therefore to draft the Bill according to the views expressed in the report; and the notices are to be duly issued. In the brief debate which preceded the adoption of the Committee's recommendation, Mr. Charles Harrison expressed an opinion that the Company should be compelled to submit to "the law of the land" as the price of having "such a monopoly." The Council would be exempt from "the law of the land," although possessing a monopoly of the most absolute kind. There is to be one law for them and another for the Company.

In their zeal against the Water Companies, the County Council are furnishing the consumer with a very fair inducement for allowing the supply to remain where it is. The Council can take up the cudgels against the Companies; but who will fight the consumer's battle against the Council? Had the Council felt assured of carrying the purchase scheme, would they have called upon the Local Government Board to open the inquiry which has just been concluded by Colonel Ducat, as to certain regulations governing the water supply, especially the flushing power provided for household water-closets? The Council asked that the flush of two gallons should be increased to three. After asserting that the Companies were unable to meet existing demands, the Council asked that these demands should be augmented by 50 per cent. in the case of a large portion of the supply. The evidence given by Mr. Bryan and Mr. Restler, as well as by other Engineers, shows how enormous would be the increase—amounting to at least 12 million gallons daily, supposing it to comprehend the entire area of the various districts. *London* is good enough to say that if the extra flush were legalized and enforced, "the Companies would have to take immediate steps to "increase their storage reservoirs and their supplies." To this it may be added that the County Council would strive to the uttermost to prevent the Companies from making any such addition to their works. *London* further says that the object of the Companies in opposing the proposed change is to conceal the weakness of their position, "and to maintain the artificial value of their "properties." It is far more evident that the object of the Council is to depreciate the real value of the undertakings, so as to prepare the way for any scheme of purchase that may be attempted later on. The increased flushing power would be simply so much waste, serving to hide the defects of private fittings. Sir F. Bramwell, who estimated that the extra gallon would mean an augmentation of 10 or 12 million gallons of water per day in the total, drew attention to the fact that this would call for increased capacity in the sewers. Witnesses for the Council asserted that the two-gallon flush was insufficient in the case of the model lodging-houses; but Mr. Farrant, the Deputy-Chairman of the Artizans' and Labourers' Dwellings Company—an authority connected with other companies of the same kind—gave evidence showing that the two-gallon flush used in the dwellings of these companies was perfectly satisfactory. Dr. Parkes, the Medical Officer of Health for Chelsea, after giving evidence in support of the case for the County Council, admitted in cross-examination that, with very few exceptions, throughout the country, in districts where there were regulations in force as to the supply of water for sanitary purposes, the two-gallon flush was the one adopted. This at once suggests the consideration that if the three-gallon flush is to be established in London, it must either be a wilful waste of one gallon in each flush, or must be a necessity everywhere. Thus the subject grows to a matter of even greater magnitude than that of the mere Metropolitan supply, and affects the water question throughout the country. Great importance will therefore attach to the conclusions arrived at by Colonel Ducat and the Local Government Board in connection with the recent inquiry. It was urged by Mr. Freeman, that Edinburgh, Bradford, and three other towns of some size, have adopted the three-gallon flush. But the majority of towns have not done so; and if the minority like to indulge in a luxury, that is no reason why others should have more than is necessary. The old maxim of "Waste not, want not," is specially applicable to the question of the water supply. Late experience has shown there is urgent reason for husbanding the water supply when it abounds, to be prepared for the time of drought.

On the statistics of this question, something remains to be said. Mr. Freeman, in summing up his case, ridiculed the idea that the extra gallon per flush would represent so many million gallons per day as the Companies had stated. On this point, we submit that it would not be at all unreasonable to suppose the extra consumption due to the three-gallon flush would represent an average of two gallons daily per head of the population. This, according to the most recent data, would correspond to more than 11 million gallons daily over the entire area of the supply; thereby justifying the general estimate presented by the witnesses for the Companies. But even a higher estimate may be perfectly admissible. All depends upon whether the calculation is based on an entire or only partial application of the enlarged flush—supposing that one is ordered. We may presume that the change, if brought to pass, would be permissive in regard to existing closets, though compulsory with respect to all future constructions. If an order were made which went beyond this, the expense to landlords and leaseholders would be enormous, independently of the burden cast upon the Water Companies. On this point, the evidence of Mr. Collins, the Engineer to the New River Company, as given under re-examination, deserves to be carefully considered. The question is whether compulsion can go beyond an obligation to which the Companies would be rendered liable.

The Directorate of the Imperial Continental Gas Association.—Consequent upon the retirement of Sir Julian Goldsmid from the chairmanship of the Imperial Continental Gas Association (to which reference is made in another column), we are officially informed that the following changes have been made in the directorate: Mr. T. H. G. Newton, who has been a Director of the Association for twenty-eight years, and Deputy-Chairman for five years, has been elected Chairman; Mr. J. Horsley Palmer, a Director of twenty years' standing, will succeed Mr. Newton as Deputy-Chairman; and Sir C. J. Jessel, Bart., has been chosen to fill the vacancy upon the Board caused by Sir Julian Goldsmid's resignation of his position as a Director.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 993.)

THINGS have gone from bad to very much worse on the Stock Exchange; and last week they had such a time as they have not had for a long while. The opening day was pretty fair. But the clouds rapidly became very thick; and the rest of the week was stormy indeed. The state of things in the Kaffir market appears to be chiefly responsible for it, where heavy bull accounts remain to be met; and it looks as if much trouble is in store for the settlement. Then foreign relations were very disquieting; and though Lord Salisbury's speech is reassuring to an extent, a considerable balance of anxiety will probably prevail awhile. It almost goes without saying that prices pretty well everywhere have been knocked down like ninepins; and on Saturday, when things were at their worst, Consols actually touched $104\frac{7}{8}$, but they rallied before the close. The Money Market had a better turn; and higher rates were easily obtainable. Business in the Gas Market was brisk and animated, and was attended with some interesting features. In Gaslights, the "A" showed confirmed weakness at first, and opened at $292\frac{1}{2}$. But, after some hesitation, it rallied, and recovered rather more than its losses—closing at 295. In the secured issues, business was remarkable; the number of transactions being probably unparalleled in any previous week. Prices were excellent generally; and the $4\frac{1}{2}$ per cent. debenture stock marked a "record" at a level 150. South Metropolitans were not particularly active; and prices were only fair. Commercials were unprecedentedly active on a fair chance of business being done presenting itself. Both stocks were full of rise, only waiting an opportunity, especially the new, which jumped from $239\frac{1}{2}$ on Thursday to 251 on Saturday. Since we drew attention a fortnight ago to their false position, both stocks have risen more than 20 points. Movements in Suburbans and Provincials were extremely capricious and irregular. Alliance old was thrust down, and the new was put up; and the seesaw being played with British and Brentford new was kept going. Bromley new advanced; but the old lagged behind. In the Continental category, Union was put down, after being put up the week before; but the rest were steady. Among the remoter undertakings, Oriental advanced; but Buenos Ayres was lower. Business in Water was quiet, and devoid of feature. Lambeth and Southwark ordinary were a point easier.

The daily operations were: Business in Gas was only moderately active on Monday; and the general tendency was not good. "Gaslight "A" fell 1; Brentford new, 2; and Buenos Ayres, $\frac{1}{4}$; but Commercial old rose 2. Lambeth Water fell 1. Dealings on Tuesday were more brisk, especially in Gaslight secured; but quotations did not move. Business fell off on Wednesday. Alliance old receded $1\frac{1}{2}$; but ditto new rose $\frac{1}{2}$. Transactions on Thursday, though not extensive, on the whole were considerable in Commercials—each advancing 3. Gaslight "A" rose $1\frac{1}{2}$; ditto $4\frac{1}{2}$ per cent. debenture, 2; and Bromley new, $\frac{1}{2}$. In Water, Southwark fell 1. Friday's operations were mostly in Gaslight "A," and at better figures. British improved $\frac{1}{2}$; and Oriental, $\frac{1}{4}$. But Alliance old was $\frac{1}{2}$ lower. Saturday was a very busy day, Commercials again having the lion's share. The old stock rose 2; and the new, 7. South Metropolitans were active, but unchanged.

ELECTRIC LIGHTING MEMORANDA.

Electric Light Inquiry at Wimbledon—Public Lighting Problems of Wimbledon—The Attitude of Gas Companies to Electric Light Schemes—The Real Duty of Incandescent Lamps.

THE proceedings at the Local Government Board inquiry into the proposal to expend some £32,000 of public money upon the electric lighting of a part of the district of Wimbledon (briefly mentioned in last week's JOURNAL), are typical of the kind of thing that is becoming a scandal. One of the Royal Engineer officers, who are such favourites with the authorities on both sides of Whitehall, conducted the inquiry. The case for the scheme was advocated by Mr. Fletcher Moulton, Q.C.; while the opposition, represented by the Ratepayers' Association, was defended by Mr. Castle, Q.C. Mr. Moulton had an interesting task in trying to convince the Inspector that a locality which has hitherto made shift with oil-lamps in the streets, for the sake of economy, is justified in going in for the most expensive means of public lighting; for it is a cardinal feature of the scheme that incandescent electric lamps are to be used for this purpose. Mr. Moulton would not be the ornament of the British Bar he is, if he were daunted by such a trifling difficulty as this. For the opposition, Mr. Castle had little trouble in bringing out the factitious character of the electric lighting scheme, which was devised by Mr. A. H. Preece, of course with the valuable aid of his eminent father, who is himself one of the shining lights of Wimbledon, where his illuminated dolls' houses have long been exhibited as triumphs of modern electrical science. Mr. Preece himself attended the inquiry and supported his son's plans; but his magnificent generalities, and customary paradoxes, did not materially help to clear up the problem of whether Wimbledon wants the scheme which the District Council are bent upon forcing upon the ratepayers. It was shown that every means open to the ratepayers for expressing their views upon the proposal of their legal representatives had been taken, with the uniform result of proving that hardly anybody outside the District Council approves of it. So long ago as 1890, the same scheme was rejected by a public meeting. But this time the District Council have taken good care not to run the same risk again. Still, a public meeting was called, which the Chairman of the District Council, a strong partisan of the scheme, was invited to attend. He did attend; he was heard; and his scheme was rejected by a practically unanimous vote. The District Council were asked to receive a deputation, but they refused; they were asked to have a poll, and this was also refused. Yet they go on with their scheme, and ask the Local Government Board to allow them to tax the district for a luxury for which it cannot be shown that there is any demand.

There are one or two peculiarities about this Wimbledon affair which appear to need some explanation. The old Local Board quarrelled with the Gas Company, who seem to be held in some despite in this neighbourhood because their headquarters are in the adjoining district of Mitcham. However this may be, the Company in question are among the smallest of the Metropolitan Suburban gas undertakings. They supply 15-candle gas, and charged last year 3s. 8d. per 1000 cubic feet for it. Their main mileage is excessive for the amount of gas consumption; and yet so straggling is the Wimbledon portion of their district that there are no mains in some of the roads that require lighting. Whatever may have been the case formerly, when the Gas Company did not see their way to serving the scattered street (or rather road) lamps of Wimbledon at a lower price than they charged elsewhere, they have lately endeavoured to meet the District Council with a concession, which not even their enemies have termed unreasonable. The District Council would have nothing to say to the Company, however, as the Chairman told the Inspector, because to accept their offer for the thoroughfares where the mains run "would mean a dual system of lighting—partly gas and partly oil." Yet this same gentleman, with all his dislike to a "dual system," is set upon having the very same thing with electricity and oil. He would probably say, if confronted with this inconsistency, that circumstances alter cases.

There is another point of this business which, as at present advised, strikes one as a bit of mistaken policy on the part of the Gas Company. It was stated at the inquiry, and admitted by some members or friends of the Ratepayers' Association, that the organized opposition to the electric light scheme had been subsidized by the Gas Company. This may mean much or little. As large ratepayers, the Gas Company might well assist any opposition, regarded by them as well grounded, to proposals likely to increase the rates, from whatsoever source arising. All the same, we are strongly of opinion that the less gas companies intermeddle with the electric light schemes of local authorities, the better. Their support to opponents of such schemes is enough in some places to determine the flow of popular sentiment in its favour; and in any case they can do themselves no good. We know that enthusiastic directors and chief officers of gas undertakings up and down the country do allow themselves to be stirred up by the flagrant partisanship of members of local authorities for electric lighting, to take sides in opposition to this misuse of administrative positions. But they had better remain quiet than increase the risk of their motives being misrepresented, as inspired by mere trade jealousy.

Recently the *Electrical Review* published some modern results of incandescent electric lamp tests, which are worthy of notice. Our contemporary remarks that, in electric supply statistics, the word "lamp" has the conventional meaning of an 8-candle lamp, which again is conventionally supposed to mean a consumption of 35 watts of current. From the mean of the English-made lamps tested, the proper consumption is really about 38 watts for an 8-candle power lamp. So that, here again, the electricians have been kind to themselves. It further appears that the average English-made 16-candle lamp takes 60 watts of current; yielding an average illuminating power of 14·21 candles throughout its normal life of 600 hours. Similarly, the nominal 8-candle lamp has an average illuminating power of 7·81 candles. It is remarked that for all-round efficiency the English-made lamps are more than holding their own against the cheaper Continental-made article. As 16-candle power lamps can be bought for anything from 6d. to 2s. each, while they may consume anything from 10 to 80 supply units during their life, it is clear first cost is only a small part of the total expenditure for light which it represents before it is done with.

Incandescent Gas v. Electric Lighting for Streets.—The Chagford Local Authority have decided to discontinue the electric lighting of the streets; and they have accepted an offer made by the owner of the gas-works (Mr. Willey, of Exeter) to light them by means of incandescent gas-lamps.

THE LATEST LABOUR WAR.

The troubles in the shipbuilding trade of Belfast and the Clyde entered upon a grave phase last week, with the decision of the executive of the engineers' trade societies to withdraw their members from the works in the latter district, in which the partial lock-out necessitated by the employers' agreement with the Belfast shipbuilders had been enforced. Honestly speaking, if the Trade Union meant to fight the matter out to the end, there was nothing else to be done. It brought the issue to a climax, if the phrase may be permitted; and at the same time it awoke the whole country to a lively sense of what a labour dispute between organized employers and one of the strongest of the so-called "old unions" means. So far as the shipbuilding trade alone is affected, of course we have no particular interest in this dispute; but there are several considerations growing out of the state of things at present existing in Belfast and on the Clyde which no employers of labour—especially in a great national industry—can afford to disregard. The affair also has certain aspects of great interest for observers of the ways of trade unionism, and for ordinary citizens. The original causes of the trouble, which began in Belfast, need not now be discussed. The important facts of the situation to be considered are—first, that a powerful Trade Union composed of skilled workmen have preferred a demand for increased pay which may or may not have been justifiable from the men's point of view; secondly, that the employers, likewise with or without justification from their own standpoint, have met the demand in a way which has resulted in the partial stoppage of a national industry, and must also entail the paralysis of an incalculable number of other industries.

It is natural for the best organs of public opinion to discuss the affair from the standpoint of national interests. Accordingly, the *St. James's Gazette* points out, as an alarming feature of the situation created by the actions of the shipbuilders and their men, how the execution of Admiralty contracts may be suspended, possibly for months, and the nation be consequently deprived of ships which may be badly wanted. The stoppage may have been due in the first place to a question of money; but no money can make up for lost time. The *Daily Graphic* follows on in the same strain, arguing that "the Clyde shipbuilders are not merely private venturers for profit; they are, in a very literal sense, the servants of the country." And the cry is raised that the needs of the nation must not be left to go unsatisfied because a few employers prefer to close their works rather than yield to every demand of their workpeople. This is all very well; but what is to be done to remedy the mischief—by Government or anybody else? It has been understood that Messrs. Harland and Wolff, the great Belfast firm, would have nothing to do with trade unionists, because they preferred to keep the control of their business in their own hands. If the attractions of the Amalgamated Society of Engineers have proved too strong for the Belfast men, and Harland and Wolff's yard has become a "society" establishment, the present result of a local wages dispute goes far to support the original policy of the firm. But, again, what is to be done? If the employers and the Trade Union cannot settle their differences by agreement, which party is to be coerced, and how?

The greater issue herein raised—of the ultimate interest of the community in the prevention of strikes and lock-outs in an industry of national importance—is precisely the same as that which has been kept steadily in view by those who have given in their adhesion to the principle that the extension of trade unionism cannot be permitted in industries which are also public supply services. There must be no Trade Union of postmen, firemen, railway servants, the employees of municipal sanitary departments, or gas workers, if the public interest is not to suffer. All experience goes to show that, with whatsoever fair promises so-called "trade" societies of this order of workers may start, sooner or later (if they grow and prosper) they come into conflict with the authorities who are responsible for carrying on the service. And it may happen that the ostensible cause of difference is something which the outside public cannot understand, or are led to misunderstand in the supposed interest of the workpeople. If the service is gas supply, for example, a plausible demand for increased pay, for shorter hours of labour, for holidays, or some other quite legitimate amelioration of the conditions of employment, will be made by the Trade Union officials in the name of the workers. If such a demand is once acceded to, the Union is exalted in the eyes of the populace and its members. All the resources of the cheap newspaper press, and the aid of the pulpit and the platform, are bespoken for the glorification of the victorious Union; and even men who suspect that Union leaders are not wholly disinterested in undertaking to obtain for the working man what he is supposed to be unable to gain for himself, are over-persuaded that it pays to take a society card. The only safe policy to follow in the face of a Trade Union demand is to refuse to recognize the agency through which it comes. We are not speaking now of the affairs of a purely commercial concern, or any question of work or wages arising in connection with a private business. A boot manufacturer, or a printer, may be safely left to find out for himself whether he can work his establishment as a "society house," or not. In the case of workpeople engaged in the performance of tasks which are in any important degree public services, the position is clear—no Trade Union should be recognized or dealt with by the employers of such labour, under any pretence whatsoever.

Of course, the men who perform necessary public services deserve all reasonable consideration and fair treatment. We have no sympathy—rather the opposite—with those employers who do not keep abreast with the times in this respect, and obstinately adhere to the notion that what has been will always be good enough for their workpeople. Such masters are foster-fathers of trade unionism, and are a danger to their order. But when a gas manager, or the head of any branch of the national or municipal service, pays his men the full market value of their work, and gives them reasonable compensation for anything they might be supposed to lose by turning their backs upon trade unionism, whatever happens to the service, he cannot be blamed. And that troubles will come where the Trade Union leader is in authority, is as certain as that the night follows the day. For it is by keeping things in a continual ferment that these men live. The moment their supporters are satisfied, or at least feel that they can get no more through them, they become a superfluity. The societies that hold sway over the trades which follow the course of the open market retain their usefulness, in the estimation of their members, because their agency may be required at any moment to obtain an increase or resist a reduction of wages. The men whose work is a public service do not feel the changes of the labour market, or only experience them in one sense—that of improvement. In the gas-supply service, reductions of wages are unknown. Hence in such a service, the Trade Union agitator can only keep his footing by ceaselessly interfering with other conditions of the employment. This is the justification of those who regard him as a nuisance, not to be borne with upon any terms.

It is apparently forgotten by those well-meaning people who think the Belfast and Clyde shipbuilders are blameworthy for suspending work upon ships intended for the Navy, rather than give into the Trade Union demands, that an employer has every inducement, besides the sense of duty to the country and the community, for keeping his establishment going, if possible. His capital stands engaged; his staff must be paid; his rent and other permanent charges remain to be borne, whether he is turning out his usual product, or not. To shut the works gate is the last resort of a solvent employer, or of one who desires to remain so; and it is hard for an ousider to say when or how he is to be deprived of this most costly means of self-defence. The public are apt to forget that the employer's reluctance to take this step is one of the considerations upon which trade agitators most confidently rely for getting their own way. And when the case for keeping the gates open is reinforced, as it is in the *pseudo*-services, national or municipal, by consideration of the interest of the community, it is all the more important that the agitator should be prevented from manipulating this advantage. In statutory gas supply, the justification for a lock-out would need to be very clear and strong indeed to acquit before the bar of public opinion those who might counsel or carry it out. But nevertheless such justification is not unattainable. As a matter of fact, every ground upon which it would be supported exists in very many—perhaps the majority—of the gas-works of the United Kingdom at this hour. These are the establishments where the workpeople have no reasonable grievance left, and where not the most ingenious trade agitator could manufacture a case for one.

It is perhaps hopeless to look for a similar condition of affairs in a trade governed by commercial considerations. But, after all, the Belfast and Clyde employers must be supposed to be the most competent judges of their own business, including that of knowing when and how to meet their enemies. The emergency must be regarded as grave that could unite rivals in trade in a common policy of stopping work. The Amalgamated Engineers are reputed to be a wealthy body, as they are admittedly strong in membership; but there is a running sore in the constitution of the Society which must render the leaders averse to squander their resources upon a strike for a local cause. Of all trade societies, this has the highest average of unemployed members, and pays the largest sums for out-of-work relief. The reason given for this chronic condition of the Society is instructive. It is that the rules have been so successful in raising the minimum rate of wages to be accepted by members, that employers will not engage men over 45 years of age, who might be unable to earn the full Society wages, but prefer younger men. Consequently, the out-of-work relief paid by the Society is to an unknown (but perhaps a large) extent old-age pensions in disguise. If this is so, the future is not likely to bring to the Society increase of strength.

Lastly, the present dispute is a warning against imperfect settlements of wages questions. Some time ago, Messrs. Harland and Wolff were compelled to dock wages by 2s. per week, in consequence of bad trade, promising to return to the old rates when trade should revive. Now the men say that trade has revived, and the firm accordingly ought to perform their promise. The firm object that the improvement does not affect work in hand; and they declare that they must be the sole judges as to when their engagement becomes redeemable. Hence all this trouble; and the end is not yet. Our sympathies are with the

coal and iron trades of Lanarkshire, which are only too likely to suffer from the stoppage of the engineering works. The whole business is calamitous; but we at any rate are not disposed to hold the employers to blame for their share in it, without knowing more of their case than has yet been published.

NOTES.

A Test of Belleville Boilers.

In view of the growing popularity of boilers of the water-tube type, which are acknowledged to be well adapted for burning breeze and many other poor kinds of fuel, and to be capable of almost any degree of forcing upon an emergency, some recently-published particulars of evaporative trials of Belleville boilers built by Messrs. Maudslay, Sons, and Field may be recorded. The test was carried out on the 1st ult., at the builders' works at Greenwich. At 5.40 a.m., the fires were lighted—the weather being foggy and damp; but at 6.20 a.m., the steam-gauges registered a pressure of 200 lbs. At 8 o'clock, the official evaporative trial commenced, and was continued for twelve hours, with the result of showing that the average evaporative duty was 8·81 lbs. of water per pound of coal; the steam pressure being 200 lbs. throughout, and the temperature of the feed water 54° Fahr. Welsh steam coal of average quality was used for the trial; and the fires were cleaned at the end of the sixth and tenth hours. The ordinary consumption of fuel was at the rate of from 17 to 19 lbs. per square foot of grate surface per hour; but at the conclusion of the trial an accumulation test was made to ascertain the effect of forced firing. Coal was burnt at the rate of from 35 to 40 lbs. per square foot of grate surface per hour; the steam pressure rising to 247 lbs. It was then proved that the safety-valves were capable of dealing with any quantity of steam likely to be produced. The test was considered to be highly satisfactory by all concerned.

Paints for Ironwork.

Mr. Walter A. Berry has reported upon the best paints and methods for painting iron bridges, viewed from the standpoint of a railway engineer; and extracts from his report, which is described as composed largely of privileged communications, have been published in the American *Engineering News*. Though unable to give his authorities, Mr. Berry formulates several personal deductions and conclusions from them. He classifies paints in common use for structural purposes as follows: (1) Oxide of iron and linseed oil paint; (2) red lead paint; (3) asphalt paints, consisting of mineral and artificial asphalts or coal tar, alone or combined with each other, and frequently mixed with metallic bases, oils, and other materials; (4) carbon and graphite paints; (5) patent paints. Ochre paints have not had an extensive trial; but they are recommended by Dr. Charles Dudley, Consulting Chemist of the Pennsylvania Railroad. His formula for such paint is: French ochre, 39 lbs.; lamp black, 1 lb.; raw linseed oil, 54 lbs.; japan, 6 lbs. Oxide of iron paints consist, or should consist, of iron oxide ground in linseed oil; but sophistications have become so common in the trade that the whole class of such paints has fallen into some disrepute. Pure oxide and pure oil, properly mixed, are yet considered by Mr. Berry as capable of yielding very good practical results for iron bridges, despite all theoretical objections to the use of iron paints in general for priming iron. Referring to oxide, red lead, and tar paints, Mr. Berry inclines to the common-sense opinion that the fact of an article or a method being widely used, though not conclusive, is at least presumptive evidence that it is useful, and adapted to its purpose. With regard to the covering power of paint upon ironwork, it is stated that good red lead paint will compare favourably with the cheaper iron oxide and asphaltum paints. The composition of so-called asphalt paints is too various and uncertain to attract Mr. Berry's favourable regard; but he nevertheless speaks well of a sample of such a paint composed of asphaltum, linseed oil, turpentine, and kauri gum, which has a varnish finish. Graphite and carbon paints have given satisfaction; but it is advised that they should be obtained only from firms of the highest standing.

A New Coal-Tar Antiseptic.

It is reported that the great German manufacturers of coal-tar colouring matters are turning their attention more and more to the production of refined antiseptics prepared from the same inexhaustible storehouse. The latest compound of the kind that has been put upon the market upon a commercial scale has been given the non-committed name of "antinonnin." Its proper name, according to the system of nomenclature followed for products of its class, is potassium orthodinitrocresolate. When this system of nomenclature was first devised for workers in the chemistry of the carbon compounds, the aspiration was indulged in that it might be found possible to keep the new coinage within a seven-syllable limit. This limit has long been extended, which is to be deplored; but since some handy, popular name is usually found for new and complex coal-tar products that appear likely to enter into ordinary manufacturing and domestic use, the evil of too polysyllabic a nomenclature falls only on chemists themselves. The new antiseptic, antinonnin, has been reported upon by Messrs. Harz and Von Miller, who have found it to be the most powerful bactericide known to science. A solution of one part in 1500 to 2000 parts of soapy water is fatal to all injurious plant parasites, without having any deleterious action on the growing plants. The new antiseptic has the additional recommendations of being odourless, and inexpensive. Whether it will fulfil all the expectations formed of it remains to be seen. Meantime, it is admitted to be an interesting, and possibly important, addition to the list of disinfectants.

More Metallic Sodium in Electric Light Conduits.

The remarkable discovery of metallic sodium as one of the unexpected bye-products of electrical distribution by the St. Pancras Vestry, has been paralleled in Boston. The case has been reported on by Messrs. Forbes and Glidden for the Boston Fire Underwriters' Union, and related to the examination of a substance found in the casing of the electric mains in the basement of the Pray building. The report has been published in the *Electrical World*. It appears from it that the substance discovered was in reality impure metallic sodium mixed with partially disintegrated wood; the metallic sodium being the product of electrolytic decomposition of impure sodium hydrate. This sodium hydrate came from the cement mortar used in laying the brick wall of the basement upon which the wires were supported. Some of the hydrate may have worked its way through the wall from the cement used in the foundation of the adjoining paved street. The electric current which caused the electrolytic action was due to a leak inside the casing from one of the mains to another; the leak having been produced by the action of the sodium hydrate on the insulating covering of the wires. Inside the casing, the wires were partially covered by an insulating tubing composed of tarred paper. When the front of the casing was removed, the wires, tubing, and woodwork about this point were found to be covered with a thick liquid, which had dried in places to a whitish substance, resembling discoloured salt, and was slippery to the touch, and strongly corrosive. The metallic sodium was smoking; and, when moistened and struck with any hard substance, it gave off flashes of flame. The substance was determined to be metallic sodium by its appearance and characteristic reactions, and by its colour in the Bunsen flame. The insulation where the deposit occurred was practically destroyed. It is satisfactory to know that the St. Pancras discovery, the truth of which was strenuously denied by certain English electric light journals, has been corroborated.

"The Handling of Dangerous Goods."—If it is truer than ever that "of the making of books there is no end," it is equally true that the manufacture of specialists is a progressive industry. This book, written by Mr. H. Joshua Phillips, F.I.C., F.C.S., and published by Messrs. Crosby Lockwood and Son, is a reminder of the numerous ways in which the public security may be endangered by the handling in, and transmission through, populous places of dangerous and deadly commodities. Accordingly, a new speciality in chemistry has been created, which is devoted to the classification, under the auspices of the railway companies, of explosives and other goods which may be dangerous to handle, carry, or store. Mr. Phillips is an expert in such matters; and his book purports to tell readers what are dangerous commodities, and why. He is a somewhat painful writer, as will be perceived from his remark, in discussing the spontaneous combustion of coal, that the proportions of the constituents of "this well-known and indispensable combustible mineral," as he calls it, "vary greatly, depending as to how complete or otherwise the natural carbonization of the original vegetable matter had taken place." After this, it is not surprising to read that "all coal give off more or less inflammable gases." It is only charitable to suppose that Mr. Phillips is a safer guide in chemistry than among the dangers of English composition. His book ought to be useful to those whom its contents concern.

Crystal Palace Old Students' Society.—The first annual dinner of this Society (which has been formed for the purpose of affording opportunities of mutual assistance and social intercourse to the old students of the Crystal Palace School of Engineering) took place on the 30th ult., at the Holborn Restaurant—the President, Mr. G. M. Lawford, Assoc. M. Inst. C.E., who is Vice-President of the Society of Engineers, in the chair. Old students will be glad to know that Sir Robert Rawlinson, K.C.B., Past-President of the Institution of Civil Engineers, has signified his interest in the Society by consenting to become an honorary member. Unfortunately, Sir Robert was prevented by ill-health from attending the dinner. Mr. S. Green, a Director of the Crystal Palace Company, at whose instigation the Society was founded, proposed the toast of the Society in a very interesting and eloquent speech; and Mr. J. W. Wilson, M.Inst.C.E., M.Inst.M.E., the Principal of the School, also spoke of the great pleasure which the formation of the Society had given him. A selection of music was given after the dinner by members and friends, under the direction of Mr. F. H. Hodson. The Society has been formed only a few months; and already it has over a hundred members. But, as there are at the present time some 1100 students who have paseed through the school, it is hoped that this number will soon be increased, and thus confirm the brilliant prospects under which a beginning has been made. For the information of old students who may desire to join the Society, we may state that the Secretaries, Mr. H. C. Rose, South Tower, Crystal Palace, or Mr. J. C. Lyell, 55, Victoria Street, S.W., will be happy to receive applications, or give any information that may be required.

COMMUNICATED ARTICLES.

NOTES ON CURRENT TOPICS.

By "Veritas."

Perhaps one of the most important investigations of modern times in the domain of gas—embracing, as it does, researches of the very highest scientific character, and which are no doubt eventually destined to have far-reaching results—was the work of the Photometrical Commission on Standards of Light. The result of the investigation, as everyone having any knowledge of the subject would naturally anticipate, was a condemnation of the standard candle, and a recommendation that it be replaced by a more efficient and constant method of ascertaining comparative illuminating values. The labours of the Commission, and the results of their investigations, are now fairly well known; and in face of the evidence, it is curious to observe the tenor of a recent letter appearing in the JOURNAL, and bearing the signature "E. Williams, F.C.S." It is still more curious that this letter has provoked no reply. But the absence of any criticism in the "Correspondence" columns makes it the more necessary to exercise criticism in some other channel.

The statements made in the letter are so strange that they might possibly be regarded as beneath discussion. In the first place, the pentane lamp, by which one may presume the "ten-candle pentane Argand" is meant, is placed in the same category of excellence as the jet photometer and the Methven screen. This is a curious attitude for a presumably scientific gentleman to assume, as it is a well-known fact that the jet photometer is simply a rough practical guide for ordinary working; and that the Methven screen, however useful in itself, is not constant for all grades of gas. The illuminating power of gas supplied to the public should, in the interests not only of the consumer but of the producer, be tested in the most scientific manner, with the highest of skill, and with the most accurate of appliances.

Mr. Williams seems to consider it a mistake for the Photometrical Commission to adhere to the term "candle power." He assumes that, as the Commission were able by the use of candles to obtain a standard of their value, it follows that the body of gas examiners all over the country would be able to use candles successfully in accurately determining the value of the respective gases which they may be called upon to test. In making this assumption, Mr. Williams entirely ignores the fact that the value of the ten-candle pentane Argand, which has been finally accepted by the Photometrical Commission, has been fixed by thousands of experiments made by the most skilful operators; and thus a fair, mean value has been secured. Whatever the actual light assigned to the pentane Argand is, it is at least the mean result of a very large number of careful tests. In addition, the light of the pentane Argand, used under suitable (and easily secured) conditions, is absolutely fixed; whereas, in spite of Mr. Williams's assertions to the contrary, the light afforded by even the best of so-called standard candles is extremely varying, and cannot be controlled by any exercise of skill by even the most expert of gas examiners. Of course, in making this statement, any personal tampering with the standard candle is ignored. Some photometrists advocate a certain amount of manipulation of wicks during combustion; but this is considered illegitimate by the best authorities.

Now, leaving Mr. Williams specifically, and considering more generally the result of the labours of the Photometrical Commission, it is an open secret that, while most authorities are in agreement that the ten-candle standard is a scientific and trustworthy method of estimating all grades of illuminating power, the greatest difficulty in arriving at a conclusion was to fix the actual value of the new standard expressed in candles. There was considerable difference of opinion as to what was the actual light-value of an average candle; and some suggestion was made that the modern candle did not afford as much light in proportion to sperm consumed as the older candle in use when the Acts of Parliament under which the existing Metropolitan Gas Companies are working were originally passed. A compromise has been effected between the authorities acting on behalf of the public on the one hand, and those representing the interests of the gas companies on the other, the effect of which is that the value of the new standard of so-called ten-candle value somewhat exceeds this estimate. The effect of this will be that, if the new standard should ever be accepted for purposes of official testing, the gas companies will not be credited with supplying gas of quite so high an illuminating power as they have been accustomed to under the old *régime* of the standard candle, which has been in vogue for many years past. A compensating advantage would no doubt be found in the fact that the ten-candle standard can be relied upon to give uniform results; whereas the standard candle gives such extreme variations that "good, honest, 16-candle gas" may be officially returned, under the most moderate estimate, as any value between 15 and 17 candles. It may be claimed that, taken as an average, these variations are of little moment; but the unfortunate fact exists that, if the gas of any special gas company is returned at (say) 17 candles, the company get scant credit for the higher illuminating power; whereas if the official return only amounts to 15 candles, the company are subject to a penalty which may reach as much as the sum of £100. One other salient feature about the use of a really reliable standard of light is that it enables different operators to secure fairly constant results. For instance, tests might be taken at a gas company's works, and at an official testing-station on some leading main in the district; and, with skilful operators, the results would fairly agree. Before the Dibdin ten-candle standard can be definitely adopted as the standard of light, it is obvious that parliamentary sanction will have to be obtained; and how long this will take to effect, must be a matter of future history.

It may be interesting to briefly trace the life history of the proposed new standard of light. Many years ago, Mr. William Sugg, whose reputation in connection with gas-burners is so well known, introduced a ten-candle standard. This standard was an ordinary Sugg's "London" Argand, provided with a screen which cut off the upper portion of the flame. Adjusting the flame to a given height, it was claimed that, with ordinary gas, the proportion of light passing beneath the screen afforded a fairly constant illuminating power of 10 candles. This would probably be an accurate standard if the lighting power of the gas only varied within comparatively narrow limits; but a really scientific standard must be independent of any variations whatever in illuminating power. Mr. Methven, whose ordinary standard is an exceedingly useful one for practical working, has recognized this fact. Although not strictly accurate for grades of gas of from 14 to 18 candle power, the ordinary Methven screen affords sufficiently accurate results for all practical purposes when used on gas within these limits. Subsequent to the introduction of the original Methven screen, the inventor has brought forward a modified form, in which the gas employed is passed through a carburettor containing liquid pentane; and thus, whatever the variations in the quality of the original gas may be, an enriched gas of constant light is supplied to the standard—thus rendering it available for testing gas of any ordinary illuminating power.

The Dibdin ten-candle standard is an evolution of the principle of screening off the upper portion of a flame, introduced by Mr. Sugg; and the employment of pentane as an enricher to produce a gas of fairly constant illuminating power, introduced by Mr. Methven. The special credit due to Mr. Dibdin is the development of the combined principles to such an extent as to produce a standard which is now regarded as thoroughly reliable by all experienced photometrists. A very strong point is the use of air as a carrier for the pentane vapour, in place of gas; so that there is always employed a gaseous vehicle of fixed composition, in place of one of varying composition.

Reverting to an earlier period in the evolution of this standard of light, it could not possibly have been brought into existence unless Mr. Vernon Harcourt had previously shown that a certain hydrocarbon known as "pentane" could be prepared with such a reasonable degree of scientific accuracy that, when its vapour was mixed with air in definite proportion, a gas of specific illuminating power could be always ensured. In fact, the fundamental basis of any standard of light depending on the combustion of a hydrocarbon must be that such hydrocarbon can be invariably, and practically, obtained in a state of at least such a degree of purity as to give consistent results under fixed conditions. Pentane meets all these requirements. It is a liquid, and therefore portable; and it is difficult to conceive any other material which could take its place. Although liquid at ordinary temperatures, it is so volatile that it is only necessary to introduce a measured quantity into an experimental gasholder containing air, to produce, in the course of a few hours, a gas of definite illuminating power. Pentane, as originally used by Mr. Vernon Harcourt, was simply employed for the production of a one-candle standard of light. This necessitated the most accurate adjustment of the liquid material to the air employed in a standardized gasholder, and suitable corrections for any deviation from the normal temperature and pressure. In addition to this, the standard flame—unless most carefully adjusted to the exact height—does not afford an accurate degree of light. It was, in fact, found during the investigations of the Standards of Light Commission that even the most skilful photometricians differed in their estimate as to the exact point at which the tip of the flame exactly touched (without exceeding) the platinum wire used for adjustment. This, of course, led to discrepancies, which were aggravated by the fact that, in comparing a one-candle standard against gas of nominally some 16 candles' value, any error in the adjustment of the unit flame was correspondingly augmented.

Subsequent to the introduction of the one-candle pentane unit of light, Mr. Harcourt proposed an alternative method—viz., that of so modifying the proportions of air and pentane as to produce a gas which might be consumed at a fixed rate in the Sugg "London" Argand, and would give a definite light of 16 candles. This system compared with the ten-candle Dibdin standard has again the disadvantage of requiring an accurately prepared mixture of air and pentane with all the combined necessities of scientific skill in operation. The ten-candle standard is free from all the previously mentioned complications. It is true that a gasholder is necessary, but only as a store for a supply of air under pressure. If it were not requisite to avoid irregularities in pressure, an ordinary gas-bag would suffice. No corrections for variations in atmospheric temperature or pressure are necessary; and the only conditions of accuracy

are that the carburettor be kept fairly filled with liquid pentane, and that the flame be maintained at its proper height. Even with regard to the latter detail, a considerable variation may be made—a variation which could not possibly escape the most ordinary of observers—without perceptibly affecting the light afforded by the standard. That is to say, with a material alteration in the height of the flame, the proportion of light passing beneath the screen remains practically unchanged. In pentane, we have a hydrocarbon liquid which can be made to produce a definite illuminating power under fixed conditions; but the preparation of the liquid requires a considerable amount of skill.

It is singular that, following the introduction of pentane as a practical available material, we have had the advent of acetylene. In calcium carbide, there is now available a compound from which practically pure acetylene can be obtained by the simple process of bringing the material into contact with water. Under these circumstances, it is not surprising there are reports as to possible use of acetylene as a standard of light. Considerations as to the best practical method of employment for this purpose must be reserved for future discussion.

THE CAPITAL OF GAS COMPANIES AND OF MUNICIPAL GAS UNDERTAKINGS.

By Norton H. Humphrys, F.C.S., Assoc.M.Inst.C.E.

In some respects it is satisfactory that the question raised in these columns a few weeks since, as to why the capital invested in joint-stock gas undertakings should always be regarded, in the eye of the law, as absolutely irredeemable, while that for municipal gas-works is as invariably considered to be a temporary loan repayable by annual instalments, should attract but little interest or attention. Those lines have undoubtedly been read by many holders of gas stock, whose aggregate investments would represent many millions sterling. Yet no one cares to come forward to claim, on behalf of gas companies, a right to have at least the option of redeeming portions of their capital, and that notwithstanding the fact that corporation gas undertakings are applying part of the profits earned from the consumers of gas for the purpose of reducing the capital thus invested to a vanishing point. It would be difficult to hit upon a better method of illustrating the general confidence in such investments, and in the permanent character of our special industry.

A story has lately gone the rounds respecting a certain corporation—the locality concerned had better not be further indicated than by observing that it is not in the south-west of England—who for some years past have not cared to have their accounts completely audited, as it was well known to those behind the scenes that the result would not be satisfactory. Shareholders in gas undertakings would not go so far as this, for they do not fear a free discussion—there is no reason why they should do so. But at the same time, they probably feel that the tendency of the times is not in the direction of increasing the concessions or privileges granted to gas undertakings. It is rather in the opposite direction, towards the curtailment of those already possessed; and therefore there is no prospect of getting further advantages. The practice is fixed by the law of the land; and any proposition to change it might lead to other proposals being brought forward for alteration. If any company went to Parliament for a re-adjustment of this matter, they would certainly be called upon for concessions in some form or another.

But I do not care to allow the matter to pass, without adding to the protest already expressed. One need not conclude that, because the procedure usual in respect to gas-works capital has been fixed by law, it is thus lifted beyond the pale of discussion. The modern gas-works manager has great faith in the value of discussion—as instanced by the number of meetings that are held for this purpose—and especially in the discussion of matters which, like the one in point, have become questions of procedure. It is no use to gloss over the anomaly created by the fact that a mere accident determines the permanence or otherwise of gas-works capital. If the scrip happens to be headed "—— Gas Company," the investment is permanent and irredeemable; but if the heading runs "The Corporation of —— Gas Undertaking," it is a loan repayable by annual instalments. Yet the status of the proprietors in no way affects the intrinsic value or the practical working of the concern. The consumer buys gas, and will continue to do so as long as it meets his requirements, without any regard whatever to the owners. The manager and his assistants who are responsible for the daily operations, practically follow the same course, whether they are employed by a board of directors or by a gas committee. It would seem that the financial policy of a gas undertaking should be dictated by circumstances more intimately connected with its actual working than the mere accident of ownership; and certainly it is strange that there is no choice between one of two diametrically opposite courses. If a permanent capital is the proper thing, why do corporations seek to write off the capital account? and if a vanishing capital is right, why do not the companies at least have the option of forming sinking funds? The nature of the property represented by the investment, rather than a question of ownership, should determine the permanence or otherwise. At one time, there was a comparatively wide gulf between the financial position of a joint-stock company as compared with that of a municipal corporation; but this is being gradually closed up. The auction clauses have greatly reduced the difference caused by municipal or private ownership respectively upon the profits. There are now joint-stock concerns in which the average dividend as calculated upon the actual paid-up capital, including premiums, is not very much more than that paid upon corporation stocks. It would not be difficult to instance corporations who take more than 8d. per 1000 cubic feet of gas sold for profits, and joint-stock undertakings who take less.

If the proper course in the interests of all concerned is to have a redemption fund, and pay off the capital, why call in the cumbrous aid of the municipal machine for such a purpose? Why have the tedious and costly processes concerned in valuing and transferring the concern, and the numerous disadvantages inseparable from municipal trading? Why not authorize the company straight away to issue redeemable stock, and pay off its own capital? Given a 10 per cent. reserve to commence with, this could be done without injuring the rights of the consumer. The usual reply is that the corporation ownership brings the consumer into the position of a shareholder, and that he at once acquires a partnership in the concern. But there is more fancy than reality here. There is as much distinction between a ratepayer and a gas consumer, as between a shareholder and a gas consumer. The largest sum for rates may be paid by a party residing a hundred miles away; and the heaviest contribution to the gas-rental may come from a non-shareholder. In some gas companies the consumers could carry a vote at any time; and some corporation works are not worked by a majority of consumers. The status of ownership in no way determines the proportion or amount of stock held by consumers.

Some thirteen years ago, at a meeting of the South-West of England District Association of Gas Managers, the writer ventured to question the universal rule of permanent capital for gas companies; and that without any notion of doing away with capital altogether, but simply because it frequently happens that capital must be invested for purposes of a temporary nature, and it thus ought not to pass into a permanent debt. Any loss due to legal expenses, misfortune, or unskilful management—any expense, in short, that does not secure a fair permanent representation in structural value—or depreciation in values due to cheapening of materials or labour, belongs more to the present than to all time. It was shown that, to a limited extent, capital could be reduced without putting an unfair tax on the consumer. The subject, however, fell flat, from which it appears that no one has yet experienced the need for reducing capital. It does not follow that such a need will never become apparent.

We are frequently reminded that Parliament does not allow repayment of capital out of revenue—that is, not to joint-stock companies. It not only allows but forces municipalities to do so. We are told that Parliament only sanctions *fair* profits on capital in addition to actual expenses; but what is a *fair* profit? Forty years ago, a 10 per cent. dividend on shares sold at par was called a fair profit. The legal "fair profit" is a changeable quality, that must be adjusted according to the time of day; and at present, owing to the auction clauses, it is close on to the actual market value of money, or, in other words, close to the lowest rate at which corporations can raise capital. But besides the fair profit, Parliament has always sanctioned a fair consideration for contingencies and renewals. It makes special provision for works on leasehold land, insurance funds, and so on, though these are so rare as to constitute the exception that proves the rule. It has recognized the principle of granting temporary capital for investments of a temporary nature in one or two particular cases; and there would be no inconsistency in extending this principle to include all portions of the investment that are of a temporary or uncertain character.

The general rule is that the capital of a joint-stock gas undertaking should be represented by actual structural value. At present, there is a powerful weapon against extraordinary loss or depreciation, by reason of certain appliances becoming obsolete, in the shape of a wise outlay on renewals; but its utility depends entirely upon a steady increase in business. Take away this condition, and it is nugatory at once. What is the advantage of adding to or enlarging retort-benches, purifiers, gasholders, and mains, if the existing appliances are already ample, or if the demand for gas, instead of going forward, is going back. Money sunk in fighting opposition or in useless plant, may be gradually replaced by extensions provided out of the revenue, if *such extensions are required*. But what if they are not required? Our system of permanent capital not only assumes a universal permanence in the demand for gas, but also a steady increase. So far the facts have, with few exceptions, justified this assumption; but they may not always do so. People cannot be forced to use gas. They have to pay their rates and taxes; but they can have the meter out to-morrow, if they choose. If people will not use gas, or if the population of the district is largely decreasing, what is the use of a parliamentary guarantee? The ordinary County Court summons is of no use to gas companies, as it only secures the payments of debts that can be recovered equally well without it; and similarly, the parliamentary guarantee merely protects a demand that already exists, but does not ensure the continuance of that

demand. Yet some people seem to regard an Act of Parliament as first cousin to the right to collect a poor-rate.

Those who talk about gas companies being slow to move, wanting in enterprise, unable to see beyond their own noses, given to inhabit a particular shell, to walk in one rut, and so forth, do not appreciate the weight of this drag of permanent capital—especially on small undertakings, or in places where trade is bad or the population decreasing. One or two awful experiences in the way of lost or wasted capital are sufficient to unhinge the business judgment of the average director, and to cause him to fall back upon safety before everything. A restriction on reckless expenditure is very desirable; but to be consistent, absolutely permanent capital should not be expended for any but absolutely permanent purposes. I take it that the aid of the renewal account is only recommended as a means of rendering a difficult position more tenable, and not as a permanent resource for those who are contemplating risky investments. Without going away from actual fact, it is possible to show that certain portions of ordinary gas property are not of that absolutely permanent nature indicated by the capital. Suppose a large factory, or a place of amusement, situated at a distance from the works, and that the company are asked to lay a mile or two of trunk main to supply it with gas. After carefully looking into the matter, they decide to spend (say) £1000 for the purpose; and the sum is accordingly added to their permanent capital. But after a time, the owners or occupiers fail; and the place is dismantled. The line of main which cost £1000 is now not worth £100. Again, many gas companies are investing largely in prepayment meters and appliances for letting on hire. The speculative element is always evident in ventures of this sort. A new invention may at any time reduce the value of hired apparatus to somewhere about that of old material. In carrying on the hiring business, great caution is necessary to avoid the accumulation of stock; and after every precaution, occasional losses in this way cannot be avoided. No wonder therefore if many gas directors hesitate about embarking in the hiring business. They do not care to do it with permanent capital; and they feel that to do so out of revenue would be an evasion of their Act of Parliament. It is unfair to compare the policy of gas companies with that followed in other lines of business, where the capital expenditure can be rapidly recouped out of revenue.

There are few gas undertakings that could not with advantage avail themselves of extended privileges in the way of depreciation (which, after all, are nothing but redemption) funds; and, on the other hand, the corporation should carry a fair proportion of permanent capital. I may be reminded that corporations have no right to saddle themselves with permanent capital. If that is so, they have no right to be proprietors of gas undertakings. If they must not incur permanent risks, it is difficult to justify those extending over 30 to 50 years. There is risk in every trading operation, even in the supply of gas. While investments in a corporation, as a corporation free from traders' risks, command a much higher value than joint-stock shares, a trading corporation is no better and no safer than any other company of traders.

Another consideration suggested by the gradual paying off of corporation gas capital, is the effect, as regards neighbouring gas undertakings, when the item of "interest on capital" disappears from the scene. The corporation should then be in a position to sell gas some 20 per cent. cheaper; and the result may be trouble for the gas companies, as the public will not believe that the corporation gas is unusually cheap, but rather that the other is unusually dear. In this connection, the figures quoted by Mr. George Livesey (*ante*, p. 732) are important. During the last ten years, considerable sums have been paid off by corporations; but yet we find that the average capital charges are practically the same as those of provincial companies. So far, the consumer has not benefited much; and I question whether he ever will. Corporation gas undertakings as a rule exist more for the ratepayers and their representatives, than for the consumers. The object is not so much to sell cheap gas, as to get the profits. The consumer may receive a sop or two at first; but when the corporation get into full swing, he is usually told that he ought to be satisfied to pay the ordinary rate prevalent in neighbouring districts, as the profits "go to the town." Already the ground is sufficiently cleared of capital as to leave room for some examples of cheap corporation gas; but where are they? The truth is that a corporation can always get rid of money. Even if there are not one or two unfortunate enterprises on hand, ready to swallow up profits from any source, it is easy to hit on some public improvement that seems indispensable when the money is in hand to pay for it, although no one thought of it or felt its need before. However this may be, the averages do not show that the consumer has so far benefited by corporation ownership.

Cannel Coal in Newfoundland.—A large coal area, 12 miles long and 6 miles broad, has been discovered in Newfoundland, on the new line of railway to the West Coast, and 40 miles by rail from the Bay of Islands. The Geological Surveyor estimates that one seam alone, which is 4 feet wide, contains 11 million tons of excellent cannel coal. Six other seams have not yet been traced. The discovery has caused great rejoicing, as it immensely enhances the value of the railway, and brightens the prospects of the colony.

TECHNICAL RECORD.

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Quarterly Meeting in Birmingham—Discussion on Prepayment Meters.

We complete to-day our report of the proceedings at the above meeting by giving the discussion on Mr. John Young's paper entitled "Two Years' Experience of Prepayment Meters," (*ante*, p. 875).

The Vice-President said the members must all feel indebted to Mr. Young for the clear information he had given in his paper. The great absorbing question of the day with all gas managers was the introduction, working, and satisfactory collection of the money in connection with the prepayment system. From the remarks the author had made, and the figures he had submitted, it was, in his case, a decided success.

Mr. F. W. Cross (Wellington) said Mr. Young, in the opening paragraph of his paper, remarked that he should have been glad if they could have had some notes on the experiences of those using a larger number of these meters. In an Association of this kind, the members were quite content to have the experience of such Managers as Mr. Young. The number of meters he had out, or would have out in a short time, showed that the experience was quite sufficient for them. He presumed that, when he referred to larger places, he had in mind the South Metropolitan Gas Company and The Gaslight and Coke Company. But if they had the experience of such Companies, they could not possibly, for an Association of that character, get the knowledge condensed into such a convenient and useful form as he had so ably put before the members. With reference to the point as to the handbills, Mr. Young told them that he had them freely circulated, and that his orders came in slowly. He (Mr. Cross) also had a handbill printed, and circulated it in one street only. He soon had a few meters fixed, and had not circulated any handbills since—the meters circulated themselves. The orders came in quite fast enough for him. His Company was a small one; and therefore they could not go ahead too fast. The author's remarks as to the ordinary consumers decreasing, were rather surprising to him (Mr. Cross), especially when he came to look at the table contained in the paper. There must be certain circumstances in the nature of the locality and the inhabitants that he could not quite understand. The total increase in the meters in 1886 was four; but the new services laid during the year were 206. Therefore Mr. Young must have dropped 202 of his consumers. There must surely be something in the locality that did not obtain in many other places. In regard to the reduction of price, the return of the difference in the money-instead of altering the amount of gas supplied, might be applic, able to Mr. Young's case, where he had a large number of meters; but he (the speaker) thought he should be inclined to alter the meters. It might be that Mr. Young had a variety of meters; but that would not necessitate every meter being brought back to the works. He (Mr. Cross) had three or four kinds of meter; and only in the case of one should he feel called upon to have it taken to the works to be altered and tested. Mr. Young said, in respect to the reading of the meters, that the district was divided into sub-districts; and the meters in a sub-district were never read by the same inspector twice consecutively. That was a very good check; but he went even a step farther. He endeavoured not to get the same meters read twice running by the same man; but, in addition, he had two books. The money was collected monthly. The index was read, and the cash put down, in one book for July, September, and November. That book would be brought into the office; and in August, October, and December another book would go out. Therefore, if there was any deliberate intention to defraud on the part of the meter inspectors, it would soon be found out. They had no knowledge of the state of the index the previous month. In Mr. Young's case, he presumed that the inspector in August would have the book used in the district by the July inspector. He would thus have the registration in front of him; and therefore he could defraud if he wished, and could alter the index in any way. Mr. Young spoke of his collection being made quarterly. He (Mr. Cross) preferred that it should be done monthly. By keeping in touch with the consumers, complaints were minimized to a great extent; so that there was an advantage in taking a monthly rather than a quarterly collection. Consumers left for a whole quarter had time to think over things and accumulate complaints; whereas, if there was a monthly visit, any little difficulty could be at once explained to them. From the papers that had been read on the prepayment system, many little wrinkles could be picked up; and every manager, in starting, should study what had already been done. But in all the papers he had read on the subject, he had not seen any due prominence given to payment on a higher scale. Some meter makers said they could manufacture meters to pass any coin. A shilling seemed to be the regulation coin; and he certainly thought more prominence should be given to shilling-in-the-slot meters. There was a great deal of novelty about penny-in-the-slot meters; but that novelty was bound to work off in course of time. In the winter, too, no doubt many managers would collect from 10s. to 20s. in some of the meters; and there was not the slightest doubt that pennies to that extent would become

rather a nuisance to the householder than otherwise. If managers were wise, they would begin to force, to as great an extent as possible, the shilling meter, because he believed it was the meter that was bound to become popular in course of time. It would give less trouble than the penny meter to both consumer and manager. There was another point in the paper he should like to refer to. Mr. Young said that sometimes a meter which was quite correct when the first two or three pennies were put in, would not give the right amount when twelve were inserted. He (Mr. Cross) would like to have all his meters in that condition; his experience being rather the reverse of that. He found that a great many people "worked" on the first penny. Only the previous day, he had a meter brought into the office, and tested it. He found that the consumer must have been working on one penny alone. He found out that, in place of the 17½ cubic feet which the Company in that case gave for a penny, he could get 20 feet for his first penny. The consumer was working on that penny until he (Mr. Cross) stopped it. Two pennies would adjust the matter; and the consumer would only obtain 35 cubic feet of gas. If he put in anything beyond that up to 10d., he would only get 17½ feet for each penny; but by only taking a pennyworth at a time, he obtained 20 feet. He mentioned this matter because it surprised him; and it occurred to him that it was rather an original game. He thought it would be well for members to watch this matter, as there were many householders who would put in one penny and work upon it. Where they could replace a penny meter by a shilling one, he should recommend that it be done, as there were really more correctness and greater convenience with the shilling than with the penny meter.

Mr. W. W. Hulse (Longton) said he had never spent a single penny in advertising his prepayment meters; and he had now nearly 1000 in use. Of the total number of consumers, about 30 per cent. were burning gas on the prepayment system. Like Mr. Young, they gave 25 cubic feet of gas for a penny, although in his case the price to ordinary consumers was higher—viz., 3s. per 1000 cubic feet. Some time ago, the Gas Committee resolved to allow a discount of 5 per cent. for prompt payment to the ordinary consumers; and in the case of prepayment consumers, the 5 per cent. was handed back to them by the collector. He found, contrary to the previous speaker, that it was an advantage for the collector to have the previous registration in his book. He was also provided with a scale of the price of gas at 3s. 4d. per 1000 cubic feet; and he checked the consumption with the amount of money in the meter at the time of collection. If there was any discrepancy, it was reported to the office, in order that the matter might be rectified. The collector was not the ordinary meter inspector. They were two distinct persons, and had two distinct books; so that the registration of the meters could be checked from one book to the other, and any fraud, if there were any, would thus be detected. They had a number of shilling meters fixed, and found them very useful. He was led to adopt them through one particular consumer, whose meter, unless the money was collected every fortnight, became choked with pennies. He found them useful for places where the gas consumption was greater, such as small beer houses and shops where there was a tendency to run into debt; and they hoped by these means to reduce the item of bad debts. If Mr. Cross had adopted his system of allowing the inspector to have the previous registration in his book, he would at once have detected those consumers who were getting 20 instead of 17½ cubic feet of gas. At Longton, they had had several cases of stealage from the prepayment meters. They found that a number of their meters had been broken open; and this led him to adopt monthly collections. Unlike Mr. Young, he had not many 2-light prepayment meters in use. At first he adopted them; but ultimately he went in for 3-light meters, as the cost was but little more, and the advantages were considerable. In his case, meter-rents had been abolished; and so the excess in the amount collected from the prepayment meters over the amount which would have been realized from the same consumption by the ordinary consumers, was available towards the extra cost of collection and other expenses in connection with this system. Their average consumption worked out very nearly the same as Mr. Young's—viz., about 9000 cubic feet per annum.

Mr. C. Meiklejohn (Rugby) said perhaps some of the members would point out how much was given to the consumers for the amount of capital expended. He saw, by Mr. Young's paper, that the profit, or interest on the investment, was 9·8 per cent. This was practically equivalent to 7d. per 1000 cubic feet, which, he thought, was the difference in the price of the gas. A good deal bore upon the value of this 9·8 per cent.—as to what the consumer was receiving. In Mr. Young's case, as far as he could gather, he simply fixed the meter. He did not see that he supplied anything in the way of fittings, the cost of which, if added to his capital expenditure, would considerably reduce the 9·8 per cent. The only other point he wished to allude to was the reference made by Mr. Cross to shilling prepayment meters. He could hardly agree with his contention in that respect; because the class of consumer it was desirable to gain was, of course, that which was the greatest in number. The penny-in-the-slot meters would always apply to the bulk of the population; while the shilling meters would mainly apply to those consumers who would not feel the meeting of a quarterly account to the same extent as a poorer man.

Mr. Young said that it might open up another branch in the discussion if he replied to Mr. Meiklejohn at once. He did not give the consumers anything, except the meter and service. They were not supplied with any fittings; and it had not been found necessary.

Mr. J. C. Belton (Willenhall), referring to the last paragraph in the paper, said Mr. Young stated that the average consumption per prepayment meter was, in 1894, 8666 cubic feet, and, in 1895, 8818 feet, which was a little in excess of the amount used by the ordinary consumer.

Mr. Young: That is in comparison with the average of the ordinary 2-light system.

Mr. Belton said that was what he intended to ask—whether Mr. Young was referring to the ordinary 2-light or 3-light consumer only?

Mr. W. North (Stourbridge) remarked that he had had some little experience of these meters. In the first place, he should not be disposed to criticize Mr. Young's paper at all, but would simply state his own experience in the matter, and leave it for comparison. They were all beginners in this work; and each of them, no doubt, tried to do the best he could under existing circumstances—they could not all work on exactly similar lines. About the same time that Mr. Young introduced his system, the Local Authority of Stourbridge purchased the gas-works—that was in June, 1893. About a month before that, he obtained three prepayment meters, and put them into the houses of his own men. After the Commissioners had purchased the works, they had an exhibition in the first week of July; and he had six of the meters fixed in the Corn Exchange, with all the lights attached to them—three lights to each. He had not introduced 2-light meters; only 3 and 5 light ones. From the time of the exhibition to now, they had never ceased fixing meters; and by Christmas next—2½ years—they would have about a thousand fixed. They had done but little in the way of advertising; and they had fixed more than one a day since they commenced. The system had been a perfect success in their case, and had given little trouble. He started on a liberal policy, and took rather broad lines. He gave the consumers 25 cubic feet of gas for a penny at the present price, and fitted up their houses free. They did not take the service-pipe into the calculation, as that was put in in the case of ordinary consumers. They gave the prepayment consumers three lights—a pendant and two brackets; and as they supplied 25 cubic feet of gas for a penny (which was 3s. 4d. per 1000 cubic feet, as against the ordinary charge of 2s. 8d.), they obtained 8d. per 1000 cubic feet to cover interest on the outlay and any extra expense. In the quarter ending September, £237 7s. was collected from the meters, which showed that they would get above £1000 in the year. This was all new business, with the exception of about half a dozen people whom they did not care to trust—the tenants of little public houses, for instance. They refused to pay a deposit; and so he put in slot meters. Some of the old consumers asked for slot meters; but he would not let them have them. As to the returns, in order to check them, last quarter they worked out the amount of money they ought to have received for the total consumption registered by the slot meters; and it was found they were a few shillings to the good on the whole transaction, which indicated that the meters were working very correctly. They had at that time 800 of the meters fixed; and now they had 846, with 138 on order, so that they would easily make the number 1000 by Christmas. They had had two cases of tampering with the meters. In one, the bow of the lock was filed in two; and in the other, the money did not correspond with the state of the meter. In the latter case, they had a special lock made for the consumer; and the deficiency had not occurred since. His Committee were perfectly satisfied with the way the consumers had been dealt with; and he was convinced that the more liberally they could treat them, the better the system would succeed. He did not think there was anything in the paper he should care to criticize. Circumstances varied in every place; and Mr. Young was fortunate in having got his business without dealing so liberally as he (Mr. North) had had to do. So long as Mr. Young could do that, he should say, "Go on, and prosper." Districts, however, differed; and the inhabitants differed. He was of a strong opinion that they would not have obtained half the number of consumers they had done if they had proceeded under Mr. Young's plan. He would fit up a house free rather than lose a customer; for the more gas they had to make, the cheaper they could produce it. New business was a very desirable thing to have. The standing charges remained the same; and the little additional expense for collection was covered by the extra 7d. or 8d. per 1000 cubic feet sold. They chose as their meter inspector a man who had been on the works twenty-seven or twenty-eight years; and they did not go to the trouble of checking him as some of the members did their inspectors. They collected every month; and from some of the meters they obtained as much as 17s., 18s., and even 20s., so that they would not run a quarter without being choked up. He could scarcely agree with Mr. Cross respecting the shilling meters. With such meters, they would be cultivating a higher class of consumer altogether. The working man was what they were going for; and for him the penny-in-the-slot meter was the most suitable. As he had remarked, some of his old consumers had asked for slot meters. They would come to him and say: "I want a slot meter." He would ask: "Do you call yourself a working man?" and the reply was something to the effect that "I should

not like to be classed as one," upon which he (Mr. North) would remark: "Then don't have a slot meter." This, he found, was the best way of settling the matter. (Laughter.) To push the shilling meters was a mistake, as they would not appeal to the class of consumer the prepayment system was introduced for. It was intended to capture the working class; and he knew, by experience, that they had hitherto failed to get that section of the community as consumers. There were three things that kept them back. In the first place gas companies would not trust them; secondly, they could not afford to fit up their houses themselves; and, thirdly, they could not afford to pay a deposit. Now gas companies and gas committees had met them with the prepayment meter; and having obtained a footing among them, gas managers must do their utmost to make the system a grand success.

Mr. Young, in replying to the discussion, said that Mr. Cross had spoken of the peculiarity of the district supplied by the works under his (Mr. Young's) charge, and of the number of consumers decreasing. They had, and most manufacturing districts had, a shifting population. The people were keen enough to come in during the winter time; but directly the light weather came, they would fly off again. In places of that kind, people would often burn gas, under the old system, for a quarter or two; and then, when the bill came in at the end of the quarter, they would find it amounted to more than they had been able to save. The British working man was not, as a rule, of a very saving disposition; and it was a bit awkward for him to have a bill for gas and the demand-note for his rates coming in at the same time. Then he would have the gas cut off; and this was the reason why the actual increase in the number of consumers was so small in a district like his. The introduction of prepayment meters had obviated this; and the working man showed his approval of the system, and was pleased to do so, especially since the price of oil had risen. With reference to the point as to the alteration of the meters on a reduction of price, that would involve a considerable amount of difficulty, because there were a good many of the meters he would wish to have tested if any alteration were made. Any little discrepancy that occurred now between the amount of gas shown by the index as having been consumed and the amount of money in the box, was easily adjusted. They were always something to the good; and therefore they could afford to return to the consumer the difference in the price, after having seen that the money was correct. This was rather a favourite method with the consumer himself. He liked to get his "bit" of money at the end of the quarter. As to Mr. Cross's system of two books for the registration of the meters, Mr. Hulse had said something upon the point; and he (Mr. Young) could not see how Mr. Cross's man could have any check on the amount of money found in the meter when he was not in possession of the last index—he could not check it until he returned to the office.

Mr. Cross: It has nothing to do with the collector whether the cash is right in the box or not; he has simply to hand in the cash and his book to the office.

Mr. Young (proceeding) said that Mr. Cross had also remarked that monthly collections kept him in touch with consumers, and enabled complaints to be attended to. In his (Mr. Young's) case, few of the meters required a monthly collection. As to complaints, the consumers, whether there was a monthly or quarterly collection, were keen enough upon complaining if they had anything to complain about. It made rather a serious item in wages alone, if they had men perambulating the district making monthly collections. Regarding shilling-in-the-slot meters, in the case of some public houses, shops, and so on, where they might have had difficulty in the old days to get the money, and had had to threaten to cut off the supply, these meters were very useful. Mr. Hulse had stated that 30 per cent. of his consumers were on the prepayment system; but he had not informed them how many of his old consumers were now supplied in this way.

Mr. Hulse: About two-thirds of the consumers on the prepayment system are new.

Mr. Young said the question of fittings was rather an awkward one. There were two sides to it. If they were going to codle up the new consumers, they ought, in fairness, to fit up the houses and even mills of those who had been good consumers in the past. The 8d. per 1000 cubic feet would not necessarily cover the cost of the fittings. If the consumer was burning a fair quantity of gas, 8d. per 1000 feet was a very good return. It was true that the cost of the fittings on the prepayment system was not very large; but, at the same time, it was difficult to see why they should not extend certain privileges to the old as well as to the new consumers. This was a question that each manager must decide for himself. He should like to ask Mr. North whether, if the fittings were already in the house, he gave the consumer more gas, because otherwise it would not be fair.

Mr. North: I wish you would not ask such close questions. (Laughter.)

Mr. Young concluded by thanking the members for their attention, and especially those who had taken part in the discussion.

[The remainder of the business was reported in the Journal for the 29th ult., p. 876.]

THE COMMERCIAL VALUE OF PHOTOMETRY.

(*Continued from p.* 924.)

We have now to meet another line of attack. The claim has been repeatedly made that some kinds of light possess greater "diffusive" power than other kinds; that there was here a departure from the law of distances; and that this departure was easily apparent to the unaided eye. If this were so, it would necessarily be because the light from some parts of the spectrum penetrated distance better than from other parts. Generally the statements in this connection have been most indefinite as to argument, but none the less positive on account of that weakness.

One gentleman, prominent in our discussions eight years ago, did, however, back up his position as an advocate of differences in "diffusibility" by stating that "we know that the yellow rays have greater diffusibility, and take up more room in the spectrum, than the lighter and whiter rays." It was contended that a 16-candle coal-gas light gave fully as great an illuminating effect as a 20-candle water-gas. Generally this was coupled with the statement that the light from the water gas was less diffusive on account of its "greater intensity," or on account of the flame being whiter.

This was made the point for discussion in a paper entitled "Illumination *versus* Candle Power,"* which I had the honour to read before this Association at its meeting in 1887. In that paper, I detailed the results of a series of careful experiments in which the "diffusive" power of the lights from a coal-gas flame, a water-gas flame, and a Welsbach lamp were compared. The coal gas was of 16·5, and the water gas of 23 candle power. In these experiments, the disc was set at the centre of a long table, and the burners were put at equal distances on each side of the disc, and then adjusted to give equal intensities of illumination. The burners were then moved out each one foot from the disc, and another reading made. This was repeated foot by foot, until the burners were so far removed that the illumination on the disc was reduced too low for satisfactory work. The readings remained practically constant. This proved that the light from the whiter water-gas flame and from the still whiter (or greener) Welsbach, carried as well as the light from the yellower or redder coal-gas flame.

The recent discussions in England have been as to the relative illuminating power of flames of the same candle power. It has been claimed that the flame from a low-candle gas gives a more diffusive light than the flame of higher-candle gas. But there has not been a close agreement as to the reason for this; some contending that this claimed superiority of the low-candle flame was due to lower intensity, and others that it was due to a whiter flame.

This claimed difference in diffusibility or carrying power was also particularly referred to more than once in the discussion of Mr. Newbigging's paper on "Illuminating Power and Illuminating Effect,"† in connection with the comparison in lighting effects of a gas-flame and a kerosene-oil lamp. As in our discussions, where gas and electric lights were compared, the claimants for greater diffusibility were here willing, as opposed to a common competitor, to claim the advantage for gas without specifying its kind.

The kerosene-lamp light is spoken of as being "less in quantity," "of greater intensity," "more concentrated and localized." Shop windows having brilliant illumination showed no diffusion outside the windows, as compared with gas-lighted windows, &c. The kerosene-oil flame being quite different in character from either a coal-gas or a water-gas flame, I determined to test the relative carrying power of the lights from these flames. Through the courtesy of Chief Engineer Bradley and Dr. Elliott of the Consolidated Company of New York City, I was able to make the tests at their Twenty-first Street laboratory, where both water gas and coal gas is on tap. The oil-lamp used was the "Belgian," and gave about 35½-candle power; the coal gas was of about 16-candle, and the water gas of about 27-candle power. The same arrangement as in the experiment of 1887 was employed; sufficient gas in each case being burned to balance the light of the lamp when the first reading was made. Dr. Elliott and his assistant agreed with me that this test failed to discover any difference in carrying power or diffusibility.

The only warrant which I have been able to discover for a belief in any difference in this direction is in a minor point mentioned by Captain Abney and Professor Palaz. Captain Abney says that, in the case of low intensities of illumination, the eye is less sensitive to impressions from the lower, or red, end of the spectrum than from the parts higher up, and especially from the green. The difference is discoverable by illuminating a disc with red and green lights of equal intensities, and then moving the lights away. The green light will keep the disc illuminated for a greater distance.

If there were a material difference in this regard, white light, being composite, would give a different resultant colour to the eye as we receded from the source, by reason of the retina failing to respond to the red rays equally with those from higher in the spectrum. If there is a difference in effect upon the retina, it goes to demonstrate how completely we may be deceived by

* See Journal, Vol. L., p. 970. † *Ibid.*, Vol. LXIII., p. 1219.

crude observations of lighting effect made without the opportunity for measurement of quantities; for the advantage as to greater carrying power has in America invariably, and in England generally, been claimed for the light containing the greater proportion of the red rays.

The impressions obtained, even by experienced gas men, from these crude observations are apt to be more fanciful than valuable. We can by the eye tell if a lighting effect is pleasing, or if the illumination is of a character to enable us to perform our tasks fluently. But we cannot, even approximately, so measure and compare the means employed to give the illumination observed. If in such comparisons we accept the advertised statements of candle-power values of the light-sources, the responsibility for which statements is unfairly charged to the much-abused photometer, then we are simply inviting self-deception.

It is to be noted that the men who claim the ability to make these "practical" comparisons are often the ones who express the most contempt for the values determined by painstaking photometrical observations. Such practical observations are of no value unless we obtain the number of the light-sources, and can estimate the candle power of each and the plan of distribution. We still have to account for the differences in surroundings, especially as to the relative powers of absorption and reflection of the surfaces involved. One rough test which has a value is, I think, but seldom employed—viz., the reading of different sizes of type at a given distance.

Let me, as briefly as possible, remind you of some of the reasons for the eye's inability to estimate illuminating values by simple inspection. The impression of illumination which we receive is caused by excitation of the retina. This impression is not in proportion to the visual intensity energy, nor is it even in proportion to the actual illumination developed. A given amount of energy developed into visual intensity energy will furnish widely different results for the different parts of the spectrum. Taking dark red as 1, the yellow will be 28,000; the green, 100,000; the blue, 62,000; and the violet, 1600. But this concerns us more in connection with the economical production of light than in connection with the comparisons between the lighting values of certain light-sources, no matter how or at what cost produced.

But even here we must always bear in mind that lighting values are arbitrarily determined by the retina. If a surface is illuminated with a certain intensity, the practical result is not in proportion unless the effect on the retina is in proportion. But the retina does not act alone; the adjustable diaphragm, the iris, co-operates with the retina to prevent, as far as possible, too violent and sudden excitation of the former. If this protection is insufficient, then the retina is rendered temporarily incapable of appreciating the value of a given impression. This paralyzing effect is produced by too great an intensity of illumination; by abrupt variations in the degree of illumination; and, more than all, by the direct rays from a light-source of great intensity. Familiar examples of this effect from each of these causes instantly occur to all of us.

(*To be continued.*)

THE CHEMICAL PURIFICATION OF ILLUMINATING GAS.

In the notice of the proceedings at the annual congress of the Société Technique which appeared in the JOURNAL for July 23 last, it was mentioned that one of the papers submitted in competition for the Society's premiums was on "The Chemical Purification of Illuminating Gas;" the authors thereof being MM. Delseaux and Renard. The full text of the paper has been published in the *Journal de l'Eclairage au Gaz;* and, as the Committee of the Society deemed it worthy of a prize of 750 frs., we give a full abstract of it.

The authors introduce their subject by remarking that purification may justly be considered as one of the most important branches of the gas industry; and the aim of those engaged in it should, they think, be to have a system which not only ensures the extraction from the gas of the greatest number of its injurious properties, but utilizes them in the production of bodies possessing a certain commercial value. The operation of purification may be divided into two branches—mechanical and chemical; the former comprising condensation, and the latter including washing and dry purification. On leaving the hydraulic main, the gas contains tarry vapours, the condensation of which is important from the point of view of the separation of naphthalene and of the richness of the gas in benzol; ammoniacal salts, which have a corrosive action, and produce, in burning, deleterious gases; sulphuretted hydrogen and other sulphur compounds (the impurities to which the greatest importance is attached in the contracts entered into between local authorities and gas companies); cyanide compounds, which in combustion throw off carbonic acid; and, finally, carbonic acid itself, which not only largely diminishes the light-giving power of the gas, but vitiates the atmosphere. Carbonic oxide may be regarded as an impurity; but so may all the other gases other than the light-giving hydrocarbons, considered from the point of view of the luminous intensity of the flame produced by the combustion of the gaseous mixture. Still, the question of the removal of the carbonic oxide has been raised, probably on account of the large proportion of carbonic acid which this gas produces in burning, as well as of the dangers arising from escapes. But the authors think the latter are not very serious; while the removal of the impurity would cause more trouble than it would be worth.

Having given, in a tabular form, the composition, at various parts of the apparatus, of the gas experimented with, the authors take up the subject of condensation. They advise that the gas, on leaving the hydraulic main, should be allowed to flow on slowly, and be kept at a temperature of about 140° Fahr. in the collecting-main. Under these conditions, only some of the tarry vapours are condensed. The rest carry along with them but a small proportion of benzol; that which remains serving to arrest the naphthalene in the condensers proper. The temperature of the gas should be rapidly brought down to about 60° Fahr. when it reaches the tar-extractors or the condensers acting by impingement, which appliances should always be placed between the exhausters and the washers.

Taking up next the subject of washing, the authors explain that its chief object is to extract from the gas the ammoniacal salts contained therein. But they point out that, in removing these, other bodies are removed in varying proportions—some of them performing useful functions in the composition of the gas, while others are injurious, and would have to be got rid of at a subsequent stage. The efficiency of a washer depends alike upon the apparatus employed and upon the temperature at which it is worked. The operation should not be pushed too far, to the detriment of the illuminating power of the gas, especially when working under the most favourable conditions—that is to say, at a low temperature. A return to the use of metallic solutions for washing gas has been witnessed of late years; and a patent has been taken out for the United States by Mr. W. L. Rowland, of Philadelphia. It consists in adding an iron salt to the water employed to take out the ammonia; completely arresting the cyanogen, and forming a soluble compound of ferrocyanide accompanying the ammoniacal salts. The ferrocyanide, after having driven out the ammonia by the ordinary processes, is transformed successively into ferrocyanide of calcium, double ferrocyanide of calcium, and potassium; and then, after treatment by alkaline carbonate, into alkaline ferrocyanide which is crystallized.

The authors now enter upon the real subject of their memoir—viz., the chemical purification of gas; and they divide their work into three sections: (1) The operation and the materials employed therein; (2) the revivification of those materials; and (3) spent materials.

Dealing first with the operation, the authors remark that prior to it the gas contains as impurities sulphur compounds, hydrocyanic acid, and carbonic acid. The part played by chemical purification has for a long time been to rid the gas of those properties which should not be contained in it, especially sulphuretted hydrogen. But the removal of the other two acids is as important from different points of view—one especially being injurious to the illuminating power of the gas, and the recovery of the other reducing, in greater or less proportion, the cost of purification. The various materials which have been employed for purifying gas—lime, natural oxide, oxide of iron, Laming material, &c.—are touched upon; and then the authors proceed to consider their affinity for hydrosulphuric and hydrocyanic acids when working under the same conditions, and endeavour to ascertain what would be the influence of different causes—such as temperature, moisture, speed, &c.—on the process of revivification. They summarize what has been written upon this subject; adding the results of their own personal investigations.

The first material to be considered is oxide of iron; this being the one now most employed. It is found in a natural state in the anhydrous or hydrated form. This difference in its composition—viz., the hydration—is a rather important matter. According to Brescius, dry sulphuretted hydrogen, which does not act upon anhydrous oxide of iron, reacts, with a rise in temperature, upon ferric hydrate; humid gas acts only incompletely upon anhydrous oxide. Mr. Lewis Thompson explained the maximum of power of the oxide, after three or four passages in the purifier, by the fact that the oxide is at first in the hydrated condition, and passes into the anhydrous state, which has more effect in purification. Others have come to the conclusion that the oxide should be hydrated in order to act upon sulphuretted hydrogen—that is to say, that anhydrous oxide is of no use for the purification of gas. In agreement in this respect with the opinion expressed by Mr. John T. Sheard, the authors consider that sulphuretted hydrogen acts upon both anhydrous and hydrated oxide of iron; and that if the action is less rapid in the former case, the activity continues longer. They, however, acknowledge the presence of hygrometric water in the reactions.

The natural oxides of iron may, from a mineralogical point of view, be divided into anhydrous and hydrated. The kind most in use for the purification of gas is bog ore, which is very plentiful. As supplied to gas-works, the stuff is in a more or less compact state, and cannot be used as received, but has first to be pulverized. The molecular condition in which it is submitted to the stream of gas is a matter of much greater importance than is generally supposed. Three experiments were made by the authors with dry hydrated oxide—the first with

the material in fine powder; the second, with it in small grains; and the third, with it in larger pieces (0·2 to 0·3 inch in diameter). The result showed that the granular is better than the powdery condition; but in most gas-works on the Continent, a little sawdust is put with the oxide to absorb any moisture. Whatever inert material may be added, however, it should only be in such quantity that the gas easily passes through the mass, as when in use it increases in bulk by the formation of free sulphur. The quantity of hygrometric water contained in the oxide exercises considerable influence, not only in regard to the reaction, but to the caking of the material. In point of fact, there can be no doubt that a dry oxide will become clogged more easily than a wet one, and will consequently offer greater resistance to the passage of the gas. It must not be supposed, however, that a material should contain a certain percentage of water in order to have its maximum of effectiveness. Mr. Sheard thinks that, as a general proposition, oxide which has the least moisture is the most efficacious. But if humidity is necessary, it must not be present in too great quantity.

The authors next describe in detail the reactions which go on in purifiers; studying successively the action of sulphuretted hydrogen and hydrocyanic acid upon oxide of iron. They acknowledge the difficulty, if not impossibility, of getting an exact idea of these changes, owing to the diversity of the gases acting upon the complex mixtures of oxides of iron. They therefore rely upon laboratory experiments with pure gases acting separately and mixed upon pure oxide; all possible precautions being taken that these operations should be carried on in neutral atmospheres—*i.e.*, not liable to be affected by the outside air. Full particulars of these tests are given. The authors point out that the reactions described vary according to the rate at which the gas passes through the oxide, the time of contact, temperature, the hygrometric condition of the gas, and its more or less perfect washing. These matters are successively considered. Speed should be proportionate to purifying surface. Mr. Crisfield, of Savannah, has shown that the useful surface for the passage of the gas should be about one-third of the total volume of the oxide. This gentleman considers that the most advantageous time of contact is 48 seconds. The results of two experiments are given to show that prolonged contact favours the formation of cyanides of iron. As to the bulk of material to be employed, the most economical result is obtained when it is 1-20th that of the gas passed in an hour. The time of contact being proportionate to the thickness of the layer of material, the authors consider it would be advisable, if the total mass of oxide became changed into sulphur, to make the layer as high as possible.

The purifying material is employed, according to its density, in one or in several layers. The authors think that, with a material weighing from 56 lbs. to 64 lbs. per bushel, a single layer would be preferable. Using one 24 inches thick, the test showed 15·65 per cent. of total sulphur, and 11·75 per cent. of free sulphur; while with the material employed in four layers 6 inches thick, they showed 14·96 and 9·03 per cent. respectively. The authors claim that their views accord pretty nearly with those of Mr. Hawkins, who is of opinion that the best way of using oxide of iron is in layers 18 inches thick, two layers in each purifier. The consolidation of the material may be affected by the disposition of the inlet and outlet pipes to the purifiers—in other words, by the direction of the current of gas through these vessels. The authors think it should pass from the lower part upwards; but a more efficacious utilization of the material is obtained in those purifiers in which the current is reversed.

The hygrometric condition of the gas evidently has some influence upon the intensity of the chemical reactions. For example, dry sulphuretted hydrogen does not act upon oxide of iron deprived of all trace of moisture. This is the case not only with oxide of iron, but with other bodies, such as acetate of lead, lime, magnesia, or baryta. This condition affects also the arrest of the hydrocyanic acid in the purifiers—a fact which may be easily accounted for, seeing that without humidity there would be no formation of sulphide of iron. In manufacture, gas is considered to be constantly saturated with moisture, inasmuch as, in the course of its passage from the hydraulic main to the holder, it is in the presence of water in its most efficacious state —viz., as a liquid and not as vapour. Though the temperature of the gas may be lowered, it will still be saturated with humidity; but as soon as there is a rise of temperature, the hygrometric condition is heightened. Temperature, consequently, has an important bearing on purification; and this matter the authors next deal with. The fact of purification being more efficient in summer than in winter might, they remark, lead to the conclusion that the higher the temperature the better will the material work. But this is not so. There is a maximum temperature at which the reaction does not take place; and this maximum varies for each kind of oxide. Some experiments were carried out by the authors to ascertain the effect of different temperatures on the same kind of oxide, anhydrous and hydrated; and the results are tabulated. Speaking generally, as far as the removal of sulphuretted hydrogen is concerned, natural oxide of iron is more active hot than cold; and if a certain determined temperature could be maintained for each kind of oxide, the reactions would be favoured. What has been said with regard to natural oxide applies equally to all mixtures having oxide of iron as their basis. In practice, the difficulty of maintaining this temperature is increased by the heat which is thrown off by the mass of material while it is at work—heat which does not attain its maximum till the stuff has been two or three times in the boxes, and diminishes as it becomes spent.

The authors next pass on to consider the effect of the more or less perfect washing of the gas—in other words, the presence in it of a variable proportion of ammonia—on the process of purification. Being desirous of ascertaining what would be the effect of introducing ammonia into washed gas before it reached the oxide of iron, they first caused the gas to pass into an atmosphere charged with ammoniacal vapours; and then employed gas which was free from every trace of ammonia. The results appeared at first to contradict those arrived at by MM. Aguitton and Debenoist, who investigated the matter a few years ago, and communicated the results to the Société Technique in 1889. They showed that the absence of ammonia from the gas reduced the sulphocyanates, but augmented the ferrocyanates, in the material; and that if the total quantity of cyanogen retained in the two cases were calculated, less would be found in the latter. They therefore came to the conclusion that the effect of the absence of ammonia was to render a portion of the oxide inoperative, owing to the formation of prussian blue, and that consequently its purifying power was considerably diminished—to the extent, in fact, of 32 per cent. In the authors' experiments, the oxide through which the gas freed from ammonia had passed contained 22·41 per cent. of sulphur, 0·44 per cent. of sulphocyanic acid, and 2·40 per cent. of prussian blue; that through which had passed the gas charged with ammoniacal vapours contained 20·26 per cent. of sulphur, 1·85 per cent. of sulphocyanic acid, and 6·75 per cent. of prussian blue. But it is pointed out that the two currents of gas were equally well washed, and consequently they contained the same quantity of hydrocyanic acid. MM. Delseaux and Renard found, like their predecessors, that the largest quantity of cyanogen is retained when ammonia is present. But if the latter increases the formation of sulphocyanates, it also augments the cyanides; and, regarded from this point of view, it would act more efficiently in the last purifiers, where sulphuretted hydrogen is no longer present.

The authors now come to the subject of purification by lime, their remarks on which will be noticed in a subsequent issue.

Southern District Association of Gas Engineers and Managers.—The next general meeting of this Association is to be held at the Holborn Restaurant on Thursday, under the presidency of Mr. S. W. Durkin, of Southampton. We learn from the circular issued by the Hon. Sec. (Mr. J. W. Helps, of Croydon), that after the formal business, which will include the election of officers for the ensuing year, Mr. C. C. Carpenter will read a paper on "Gas Condensing and Exhausting;" and Mr. A. E. Broadberry will deal with "Cleansing Spent Oxide." These matters having been discussed, the members will consider a letter which has been received from the Hon. Sec. of the South-West of England District Association, in regard to the proposal for amalgamation which was brought forward at the last meeting of that body.

The Dangers of Trolley Wires.—Last week, we commented on the report of Major Cardew on the subject of the accident on the electrical railway at the Giant's Causeway, and mentioned that the Inspector had recommended the removal of the rail charged with electricity, and the substitution of an overhead system placed at a height of not less than 8 feet from the ground. It is quite as well that the distance was specified, as in the event of the cable sagging, other troubles might have ensued. A short time ago, a preliminary test was made of the trolley cableway for the propulsion of boats on the Erie Canal at Tonawanda, under the direction of Mr. Frank W. Hawley, the President of the Cataract Construction Company of Niagara Falls. It appears that, after the current was turned on, the motor moved along the canal for about 220 yards, when the cable sagged under the weight of the motor, and the latter touched the ground. Flames immediately shot out and enveloped it, blazed for a couple of minutes, and then died out. With this the preliminary test came to an end. Mr. Hawley stated that it would be necessary to procure machinery to prevent the cable from sagging before any more tests could be made.

Flame Temperature and the Acetylene Theory of Luminosity.—At the meeting of the Chemical Society last Thursday, Professor Smithells read a paper on this subject. It was devoted to a discussion of the acetylene theory of luminous hydrocarbon flames which was originated by Professor Vivian B. Lewes. As the result of experimental and critical examination, Professor Smithells expressed himself entirely opposed to the theory. In the first part of the paper, the author recorded some experiments made with the platinum and platinum-rhodium thermocouple of M. Le Chatelier; and he showed that, even when special precautions are used in applying the instrument to flames, erroneous results are very likely to be obtained. The arguments which Professor Lewes had used, based on temperature measurements, on the comparison of hydrocarbon flames, on the peculiarities of the flame of pure acetylene, on the behaviour of cyanogen, and on theoretical considerations of a thermo-chemical kind, were in turn examined and rejected. Finally, Professor Smithells gave reasons for believing that the older view of the structure of flames furnishes a better explanation of their luminosity than the acetylene theory.

A TABLE FOR EQUALIZING GAS-PIPES AND BRANCHES.

In the JOURNAL for Oct. 29 (p. 874), we gave a new suggestion, due to Mr. Arthur H. Crump, in regard to the determination of the flow of gas in pipes. There has recently come to hand another statement relating to the same subject, emanating from the Norwalk Iron-Works Company (of America), and originally given in a pamphlet of theirs entitled "A Few Facts Concerning Machines for Pumping Natural Gas." This statement runs to the effect that the common idea as to the carrying capacity of a pipe being in proportion to its internal area is not well founded. A pipe 4 feet in diameter has only four times the area of a pipe 2 feet in diameter; and yet the 4-feet pipe will carry 5·66 times as much fluid as the 2-feet pipe, under the same conditions of length and head. In other words, a 2-feet pipe will only carry 17·6 per cent. of the discharging capacity of a 4-feet pipe. This proportion of carrying capacity does not hold good for smaller pipes of the same ratio of diameter. A 12-inch pipe has only 16·6 per cent. of the carrying capacity of a 24-inch pipe; and a 1-inch pipe will only carry 14 per cent. of the capacity of a 2-inch pipe. It is remarked that these features have not heretofore been taken into consideration in tables prepared for equalizing pipes. The proper values are given in the table below. In this table, the commercial or nominal size of pipe is given; but, in calculation, 1¼-inch pipe was taken as 1·3 inch diameter, and 1½-inch pipe as 1·6 inch, as these are nearer the actual sizes. The size of pipe is given in the top horizontal line; and directly underneath is shown successively the proportion of its capacity that other sized pipes will carry—these sizes being given in the left vertical column. From the table it appears that a 6-inch main can have 15 per cent. of its capacity taken off by a 3-inch pipe, 23 per cent. by a 3½-inch pipe, 34 per cent. by a 4-inch pipe; and also that a 24-inch pipe carries 38 times as much gas as a 6-inch pipe.

In taking branches off a main, it is declared to be advisable that the sum of the percentages of the carrying capacities of all the branches should be 100 per cent., or more. Turning again to the table, for an illustration of this rule, and referring once more to the 6-inch main, it will be seen that, if this main is divided into two branches, 4 inches and 5 inches in diameter respectively, the carrying capacities of these branches would only be 34 per cent. and 64 per cent. of the trunk main. Thus provision would be made in this way for only 97 per cent. of the original flow; and consequently there would be slight additional friction from the point of diversion of the branches. If the branches are made 4½ inches and 5 inches respectively, their combined carrying capacity would be 110 per cent. of the original main; and hence the flow of gas would be considerably freer than in the former case.

Relative Carrying Capacity of Pipes for Gas.

	1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	10	12	24
1	1·00	0·48	0·27	0·14	0·07	0·05										
1¼	2·10	1·00	0·55	0·29	0·16	0·10	0·06									
1½	3·70	1·80	1·00	0·53	0·29	0·18	0·11	0·08								
2	7·14	3·40	1·90	1·00	0·53	0·33	0·21	0·14	0·10							
2½	13·40	6·30	3·50	1·90	1·00	0·63	0·40	0·27	0·20	0·15						
3	21·40	10·30	5·70	3·00	1·60	1·00	0·67	0·43	0·32	0·23	0·15					
3½		16·10	9·00	4·70	2·50	1·50	1·00	0·68	0·50	0·38	0·23	0·15				
4			13·10	6·90	3·70	2·30	1·40	1·00	0·71	0·56	0·34	0·23	0·15			
4½				9·60	5·00	3·10	2·00	1·40	1·00	0·77	0·47	0·31	0·21	0·12		
5					6·70	4·40	2·60	1·80	1·30	1·00	0·63	0·42	0·28	0·16	0·10	
6						6·50	4·30	2·90	2·10	1·60	1·00	0·66	0·45	0·26	0·16	0·03
7							6·50	4·40	3·20	2·40	1·50	1·00	0·71	0·40	0·24	0·04
8								6·50	4·70	3·50	2·20	1·40	1·00	0·59	0·36	0·06
10									8·30	6·30	3·90	2·50	1·70	1·00	0·61	0·10
12										10·30	6·30	4·10	2·80	1·60	1·00	0·17
24											38·00	24·00	17·30	9·60	6·00	1·00

The Flow of Liquids in Channels.—Messrs. W. Santo Crimp and C. E. Bruges have produced a new formula for determining the flow in water-mains and sewers; and they have explained it in a contribution to the "Proceedings" of the Institution of Civil Engineers. Chezy's formula is $v = c\sqrt{rs}$, where v is the mean velocity in feet per second, r is the hydraulic mean depth, s is the surface inclination, and c is a co-efficient. The new formula is $v = 124\sqrt[3]{r^2}\sqrt{s}$; and its merit consists in the fact that only one co-efficient is employed for all sizes of channels, if they are constructed of good brickwork or cast iron. The formula has been practically tested; and it has been shown to give very trustworthy results.

The Proposed Adoption of the Metric System in England.—In the course of his address at the opening meeting of the new session of the Royal Institute of British Architects, the President (Mr. F. C. Penrose) alluded to the proposal to adopt the metric system of weights and measures in England. He said he thought the change would introduce certain far from unmixed advantages, and be attended with enormous trouble. He ventured to suggest, as an alternative to "swallowing the metric system as a whole," a plan which would, in his opinion, give all the advantages of that system with less than a tithe of the disturbance. If the inch were reduced in length by one hair's breadth, 10 of such inches would be equal to 25 centimetres, which is equivalent to the Italian *palmo*. He therefore recommended the word "palm" to denote a length of 10 inches, which would serve for general use instead of "foot." In dealing with those nations which have adopted the metre, it would be only necessary to multiply or divide by four, as the case might be—that is, divide a measurement given in metres and centimetres by four to bring it to English palms and inches, or multiply English palms and inches by four to bring them to the metrical scale. Weights and measures of capacity could be dealt with in an analogous manner by an almost insensible alteration of the ounce or the pound, the pint or the gallon; though the necessity in these probably would not, he thought, be so great, because the kilogramme and litre are considered more reasonable standards than the metre.

The Prevention of Smoke Arising from Intermittent Firing.—At the close of a paper on the above subject read before the Manchester Section of the Society of Chemical Industry, Mr. R. Le Neve Foster, F.C.S., threw out the following suggestions as helping to a practical solution of the smoke question: (1) To see that the plant is constructed in such a manner as to consume the coal to the best possible advantage with a view of minimizing the emission of black smoke. (2) To fire as carefully as is consistent with the processes carried on. (3) To consider whether a number of chimneys is advantageous or not. (4) To devise some method whereby the ratio of unconsumed carbon can be readily gauged in proportion to the volume of smoke emitted and the coal used. (5) Whether the inspection of chimneys should not be in the hands of a competent Government official, who could scientifically ascertain if manufacturers were doing what was reasonably practicable.

Professor H. Adams on the Force of the Wind.—At the first meeting for the present session of the City of London College Science Society, Professor Henry Adams, M.Inst.C.E., one of the Vice-Presidents, read a paper on "The Force of the Wind.' After reviewing a number of the recorded experiments on wind pressure, he tabulated the results upon a common basis, to show that, within certain limits, the intensity of the pressure increases with the area of the receiving surface, but over large areas the maximum is not reached in practice, owing to the wind moving in concentrated gusts. An account was given of the pressure said to have been reached in various historical gales, as well as extracts from several standard works as to the proper pressure to be estimated for in designing structures. In conclusion, the author suggested that, though 56 lbs. per square foot might be looked upon as the standard, this should be modified according to the circumstances of the case—viz., with the height from the ground-level, the unsupported width, and the angle of incidence. The pressure, according to the table submitted, varied from 16 lbs. at the ground-level to 80 lbs. at the height of 200 feet, and in the latter case from 80 lbs. at a width of 10 feet to 40 lbs. at a width of 1000 feet; while the multiplier for angle varied from 0·45 at 5 degrees to 1 at 60 to 90 degrees.

REGISTER OF PATENTS.

Producing Gas by the Use of Electricity.—Dunn, J. H., of Holloway. No. 19,423; Oct. 12, 1894.

The object of this invention is "the production, by the use of electricity, of gas from coal or other fuel—such, for example, as petroleum. or other liquid hydrocarbon or other carbonaceous matter—in a rapid and efficient manner."

The inventor provides the chamber or retort in which the gas is to be generated with electric conductors, arranged in pairs after the manner of the carbons of an electric arc lamp; the several pairs of carbons, when using more than one pair, being either worked in series or in parallel as desired. The carbons are carried in tubes inserted in holes provided in opposite sides of the chamber or retort; the inner ends of the carbons of each pair preferably meeting, so as to form the arc, about midway between the opposite sides of the retort. The liquid hydrocarbon or carbonaceous matter to be gasified is introduced into the retort through suitable passages, and is caused to cover the carbon conductors; and the retort being closed, and the current of electricity turned on, the arcs struck between the pairs of carbons causes a high temperature to be produced, which rapidly generates gas from the contents of the retort; the gas produced passing from the retort, and being subjected (if required) to any suitable purifying processes.

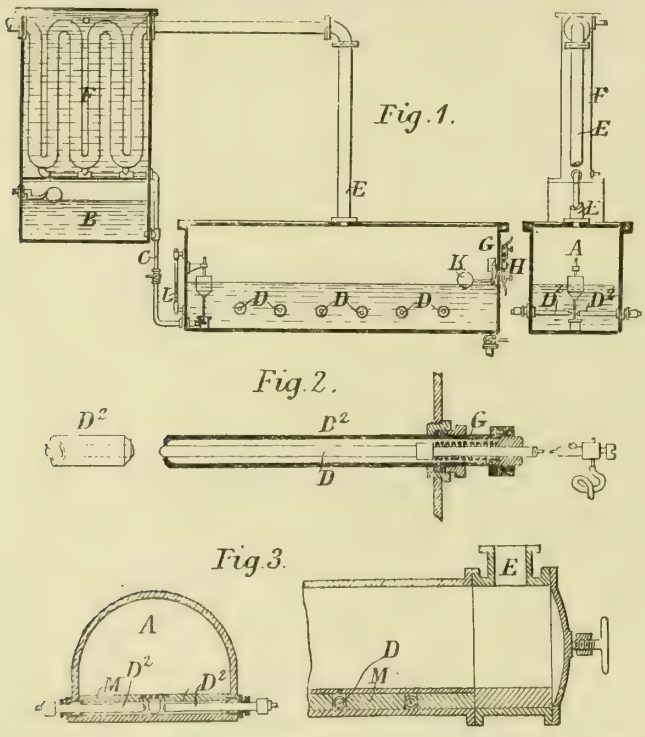


Fig. 1 represents in longitudinal and transverse section an arrangement for producing gas from liquid hydrocarbon by means of electricity. Fig. 2 is a longitudinal section of one of the carbon holders drawn to a larger scale. Fig. 3 is a longitudinal and transverse section of a portion of a retort for producing gas from coal or other solid carbonaceous matter by means of electricity.

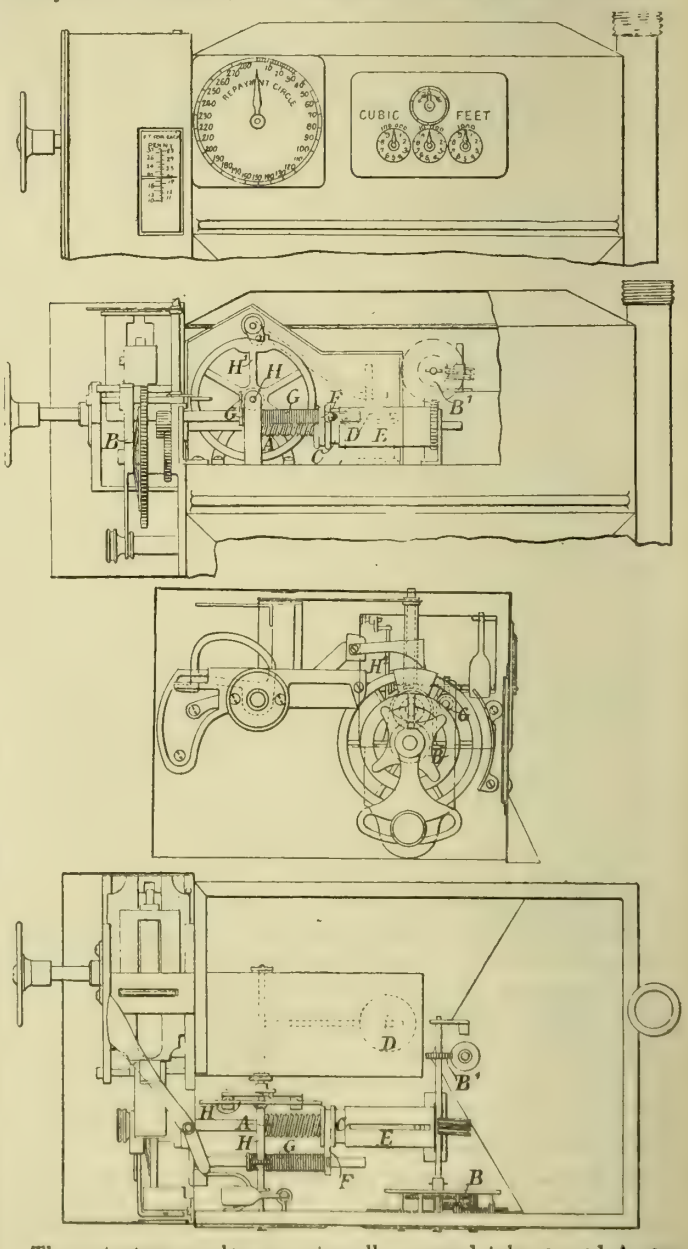
Referring to figs. 1 and 2, A is a chamber or retort for oil to be supplied from a tank B through a pipe C, provided with a stop-cock. The lower end of the pipe communicates with a chamber provided with a valve, through which the oil must pass to enter the chamber. The valve is connected to a float to automatically maintain the level of the oil uniform. The two opposite sides of the retort are provided with holes, to receive carbon electric conductors D arranged in pairs (similar to the carbons of arc electric lamps), the holders of which consist of tubes D^2, in which the carbons are free to slide under the action of springs, as shown in fig. 2, to maintain the arc. The ends of each pair of carbons may be normally in contact, or placed at such a distance apart as to prevent the arc being formed; and when the current is switched on, the tubes D^2 slide in their holes, so as to bring the ends of the carbons into position to strike the arc. As the carbons wear away, they are pressed forward in their holders by the springs, so as to maintain the arc; stops being provided to prevent the carbons from being forced too far through the tube. The oil in the chamber entirely covers the carbons; so that, when the arcs are struck, the heat therefrom rapidly gasifies the oil, and the gas generated escapes through the pipe E to a gasholder direct. It may, however, be first passed through a condenser F, wherein any ungasified vapour that may escape with the gas becomes condensed, and passes into the supply-pipe C, and is again conducted into the retort.

G is a safety device, for breaking the electric circuit should the level of the oil in the retort from any cause sink below a predetermined point. This device consists of a weighted lever H, connected to a piece in the electric circuit; the weighted lever being supported, when the level of the oil is at the required height, by means of a float K carried on one arm of a bell-crank lever, the other arm of which engages a projection on the weighted lever. Should the level of the oil sink below the normal, the float K will sink with it, and remove the arm of the bell-crank out of engagement with the projection on the weighted lever, whereupon the lever will suddenly turn with the piece on its fulcrum, and so break the circuit. The spindle carrying the piece and weighted lever H passes to the exterior of the retort A, and may be provided with a handle for returning the parts to their normal position, when the proper level of the oil is restored. L is a gauge, to show the level of the oil in the chamber or retort A.

For producing gas from coal or other solid carbonaceous material by means of electricity, an ordinary ⌂ or other retort may be employed, as shown in fig. 3; the carbons D for striking the arcs being fitted in holes in the sides of the retort, and operated to strike the arc by mechanism similar to that employed in electric arc lamps. The retort A is preferably provided with a false bottom M, having grooves or recesses to receive the carbons, so that they may be protected from injury when the coke is being drawn. Perforations are made in the false bottom where the arcs are formed, through which the heat passes to the coal placed upon the false bottom. The gas produced escapes in the ordinary manner by the ascension-pipe E.

Prepayment Gas-Meters.—Cowan, W. and W. H., of Edinburgh. No. 21,108; Nov. 3, 1894.

This invention relates to prepayment gas-meters of the type described in patents No. 11,537 of 1890, No. 24,490 of 1893, and No. 7988 of 1894. It consists of an arrangement of mechanism, by the use of which a predetermined quantity of gas will be placed at the disposal of the consumer every time a coin or token is placed in the money-slot of the meter, and an external handle or knob is actuated.



The patentees employ an externally screwed tube or rod A, one end of which is geared with the working parts of the prepayment mechanism B, so as to be revolved by it on the insertion of a coin. This tube or rod is carried in suitable journals, so as to prevent it moving lengthwise; and it has mounted on (and concentric to) it an internally screwed tube C, capable of being moved to-and-fro lengthwise, so as to be capable of actuating the supplementary valve D, or, it may be, the stop of the meter. The tube C is mounted within an outer tube or casing E, to which it is connected by a groove and feather or key or slotted opening and pin—that is to say, the movable tube C has attached to its periphery a projection, feather, key, or pin, which works in a groove or slotted opening formed in the outer tube or casing E in such a manner as to enable the latter tube, on being revolved by the meter mechanism B^1, to actuate the valve D or stop, in a reverse direction to that in which the inner tube or rod C actuates the valve D or stop, by means of the screwed movable tube or rod C, through the medium of the meter's mechanism revolving the outer tube or casing E. Or, if desired, the meter's mechanism may be caused during the consumption of gas to actuate the tube or rod A, and the working of the coin communicating part of the meter's mechanism to actuate the outer tube or casing E.

When the movable tube or rod C is employed to actuate a valve D, the connection between the movable tube or rod and the valve D may be effected by any suitable means, such as by one or more suitably

shaped levers; and the valve preferably used is a slide-valve of the kind described in patent No. 7988, of 1894.

As shown, a circular drop-valve D is employed, mounted within a valve box or chamber, the valve D being actuated through the medium of a projecting arm or lever F, the one end of which works in a groove or recess in the movable tube or rod C. The other end of the lever F engages with the one end of an auxiliary screwed rod or rack G, which gears into a spur-pinion, keyed on the prepayment circle or dial-shaft H, which has the valve-operating wheel H^1 mounted on it. This wheel actuates the crank of the valve's cross-shaft by means of a notch and projection, as described in the earlier patent.

Preventing the Freezing of Telescopic Gasholder Cups.—Livesey, F., of Old Kent Road, and Sugg, W., of Westminster. No. 23,826; Dec. 7, 1894.

The patentees propose to apply a series of water-heating apparatus to each lift of a holder below the top one, by the use of which the seal-water will be kept at such a temperature that it will not freeze. For this purpose, small vertical boilers are employed, closed in at the top, and having tubes by which the products of combustion can pass away. These boilers are heated by gas-jets supplied from the holder, and are provided with circulating-pipes, which dip into, and extend for some distance along, the gutter—preferably near the surface of the seal-water. The boiler is enclosed within a case fixed to the lift, and carrying at its upper part a small reservoir arranged to be automatically filled by rain water or by hand when necessary. It is connected with the circulation-pipe in the annular gutter, so that the boiler and tubes are kept full of water. The boiler is also provided with a steam-pipe delivering into the reservoir, and is surmounted with a suction and down-draught-preventing cowl. A series of these heating appliances are placed round each lift; and the gas, when lighted, heats the water in the boiler and pipes, circulation being set up, and thus the temperature of the seal-water surrounding the pipes in the annular gutters is maintained above freezing-point.

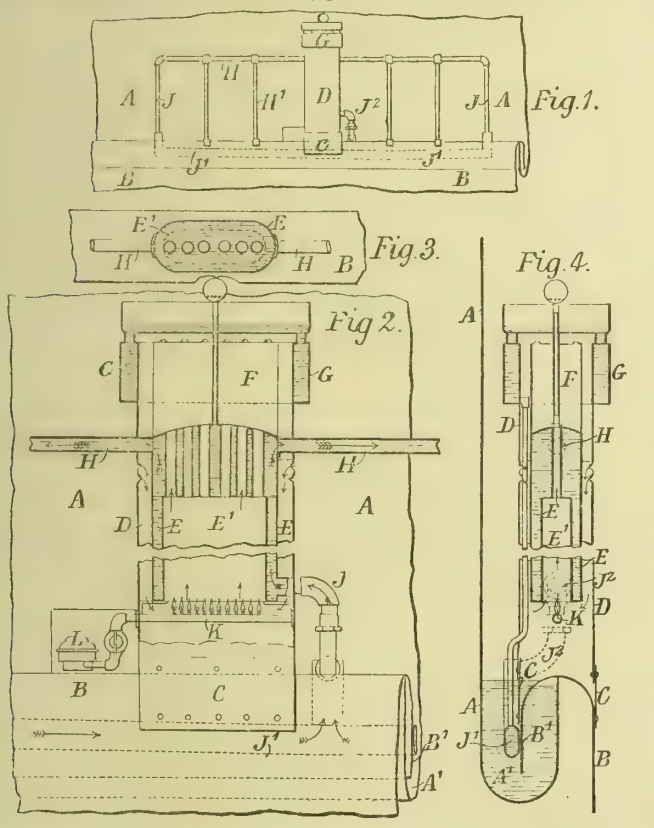


Fig. 1 is a side view of a portion of a telescopic holder, with this invention applied thereto. Fig. 2 is a vertical section of the apparatus. Fig. 3 is a horizontal section. Fig. 4 is a cross section. A represents one (the upper) lift of a holder, and B another (or lower) lift. A^1 is an annular gutter, which is filled with water, and receives the downwardly extending annular flange B^1—the two parts A^1 B^1, with the water, forming the seal. Secured to the lift B, on both sides of the bend of the flange B^1, is the casing D of the boiler E. This casing straddles the bend, and is secured in place by plates C, riveted to the lift and to the boiler-casing D. The boiler E is preferably of oval shape, and rests on brackets secured to the walls of the casing in any convenient manner. The space E^1 serves as a combustion chamber; and the products of combustion travel therefrom, by tubes (which pass through the boiler), to an upper chamber F, from which they pass to the air through the openings shown. Above the openings is a tray to catch rain water, or to receive water by which a tank or reservoir G, carried outside the casing D, is refilled; suitable connections between the tank and reservoir being provided. The chamber F, and the holes and tray constitute a suction and down-draught-preventing cowl, the construction and operation of which is well known.

H are outflow-pipes connected with the upper part of the boiler. They are connected by the bent pipes J with the heating-pipe J^1, which, in turn, is connected with the bottom of the boiler by the inflow-pipe J^2. Thus, a complete circulation of the hot water is provided for. The pipes H and J^1 extend for some distance around the holder—the former being supported by stays H^1; the latter being under the surface of the seal-water, which is thereby heated. A pipe connects the reservoir G with the pipe J^1, for keeping the boiler and circulating-pipes full of water. K is the gas-burner (of any convenient form), which draws its supply of gas direct from the holder, being tapped into the bend of the lift B—a governor L being provided to regulate the flow of gas. Air to support combustion enters the casing D by the holes shown.

Mantles for Incandescent Lamps.—Crocker, S. H., of Holborn. No. 15,246; Aug. 13, 1895.

The patentee claims as covered by his invention: 1. In the manufacture of incandescent mantles for lamps, applying the compound in a layer upon a suitable support, and perforating it upon and together with its support. 2. In the manufacture of the incandescent mantles for lamps, applying the compound in the form of a layer upon a non-absorbent support, and subsequently perforating it. 3. An incandescent mantle for lamps having corrugations from its upper to its lower edge. 4. A corrugated incandescent mantle, having its corrugations deeper or more pronounced towards its upper edge than towards its lower edge. 5. The manufacture of incandescent mantles for lamps by coating a suitable support with a compound described, and then perforating, corrugating, and baking it. The solution referred to—"to yield on ignition the luminous matter of the mantle"—is one containing a salt of erbium, which (on ignition) will become decomposed, and leave behind oxide of erbium. If the compound is applied to both sides of the mantle, the two layers will, after ignition, remain adhering together—thus giving a somewhat thicker, but rather more porous, product.

APPLICATIONS FOR LETTERS PATENT.

19,704.—Salter, G., "Coin-freed water-delivery apparatus." Oct. 21.
19,719.—Maclean, A. H., "Gas-heated smoothing-irons." Oct. 21.
19,724.—M'Lellan, N., "Reversing gas-valves." Oct. 21.
19,771.—Bayley, J. C., "Generating and regulating the consumption of acetylene gas." Oct. 21.
19,779.—Exley, J. H., "Generating acetylene gas." Oct. 22.
19,830.—Devis, A., "Production or generation of gas for artificial lighting and motive power purposes." Oct. 22.
19,916.—Ewing, W., and Meikle, J., "Enriching illuminating gas." Oct. 23.
19,922.—Hawkins, T., "Production of explosive and other gases for motive power and illuminating purposes, and carburetting such gases." Oct. 23.
19,925.—Norton, C. G., "Automatic cut-off for atmospheric gas-burners and electrical heating-stoves." Oct. 23.
19,948.—Thorn, F. S., and Hoddle, C., "Incandescent gas apparatus for photographic purposes." Oct. 23.
19,951.—Roberts, H. T., "Self-igniter for gas-engines." Oct. 23.
19,952.—M'Donald, G., "Filtering water, sewage, effluents, illuminating gas, and other liquids and fluids." Oct. 23.
19,982.—Thomas, T. C. J., "Gas-lamps." Oct. 23.
19,987.—Kelly, T. J., "Intensifying method for increasing the illuminating power of lamps." Oct. 24.
19,998.—Westmorland, J., "Fittings used in the lighting of billiard-tables by means of gas." Oct. 24.
20,018.—Hawkyard, J., and Braddock, J., "Prepayment gas-meters." Oct. 24.
20,072.—Luis, C. G., "Producing acetylene gas." Oct. 24.
20,117.—Young, T., and Guthrie, J., "Preventing vibration in incandescent gas lights, lamps, and the like." Oct. 25.
20,152.—King, R. M., "Gas-supply tubes for gas fires and stoves." Oct. 25.
20,188.—Thomas, O., and Dyer, J. H., "Pipe-joints for water-taps and the like." Oct. 26.
20,208.—Tollerton, J., "Gas-lamps for theatres, public buildings, and the like." Oct. 26.
20,225.—Videau, G. L., "Furnace for use in the manufacture of gas and for other purposes." Oct. 26.
20,259.—Potter, G., "Descending Bunsen burners for incandescent mantles." Oct. 28.
20,260.—Leveritt, T. D. C., "Gas heating-stove." Oct. 28.
20,283.—Chambard, B., "Supporting the mantles of incandescence gas-burners." Oct. 28.
20,305.—Kane, T., "Gas and like engines, and mixing and volatilizing the gases in the same." Oct. 28.
20,382.—Potter, G., "Ascending Bunsen burners for incandescent mantles." Oct. 29.
20,394.—Nicholson, E. W., "Automatically lighting coal or other gas." Oct. 29.
20,430.—Clouard, A., "Gas-producer." Oct. 29.
20,451.—Hinks, J., and Son, Ltd., and Hinks, H., "Raising, lowering, and suspending lamps or other illuminating lights." Oct. 30.
20,453.—Exley, J. H., "Generating acetylene gas." Oct. 30.
20,454.—Potter, G., "Regenerating and superheating Bunsen burners for incandescent lighting." Oct. 30.
20,468.—Atkinson, J. E., "Manufacture of acetylene gas." Oct. 30.
20,496.—Irwin, W., "Carburetting or enriching gas." Oct. 30.
20,570.—Tollerton, J., "Gas-lamps." Oct. 31.
20,583.—Thompson, W. P., "Burners for gas-cookers, gas-stoves, and other like heating apparatus." A communication from C. Wolff and A. Behl. Oct. 31.
20,588.—Knapp, C., "Gas-burners." Oct. 31.
20,613.—Butler, E. S., "Globe and chimney supports for gas and other burners." Oct. 31.
20,632.—Bancroft, W. S., and Priestley, G. F., "Manufacture of retorts and other goods from clay or like material." Nov. 1.
20,667.—Notkin, N., "Automatically and continuously carburetting air for illuminating and heating." Nov. 1.
20,697.—Brouwer, J. de, "A new Bunsen blowpipe, or Bunsen lamp—namely, an appliance for burning a mixture of air and gas or inflammable vapour for the production of intense incandescence of mineral substances employed for incandescent gas-lamps known by the name of 'Auer' or 'Von Welsbach' lamps, or other analogous lamps." Nov. 1.
20,703.—Lister, F., "Gas and like motor engines." Nov. 2.
20,705.—Bickerton, H. N., "Gas-engines." Nov. 2.
20,727.—Exley, J. H., "Generating acetylene gas." Nov. 2.
20,752.—Saatmann, F. W., "Manufacture of ammonia." Nov. 2.
20,766.—Dawson, H. T., "Inertia governors for gas and other engines." Nov. 2.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Defects of Water Meterage Systems.

SIR,—Referring to the paragraph in your issue for Oct. 29, p. 868 (headed as above), I am not at all surprised to find that the meters referred to "seldom register against the consumer;" nor is it to be wondered at that "in some metered distribution systems, about twice as much water is pumped as the total registration accounts for." The explanation is simple. The meters, which are almost universally employed in America, are of a type which are not "tight." They will therefore not register occasional small flows; and they will further become more and more leaky as wear takes place. Also, when obstructed by impurities, they will frequently stop entirely, but will allow water to pass without being registered. The statement about meters not being allowed to be fixed "if showing errors of more than 1 per cent.," is misleading and valueless, unless accompanied by data giving rates of flow in (say) gallons per hour during the said accuracy tests. These types of meters—in common with the "inferential" type—will register fairly accurately at quick flows, and when clean; but they will not do so at small rates of flow, as when water runs through a ball-valve into a cistern, nor when the meter or its counter becomes obstructed by dirt. I have been informed that, in a certain town in the States, the $\frac{5}{8}$-inch meters, when tested after a certain length of service, are not tried below 24 gallons per hour; and the $\frac{3}{4}$-inch ones, not below 145 gallons per hour. The reason is obvious. Some of the 50 per cent. discrepancy mentioned in the paragraph is, no doubt, due to leaky mains and services; but the meters are probably the greatest culprits.

M. R.

Nov. 4, 1895.

Keeping up the Gas Supply without a Gasholder.

SIR,—I shall be glad if any of your readers who may have had experience in the above, would, through the medium of the JOURNAL favour me with their opinions as to the feasibility of carrying out the following object under the circumstances stated below.

I have a small holder which is now too small; and, owing to special and surrounding circumstances, it is almost imperative that a new telescopic holder in the present tank should replace the existing one. It would take three weeks to erect; and, if done in June, this would mean only 3000 cubic feet of gas per night being supplied. With a setting of five retorts, and arranging the charging so as to keep up a constant supply, I think this might be done. A little extra expense in working, or waste of gas, or preparation, would be of little consideration against attaining the main object. I should, however, prefer having the assurance that a similar feat has been accomplished, or that it is practicable, although not very desirable.

STORAGE.

Nov. 4, 1895.

The Affairs of the Para Gas Company.

SIR,—The Pará Gas Company's Directors are proposing to reconstruct the Company, and give the preference shareholders a priority of capital in case of winding up, which priority is not attached to the preference shares now. This is a monstrous injustice to the ordinary shareholders, and may wipe out (in case of liquidation) their capital altogether. Only one of the Directors holds more than the necessary qualification. There is to be a meeting on the 26th inst., to consider the proposal. I hope all shareholders will attend, and look after what remains of their capital; or it will soon be less than it is in value, and it is nearly at zero to-day.

S. JOSHUA COOPER,
Holder of 600 ordinary shares.

Mount Vernon, near Barnsley,
Nov. 9, 1895.

The Proposed Adoption of Incandescent Gas Lighting at Fulham.—It may be remembered that the Fulham Vestry recently decided, but only by the casting vote of the Chairman, to have a trial of incandescent gas-lights in some of the public lamps. The resolution has since been rescinded.

Incandescent Gas Lighting at Winchester.—The streets of Winchester are gradually emerging from the twilight of the oil-lamp system into the brilliant illumination of the incandescent gas-light. Three or four of the principal streets are already lighted with the new burners; and the whole of the lamps will soon be connected with the mains, and the lanterns refitted. The improved lighting is giving general satisfaction.

The Charge for Gas in the Salford Out-Districts.—The Gas Committee of the Salford Corporation recently received a deputation from the Worsley Urban Council with respect to the differential rate charged to consumers of gas in the Walkden and Little Hulton districts, which are situated at the extreme limit of the Corporation's area of supply. The price charged by the Committee in the Eccles and some portions of the Worsley district is 2s. 6d. per 1000 cubic feet; but at Walkden and Little Hulton, the figure is 2s. 11d. The Committee admitted that the differential rate of 5d. was too large; and they decided to recommend to the next meeting of the Council a reduction of 2d. per 1000 cubic feet.

New Joint-Stock Companies.—The following new Companies have lately been registered: The Meteor Incandescent Lighting Company, Limited, with a capital of £140,000, in £1 shares, to manufacture and deal in incandescent lights and carry on business as gas engineers, &c. The Truro Gas Company, Limited, with a capital of £25,000, in £1 shares, to enter into an agreement with the Truro Gas Company and the Liquidators thereof, and generally to produce and supply light in the city of Truro and elsewhere. The West African Oil Syndicate, Limited, with a capital of £40,000, in £1 shares, to enter into agreements for the acquisition of certain lands in the Gold Coast Colony, to develop and turn them to account, and to carry on business as importers of, and dealers in, coal tar, petroleum, &c.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Saturday, Nov. 9.

(*Before the* LORD CHIEF JUSTICE *and Mr. Justice* GRANTHAM.)

Price v. The South Metropolitan Gas Company—The Southwark Bridge Explosion.

This case came before the Court on an appeal by the defendants from the decision of the Judge of the Lambeth County Court, given in June last, awarding the plaintiff £12 by way of damages, arising out of the Southwark Bridge explosion. (See JOURNAL, Vol. LXV., p. 1385.)

Sir E. CLARKE, Q.C., M.P., and Mr. ATHERLY JONES appeared for the appellants; Mr. LYNDEN BELL represented Price.

Sir E. CLARKE, in opening the case, said the action was brought by a labourer named Price, who, when going across Southwark Bridge in February last, was blown into the air by an explosion which occurred under the roadway. It was alleged that it was caused by an escape of gas from a cracked pipe belonging to the defendant Company. According to the evidence, it appeared that, about a month prior to the accident, the ground in the vicinity of the pipe in question had been opened by Messrs. Mowlem; and it was no doubt owing to the disturbance of the soil by them that the pipe became cracked. The judge found that the defendants had been guilty of negligence in not having such a system that they could find out when the ground was opened under their pipes, and in not discovering the escape. He also found that it was negligence on the part of the defendants in not having seen to the replacement of the earth under the pipe after the ground had been opened. If this finding were to stand, it would impose upon the Company, with 800 miles of pipes, the duty, at the risk of being held negligent, of finding out every time sewer authorities, electric light people, or anyone else opened the ground.

The LORD CHIEF JUSTICE remarked that this did not seem to be a very formidable obligation, because the lamp-lighters were constantly going up and down the streets, and so had the opportunity of seeing what was going on. According to Mr. Livesey's evidence, it was the duty of the employees of the Company to report when the ground was opened.

Sir E. CLARKE said frequently the ground was opened and closed again in two or three hours, before any information could be conveyed to the Company's offices. If the Company had had notice of this opening by Messrs. Mowlem, and if they had had an opportunity of sending an inspector to see that they did not, in the course of their work, affect the stability of the pipe, a different argument would arise. Then it might have been said that, knowing of the opening of the ground, and not guarding against injury to their pipe, the Company were negligent. But in the present case, as the Company were not informed of what had taken place, he contended that they were not negligent. The mere fact of an escape of gas at a particular spot was not, in itself, evidence of negligence. It might arise from all sorts of causes which were not preventible. Again, a mere escape of gas would not, by itself, bring about an explosion. There must be something to cause it to explode.

The LORD CHIEF JUSTICE asked if there was any provision that people who opened the ground should give notice, to gas companies and others owning pipes under the soil, of what they were doing.

Sir E. CLARKE said there was not.

The LORD CHIEF JUSTICE: You do not object to the amount of the damages, supposing you are liable?

Sir E. CLARKE said he did not. He then referred to the Gas-Works Clauses Act, 1847; section 24 being the one referring to the liability of a gas company in respect of an escape. The words of the section were as follows: "Whenever any gas shall escape from any pipe laid down or set up by or belonging to the undertakers, they shall, immediately after receiving notice thereof in writing, prevent such gas from escaping; and in case the undertakers shall not, within 24 hours next after service of such notice, prevent the gas from escaping, and wholly remove the cause of complaint, they shall for every such offence forfeit £5 for each day during which the gas shall be suffered to escape." This section referred to the escape of gas in the houses which the undertakers served; and it was the only penalty imposed on the gas company in respect to an escape. He submitted that no sufficient evidence of negligence had been proved against the defendants to render them liable.

The LORD CHIEF JUSTICE, without calling upon the respondent, in delivering judgment, said the plaintiff in this case sued the South Metropolitan Gas Company for negligence, which he alleged caused him damage. The case came before the County Court Judge at Lambeth, who found that there was negligence causing the plaintiff damage; and accordingly he gave judgment for him. The question before the Court was whether that judgment could be supported. Sir E. Clarke was quite right in his contention that, before the plaintiff was entitled to succeed, he must establish negligence of an actionable kind. It was clear that the Company, having statutory powers and authority to lay their pipes, were not liable in respect of anything which might happen to anybody in the exercise of that statutory power, unless they were guilty of negligence—in other words, the "wild beast" principle, as it had been called in a well-known case, did not apply to this case. The facts were that in the month of January last Messrs. Mowlem and Burt, the Contractors for the Commissioners of Sewers, did some work in the neighbourhood of the gas-pipe. The details of the work, and the precise way in which it affected the gas-pipe, were not stated. The pipe in question was a 3-inch main, and was embedded in the soil of the public highway at a depth of 10 inches from the surface. On the 1st of February, the plaintiff, lawfully passing along the highway, received damage from an explosion of gas which took place in close proximity to the spot at which Messrs. Mowlem had been at work the previous month. Thereupon he brought his action, and established certain facts, from which he said an inference of negligence against the Company might properly be drawn. There was found to have been an old longitudinal crack in the pipe in question, which the plaintiff said rendered it an improper pipe. But the existence of this fact was not known, nor did there seem any ground for saying that it was not known

in consequence of any negligence of the defendants or their employees. This crack was not the immediate cause of the accident; but it had been said by Mr. Livesey that its existence would have the effect of rendering the pipe weaker at that point. Then there was found to be, at right angles to the longitudinal crack, a crack of some two or three days' standing at the time of the accident. There was no doubt that it was from this transverse crack that the gas escaped which caused the accident. Further, it was shown that, in the immediate neighbourhood of this transverse crack, the soil had been disturbed to a distance of some 2 ft. 5 in.; and one of the servants of the Company, referring to the looseness of the soil, spoke of putting his crossbar in easily to a depth of 18 inches. This pointed to the fact that this gas-main was not adequately supported by the soil underneath, and, therefore, was more liable to receive damage, not merely from the influence of the frost, which was severe at that time, but from the action of the heavy traffic which passed over the highway in question. It was said that, as regarded the loose state of the soil, no blame or negligence should be attributed to the Company, because they did not know that the ground had been disturbed. He (his Lordship) would here take the opportunity of saying that it did seem to point to a serious omission in the provisions of the Local Acts that the parties who, under statutory authority, interfered with the surface of the Queen's highway, in, under, and along which pipes of various kinds for water or gas, tubes containing electric wires, &c., were laid, were not compelled to give to all other persons who had like rights, notice of their intention to disturb the surface. However, it seemed, according to the statement of the defendants' Counsel, that there was no such provision. Would it be imposing on the Company, who, it was known, had practically the monopoly of the supply of gas in the South Metropolitan district, a very onerous obligation that they should be required, by their servants, to be vigilant to see whether or not there was any disturbance of their pipes, which might be the cause of mischief to the public. The Company had obtained their powers no doubt originally in the public interest; but they carried on their business for their own profit. The carrying on of their business involved the employment of a number of men whose duty it was daily—one might almost say hourly—to go up and down the streets and thoroughfares along which the gas-pipes were laid. The evidence of Mr. Livesey showed that it was part of the business of the employees to report to head-quarters the fact of any of these disturbances; and rewards were given for such reports. The fact of the employees omitting to make a report was a burden which the Company must bear. They could not be exonerated, merely by saying that the employees did not report this particular thing, from exercising reasonable diligence and care. The employees might have known, ought to have known, and ought to have reported. There was one remaining point, upon which no stress had been laid; but still it was a point unquestionably that must be considered by the Company in future in the light of the experience which recent events had disclosed. He adverted to it, not for the purpose of basing his judgment upon it, but simply to show that he had not forgotten it. It seemed a strange thing that gas-mains of this importance should be, wholly apart from any question of frost or disturbance of the soil, permitted to be placed in a highway having heavy traffic, at so slight a distance below the surface as 10½ inches. In conclusion, he would say that, looking to the character of the crack, and the length of time during which the gas was in all probability escaping from it, it ought to have come to the knowledge of the employees of the Company at an earlier period than the date of the accident, and by them reported to the defendants. The Company ought to have known of the disturbance to the soil, and ought to have seen that the ground was properly restored by Messrs. Mowlem—rammed home tightly, so as to form an adequate support to the pipe. The simple point being whether there was evidence on which the County Court Judge could properly find there was negligence, speaking for himself, he had no hesitation in saying there was. The appeal must therefore be dismissed.

Justice GRANTHAM concurred.

Sir E. CLARKE said, as this was a very important case to the Company, he would ask for leave to appeal, should they be so advised.

The LORD CHIEF JUSTICE saw no objection to granting the leave; but he suggested that the defendants should pay the plaintiff his claim, and costs.

Sir E. CLARKE said his clients would be quite prepared to do this. An appeal had not yet been decided upon.

HIGH COURT OF JUSTICE, IRELAND—QUEEN'S BENCH DIVISION.—Monday, Nov. 4.

(*Before Justices* JOHNSON, O'BRIEN, *and* GIBSON.)

Alliance and Dublin Consumers' Gas Company v. Dublin Corporation.

This case came before the Court to-day for the making of a final order in reference to recent litigation between the parties, on the subject of the gas lighting of the City.

Mr. R. P. CARTON, Q.C., appeared for the Corporation; Mr. A F. BLOOD, for the Company.

Mr. CARTON said the parties had agreed to the form of the order, except as to the old question of the "bends," which amounted to the ridiculous sum of 7s. 9d., and neither side was inclined to give way. Under these circumstances, it would be an absurd thing to have a new trial on this point. The whole question was whether a bend was really part of the lamp-post, or whether it was not part of the machinery for conveying the illuminant, and therefore the Company, and not the Corporation, should bear the expense of it. The action was brought for £308 os. 2d.; and the Corporation lodged £32. After the trial, they found that they had not lodged enough; and they admitted liability for £61 11s. 11d., including the £32. The jury gave, not £308. os. 2d., but £307 18s. 2d.; there being a slight mistake in the total. On the new trial motion, there were two questions argued. One was whether the Corporation or the Company were to bear the expense of fixing the meters in the lamps; and this was decided against the Corporation. The other question was whether the Corporation were liable for payment in case of alteration in the position of lamps, or resumption of discontinued lamps; and the Court decided this against the Company. The figures worked out so that, instead of £307 18s. 2d. which the jury found, the Court held that the Company were only entitled to £147 10s. 8d., after giving credit for £61 11s. 11d.—in other words, the Corporation had won £160 19s. 6d. in the litigation; and the other side had increased the sum admitted by £85 18s.

Justice GIBSON said the Court had provided that both parties should pay their own costs of the argument, and that the defendants should bear the costs of the trial.

Mr. CARTON pointed out that Justice Holmes, in his judgment, said: "The plaintiffs are entitled to the costs of the action; but I think that under no circumstances ought they to have the costs of this argument. It appears on the matters really argued that defendants were entirely successful; and the defendants ought to get the costs. But until we know this matter about the meters, we cannot very well say finally." He would ask that judgment should be entered for £147 10s. 8d., excluding the 7s. 9d., and let it be without prejudice on that subject.

Justice O'BRIEN asked whether it was really worth while having a new trial for 7s. 9d.

Justice GIBSON said he was of opinion that, inasmuch as the Company had to supply the gas, they should also supply the bends.

Mr. BLOOD said that, if judgment was entered for £147 10s. 8d., with a memorandum that it was without prejudice to the rights of the plaintiffs on the subject of bends, he was quite satisfied.

The Court directed that a verdict should be entered for £115 10s. 8d. and the sum lodged in Court, £32—the parties agreeing to strike out the 7s. 9d. hitherto in dispute with regard to certain bends, without any prejudice to the rights of the parties irrespective of any claim thereon; both parties to abide the costs of argument, and the plaintiffs to have the costs of the trial.

A prospect of yet further litigation between the Gas Company and the Corporation has, says the *Freeman's Journal*, been opened up by a notice which has been served by the Solicitors for the Gas Company (Messrs. D. and T. Fitzgerald) on the Law Agent of the Corporation (Mr. J. M'Sheehy). This is notice of the intention of the Gas Company to apply to the Master of the Rolls for an injunction against the Corporation for disobedience of an order made by his Honour on July 6, when, in the course of his judgment on the litigation between the two bodies, he directed that certain defective meters should be removed from the public lamps of the city. It is alleged that the Corporation have not complied with this order; and the Gas Company appear to be determined to lose no time in enforcing their rights.

An Ingenious Plea for Reduced Water-Rent.

At the Hove Petty Sessions, on Monday last week, Mr. R. Speed, of High Street, Portslade, was summoned at the instance of the Shoreham and District Water Company, for the non-payment of £3 10s. for water supplied. Mr. F. T. Pearson, who appeared for the Company, said the claim was for water-rates, in respect of premises owned and occupied by the defendant; and the dispute turned upon the interpretation of the 47th section of the Company's Act, under which they were not obliged to furnish a supply to a single tenement for any less sum than 10s. in one year. The rate charged was 1s. in the pound; but in the case of tenements worth less than £10 per annum, as was the case with four cottages owned by Mr. Speed, the Act allowed the Company to charge 10s. a year if paid in advance, or 12s. if paid in arrear. The Company, however, were only asking for 10s. each for the four cottages, and 30s. for the house occupied by Mr. Speed. Mr. Cowell produced the Company's Portslade rate-book, which showed that Mr. Speed's house was rated at £30 a year, and the four cottages owned by him at £40 a year. In cross-examination, witness said that Mr. Speed had tendered 50s. in settlement; but it was refused, though this sum was equal to a rate of 1s. in the pound on what Mr. Speed said was the rent he paid as lessee of the property. Mr. J. J. Frampton, the Secretary of the Company, deposed to Mr. Speed signing the ordinary form of application for water to be supplied to the four cottages. Mr. A. Treacher (for the defence) contended that, while the Company were not bound to furnish a supply to any tenant for less than 10s. a year, they could not charge this sum, except under a special contract, if they did supply water to a tenement worth less than £10 per annum, as all the four cottages admittedly were. The consumers had no knowledge of this proviso; and Mr. Speed refused to pay as soon as the demand was made upon him. He tendered 50s., which was at the rate of 1s. in the pound on the rental. The Chairman (Mr. A. G. Henriques) remarked that people were supposed to know every Act of Parliament. Mr. Treacher pointed out that this was a Private Act. The Chairman said that was quite immaterial. Mr. Treacher did not agree to this; and pressed the argument that the Company's Act was only an enabling statute, and that it required some special contract to be entered into before the Company could take advantage of its proviso. The Chairman said the Court were unanimous in deciding that Mr. Speed had entirely failed in his contention, and that a customer was not entitled to set up the defence that he was ignorant of the Company's powers. An order was made for the payment of the amount claimed, with costs.

Liability for Gas on Common Stairs.

Sheriff Cheyne, the County Judge of Renfrewshire, has lately heard an action raised at the instance of the Barrhead Gas Company, Limited, against A. Darroch, for payment of an account amounting to £9 6s. 8½d., for gas consumed on the stairs of defender's property. The account extended over a period of about three years. The defence was: (1) That there was no contract between the pursuers and defender for the supply of the gas in question, which was consumed by the tenants of the property; that there was no obligation on a landlord to light stairs prior to the recent adoption of the Burgh Act by the ratepayers of Barrhead; and that although a landlord might be said to have an interest in lighting, it was of the same nature as the interest which he had in having the separate houses of his tenants

supplied with gas, for the consumption of which he was not liable. (2) That, in any event, in the circumstances in which the account was incurred, the defender was entitled to be relieved of liability. The defender's factor absconded at the beginning of the year; and the defender then heard of the action for the first time. The pursuers had no right to give credit to a local house-factor for three years without the knowledge of the proprietor; and the credit so given could only be construed as credit to the factor, not in his capacity as factor, but as an individual. The defender's right of relief had been cut off; and on grounds of equity, therefore, apart from any special rule of law, he should be assoilzied. Evidence was led by the pursuers, which was held to prove contract; and the second plea for the defender not being accepted, his Lordship passed decree without comment.

The New Water-Works for Plymouth.—A report has been presented to the Plymouth Borough Council by Mr. J. Mansergh, M.Inst.C.E., and Mr. E. Sandeman, Assoc.M.Inst.C.E., the Engineers for the new water-works, on the progress made in the construction of the new reservoir. They state that all the excavations in the lower part of the trench for the Burrator dam have been completed, and a foundation has now been reached which they consider satisfactory. They proposed to commence the building of the masonry dam in the week following the date of the report (Oct. 24).

The Electric Lighting Question at Bangor.—The discontent of the ratepayers of Bangor with the action of the City Council in applying for a Provisional Order to establish an electric light plant in the city, found expression last Friday at a meeting of ratepayers. Dr. Emyr O. Price presided, and justified the convening of the meeting to discuss a question of such importance as the proposed expenditure of £13,000 on electric light, equal to an expenditure of above £1 sterling per head of the inhabitants. He entered into the history of the gas-works, which were bought by the Corporation in 1878, and said the large increase in the consumption of gas resulting from a reduction in price, necessitated the provision of greater facilities for its production; and it was out of this necessity that the present crisis arose, and decided a majority of the Council to introduce the electric light. He was surprised that in this matter the ratepayers had not been consulted; and it would be for them to say whether they approved or disapproved of the action of the Council. He added that the additional expenditure of about £4000 just now necessitated in connection with the gas-works would be more than recouped by the increased consumption of gas that would follow. A resolution was passed calling upon the Council to reconsider the matter, with a view to deferring any action beyond securing the necessary powers to proceed, and that no further steps be taken without consulting the ratepayers by means of a public meeting.

The River Dee and the Chester Water Supply.—The proposed sluicing of the River Dee at the Weir at Chester has been considered at a meeting of the citizens, convened by the Mayor (Mr. Churton). As stated in a paragraph recently appearing in the JOURNAL, the provision of these services will be of considerable advantage to the Water Company by relieving their intake of the suspicion that the water drawn in there is contaminated. After the Mayor had submitted a resolution consenting to the Council promoting a Bill in the next session of Parliament, to enable them to carry out the work, the scheme was subjected to a good deal of criticism. One gentleman contended that, if the water supply was to be absolutely above suspicion, it must be taken from another source altogether; and it was also urged that, if the Water Company did their duty, they would pay for the whole of the work out of their own pockets, if it was going to be the benefit to the supply that was expected. The Engineer of the scheme (Mr. Stoney) described how similar work had proved beneficial to the water supply of Rotterdam. In winding up a long discussion, the Mayor said that, under their Act of Parliament, the Company had power to supply the city, and a right to take their water, from the present intake; and they might continue drawing it from the river unless Parliament interfered with them. After all, the Town Council were the sanitary authority of Chester; and it rested with them to remove any suspicion or doubt in reference to the water. All he could say was that, if they had to use compulsion with the Company, it would more likely cost £80,000 than £8000. He had never said that the present water was impure; but the possibilities of the case had to be considered. The resolution was passed by a large majority.

Sales of Shares.—On Monday last week, 40 shares in the *Bideford Gas Company*, of the nominal value of £10 each, and bearing 7 per cent. interest, were sold by Messrs. Dymond, Son, and Blackmore, at from £15 10s. to £15 15s. per share.——At a recent sale in Norwich, 305 ordinary £10 shares in the *Norwich Water Company*, bearing a dividend of 6 per cent., were knocked down at an average price of £18 10s. 6d. each. On the same occasion, 12 £10 new preferential "A" shares in the *Great Yarmouth Water Company*, with a dividend of 6 per cent., realized an average of £18 12s. 6d. each; and 30 £10 preference "B" shares in the same Company, bearing 5 per cent., reached an average of £16 each. A few 5 per cent. second preference shares (£6) in the *Lowestoft Water and Gas Company* secured £11 each.——The £2500 of new ordinary stock in the *Lewes Gas Company*, authorized to be raised under the provisions of the Company's Act of 1878, have been offered for public competition, in lots of £100 each; the prices realized per share averaging £155.——A new issue of 397 "C" shares (£10) in the *East Grinstead Gas and Water Company*, bearing 7 per cent. dividend, has been submitted to public competition; the prices realized being £10 15s., £10 17s. 6d., and £11 per share. A number of the shares were not sold.——There was keen competition at Eastbourne, on Monday last week, for shares in the *Eastbourne Gas Company*, which were offered for sale by Mr. J. C. Towner. Original £10 shares fetched £30 and £30 2s. 6d. each; and some "B" shares realized £23 and £23 5s. apiece.——Last Thursday, four £10 shares in the *Maidstone Water Company* were sold by auction at £27 each, and five similar shares at £26 15s. each.——At Kirriemuir, last Friday, 28 £5 shares of the *Kirriemuir Gas Company* were sold by auction, and realized the following prices: Ten, £5 5s. each; ten, £5 7s. 6d. each; and eight, £5 10s. each.

MISCELLANEOUS NEWS.

THE EXTENSION OF THE CROYDON GAS-WORKS.

Opening of a New Gasholder.

As many of our readers are aware, the execution of a large scheme of extension has been in progress, during the past three years, at the Croydon Gas Company's works. A description of one section of the scheme appeared in a previous volume of the JOURNAL;* and now we have to record the successful completion of a holder which is a splendid, and (it is not too much to say) a model piece of engineering work of its kind. This important addition to the works entered upon active service last Friday, when, in the presence of his colleagues, a number of prominent gas engineers, and other visitors, the Chairman of the Company (Mr. Charles Hussey) opened the outlet-valve, and allowed the gas to pass into the mains leading into the district.

The holder is situated on a piece of land separated from the manufacturing portion of the works by the main line of the London, Brighton, and South Coast Railway, under which line two subways have been constructed—one for the mains leading to and from the holder, and the other for foot traffic. The designer of the new holder is the Company's Engineer (Mr. J. W. Helps, Assoc.M.Inst.C.E.), upon whom last Friday expressions of praise were freely bestowed by the several competent judges of such work who were present. Contrasted with the old holders on the works, the new structure is light in appearance. It consists of three lifts, and is surrounded by 22 standards. The inner lift is 187 feet in diameter by 37 feet deep; the middle lift, 190 feet diameter by 36 ft. 9 in. deep; and the outer lift, 193 feet diameter by 36 ft. 6 in. deep. The total height of the holder at the centre when full of gas is 118 ft. 7 in., with a rise of 12 ft. 6 in. in the crown. The whole of the work, with the exception of the bases and finials (which are of cast iron), is of English steel; and the total weight of the material is about 960 tons—the floating weight being 525 tons. The capacity is 3 million cubic feet. The dimensions of the tank, which is constructed of brick and puddle, is 195 feet by 36 ft. 6 in. from the top of the coping to the resting-blocks. Messrs. John Aird and Sons were the contractors for the tank; and Messrs. C. & W. Walker, for the holder.

In passing to the new holder, the Company stopped to inspect the new retort-house, after which they assembled, under an awning, by the valves controlling the holder.

Mr. HELPS, by request of the Directors, asked the Chairman to perform the ceremony of opening the gasholder, or, in other words, to open the outlet-valve, to pass the gas into the distribution mains. He had also, on behalf of the Directors, to ask Mr. Hussey to accept from them a key, with which to unlock the valve; and this he had much pleasure in handing to him. [The key is a silver one, cased with gold, and suitably inscribed.]

The CHAIRMAN, having mentioned that it somewhat surprised him to receive such a handsome key from the Directors, unlocked the valve, and, having turned it, he declared it was open for the first time to admit gas into the mains of the town. Proceeding, he said that the contract for the tank was entered into with Messrs. John Aird and Sons, in 1894; and it was begun in March, and finished at the end of that year. The construction of the holder was commenced by Messrs. C. & W. Walker in the spring of this year; and they had already successfully finished it. Instead of erecting a holder of two million cubic feet capacity, which would have answered their requirements for a year or two, the Directors determined to take advantage of the low price of iron, and construct one of three millions capacity.

The party then proceeded to the workmen's recreation-room, where luncheon was served; and subsequently several toasts were proposed. The usual loyal toast and "The Corporation of Croydon" were first honoured, and then

The MAYOR (Alderman F. T. Edridge) proposed "The Chairman and Directors of the Croydon Gas Company." He referred to the contemplated introduction by the Corporation of the electric light, and remarked that the extensions of the gas-works showed it was perfectly clear that the Directors did not anticipate, in the near future at any rate, any diminution in their business.

The CHAIRMAN, in responding, mentioned that he had received a telegram from Mr. C. C. Carpenter, the President of the Institution of Gas Engineers (who had been expected to reply to one of the toasts), announcing his inability to be present, but fortunately they had a gentleman, in the person of Mr. H. E. Jones, who was well known in the gas profession, to take his place. Having thanked the Mayor for the kind expressions he had used in regard to the Company, the Chairman said he was delighted to see present the gentleman who might be regarded as the father of their Company. He referred to Mr. W. Hyslop. That gentleman and a few others in Croydon banded themselves together a number of years ago to see if they could not produce a better state of things in connection with the gas supply than then existed—the price of gas being at that time 16s. per 1000 cubic feet. They entered into negotiations with Mr. Overton (who introduced gas into Croydon) for the acquisition of his works; and they were successful. But soon after commencing operations, the new proprietors found that they had competitors in the field, who had actually commenced the construction of new works. They approached their opponents with the object of buying them out. Their terms were exorbitant; but ultimately their concern was purchased for £1000. In 1847, the Company obtained an Act. It was interesting to notice that in that year the wages amounted to £368 19s. 7d.; in 1855, they were about £4 a week; while in the past year, they had amounted to £16,000. In the matter of public lighting, they were always supported by the old Local Board. In 1860, they had in use 312 street-lamps; while at the present time, the lamps numbered 1920. In 1847, the sum of £10,637 was spent upon capital account. He had no doubt this included a part of the purchase-money paid to Mr. Overton, and probably the cost of a holder erected about that time at Pitlake. In 1860 the works were removed to Waddon; and, from then to now, they had gradually enlarged them. During the five years he had been a Director,

* See Vol. LXII., p. 1045.

they had spent, and contemplated spending, no less a sum than £80,000 in improving the works. It was no use attempting to rest with their Engineer, who was a man who thirsted for work, and was ready to grasp every new idea that would improve the production of gas.

Mr. CORBET WOODALL said this was admittedly a notable day in the history of the Company. They had brought into use a structure which was of considerable interest from an engineering point of view, and was a great credit to its designer, and to those who had carried out its erection. The Mayor had stated that the Corporation were in the future to be friendly critics and rivals of the Gas Company in the field of lighting. For his (the speaker's) own part, he thought it was to be regretted that there should be two sets of individuals charged with the responsibilities of lighting a town like Croydon. The development of gas lighting during the past 40 years had been wonderful indeed, and up to the present the growth of the industry had been on an increasing ratio; and it promised to continue so. In the early days of the industry, it was blessed by having men at its head of high character and distinguished attainments. They were, however, few in number; and it might be said that the industry had had to struggle along during the last fifty years with comparatively untrained men. This might perhaps be said of most industries in this country—that the technical training of those who had the guidance of them had been remarkably poor. But in regard to the gas industry this had been mended in recent times; and they had now men who were worthy of so great a charge. He had great pleasure in proposing the health of the Company's Engineer. Among the young men who had risen up to take a distinguished position in the industry, there were few who held a more honoured place than Mr. Helps. They had seen that day something of his works; and the works spoke for him.

Mr. HELPS, in reply, expressed his sincere pleasure at hearing the words which had fallen from Mr. Woodall. Referring to the new holder, he said that it would enable them to store 1½ times more gas than they had been able to do in the past. Why, he asked, did they go to such a large extent in increasing the storage? In days gone by, it seemed always sufficient for a gas engineer to simply consider the hours of light and darkness in any 24 hours of the year; and one could tell within a little how much it was necessary to extend the gas-producing power day by day or week by week. But during the past few years, this practice had altogether altered. The ordinary 5 or 6 per cent. (which generally, to his mind, proved the success or non-success of a company year by year) was not sufficient in these days. The increase in consumption one day over another, or one week over another, could not be taken at anything so low as 5 per cent. In Croydon they had now something like 3000 cooking and heating stoves on hire out of about 9500 consumers; so that in these days it was more a question of temperature than of hours of light and darkness. He had known—and many other engineers present had known—that it was not an uncommon thing for the consumption of gas in a town one day over another to show an increase of something like 30 or 40 per cent. One day might be muggy and warm, and there would be scarcely a gas-stove alight; while the next day, it might freeze hard, and then there would be in Croydon something like 1000 heating-stoves in use, irrespective of cooking-stoves. Taking these stoves to consume something like 20 cubic feet per hour, if they were all put into use together on one day, it would mean that the Company would have to increase their output by 20 per cent. for those stoves alone. It was therefore very essential that, to enable a gas company to carry on their work economically, they should have a large storage to cope with any such considerable increase. The policy adopted by his Directors in ordering such a large gasholder was therefore warranted and justified. Referring to its construction, he said the tank was a large and fine one, inasmuch as from the first moment it was filled with water—from 6 to 7 million gallons—as far as they could judge by careful tests, it had not lost $\frac{1}{16}$ inch. The holder had been filled twice with air; and it did not show the slightest signs of decrease, which proved that the work had been carried out in a thorough and first-class manner. He concluded by speaking in commendatory terms of the help rendered to him by his chief assistant (Mr. D. H. Helps) and all who had been concerned in the carrying out of the extensions.

Alderman RYMER proposed "The Gas Industry." In doing so, he said that his connection with the local governing bodies extended over 25 years; and during the whole of that period, the relations between the authorities and the Gas Company had been most happy and satisfactory. He sketched the early history of gas-lighting, and expressed the opinion that, with the extraordinary strides that had been made in chemical science and with the exertions of the gas engineers, the industry would be well able to maintain its own.

Mr. H. E. JONES, the Engineer of the Commercial Gas Company, in responding, said that in the gas industry they had had parlous times of late. Some seven years ago, their industry was made the theatre of the eight-hour movement, which led to several troublesome and terrible strikes, and a period of great anxiety. The Croydon Company escaped that, and so did the Company he represented. They then came to a period when things were a little better; but all hopes of this continuing were dashed to the ground by succeeding strikes in the coal-fields. The last five years had brought into the gas industry more strikes than he could recollect during his connection with it, which, he regretted to say, now extended to above 30 years. He referred to the drop in the price of sulphate of ammonia, and said coke was not so valuable as it used to be; but, in spite of all these things, there were many circumstances that gave them courage for the future. The working man had taken to them; and they had become democratic to a degree that he never expected by the introduction of the prepayment meter. Two years ago, his Company began to fix penny-in-the-slot meters. In six months, they found that, instead of having to give a bonus to the people who introduced the customers for these meters, they were overwhelmed with orders. They had 1000 fixed at the end of six months; and now, in two years, they had 2500. At the present time, they had still 1000 unsatisfied applications; and they had been coming in during the last few weeks at a rate approaching 100 a week. At the other end of the string, they had the incandescent gas-light, which, he could say without the fear of contradiction, would cope with any illuminant. He should like to pay his tribute of praise to Mr. Helps, than whom, among the younger leaders of the profession, no one was more honoured. Some people, he believed, had been unduly anxious about the size of the new gasholder. But such holders were really cheap; and the Company had been doing a great service to Croydon by investing their capital on storage at a cost of about £11 per 1000 cubic feet, as against £20 to £30 for a smaller holder.

Mr. T. RIGBY, in proposing the toast of "The Contractors," gave some interesting information regarding the holder. He said that, in the construction of the tank, the quantity of excavation was 31,000 cubic yards; the bricks used numbered 1½ millions; the concrete was about 1600 cubic yards; and the clay puddle 4500 yards. The tank had given employment to between 200 and 300 men every week. The area of the surface of the plates of the holder was nearly 98,000 square feet, which would cover a plane surface of 2¼ acres. The length of iron in the bars, angle-irons, and tees in the holder, if placed end to end, would reach about 7 miles; and in the standards, 8 miles. There were 625,000 rivets in the holder, and 17,000 bolts. Not a single accident of importance had happened during the whole course of the work.

Mr. BASIL P. ELLIS replied on behalf of Messrs. Aird and Sons and Mr. C. C. WALKER on behalf of his firm—the former gentleman stating that, by favour of the Board and Engineer (Mr. C. Gandon) of the Crystal Palace Gas Company, they were able to obtain the clay required for the tank from that Company's works.

Among the concluding toasts was that of "The Visitors," which was proposed by Mr. JACKSON, and responded to by Mr. JAMES GLAISHER, F.R.S.

THE DISASTROUS EXPLOSION IN THE STRAND.

The Inquest on the Fireman—Evidence as to the Cause of the Explosion.

Considerable public interest was manifested in the investigation which was opened on Monday last week, at the St. Clement Danes Vestry Hall, by Mr. JOHN TROUTBECK, the Coroner for Westminster, into the circumstances attending the death of Martin Ernest Sprague (aged 27), a member of the Metropolitan Fire Brigade, who met with the injuries to which he succumbed while searching the ruins on the scene of the explosion in New Church Court, Strand, on Tuesday, the 29th ult., as reported in the JOURNAL last week.

The legal representatives of several interested parties were present, and offered their assistance to the Coroner in his inquiry. Mr. MONIER-WILLIAMS appeared for The Gaslight and Coke Company; Mr. DEBENHAM, for the New River Company; Mr. R. G. GLENN, for Sir John Hutton, the freeholder of part of the property affected; Mr. W. M. THOMPSON and Mr. A. LINCOLN REED, for various injured persons; and Mr. J. S. RUBINSTEIN, for Mr. G. A. Loveridge, of 329, Strand, whose premises and some employees were injured. Mr. SPENCER, the chief officer of the Public Control Department of the London County Council, watched the proceedings on behalf of that body.

After the usual formalities,

Mr. MONIER-WILLIAMS desired at once to say that the Directors of The Gaslight and Coke Company wished to give every assistance in their power; but until the ground was opened, and the mains were capable of being inspected, it was impossible for them to offer any opinion or evidence which could help the Court. They also desired to express their great regret that this calamity had happened.

Engineer *Henry Thoburn*, of the Metropolitan Fire Brigade, was the first witness. He deposed as to the circumstances under which they were called to the scene of the disaster about 7 p.m. on the 29th ult., and gave information as to the collapse of the buildings Nos. 26 and 27, New Church Court, and the burying of Sprague under the *débris*. When witness arrived, one building (No. 26) was in flames.

Superintendent *James Pearce* stated that, when he arrived at New Church Court, the front and back walls of No. 26 were entirely down; and the side walls were badly fractured. There was fire under the *débris* in the court. The second house (No. 27) afterwards collapsed without any warning, bringing with it the remaining portions of No. 26. On the muster-roll being called, it was found that deceased was missing. Efforts to rescue him were at once made. It was not, however, until 3 o'clock the next morning that they traced his whereabouts; and, owing to the peculiar position in which he was fixed, it was about 5 o'clock before they could release him. He was still conscious, and was at once removed to King's College Hospital. When witness reached the court, there was no sign of fire, except from the wreckage lying in the court. He had no doubt that the explosion was caused by gas.

The CORONER: Why do you say that?

Witness: There was a blue flame issuing from the wreckage; and small explosions kept taking place. He thought there was no doubt the pipes were fractured. He was so satisfied there was a great quantity of gas escaping, that he asked an inspector of police to send to the Gas Company's offices; and very shortly some of the Company's employees arrived. They cut off the gas, which took some considerable time, as the ground had to be opened at either end of the court. There were occasional bursts of flame until the gas was cut off; but afterwards there were none. The air smelt very strongly of gas; and the nature of the damage to the houses on the opposite side of the court led him to the conclusion that the explosion was due to gas. He believed, by the way the gas escaped from under the wreckage, that the supply-pipe had been fractured. There were no gas-fittings in the houses that were destroyed.

By Mr. RUBINSTEIN: It was difficult to tell whether No. 27 fell in consequence of another explosion, or by the weakness caused by the first one. He had not seen any part of the fractured pipe. It ran under the pavement in the centre of the court. He could not say that the pipe was fractured by the *débris* falling upon it; but it was not far underground.

Mr. *P. C. E. Tribe*, House Surgeon at King's College Hospital, gave evidence as to the nature of the deceased man's injuries. He stated that the cause of death was the continuous pressure on the chest, and exhaustion and shock.

Mr. *W. G. Perkins*, a Surveyor in the Architect's Department of the London County Council, produced plans showing the walls that were blown down, and those still standing. The walls were 14-inch ones, and were constructed of "place" bricks, which were of a soft nature. The mortar had no adhesive quality whatever, and was quite "rotten." In his examination, he found the vault of No. 27 was about three parts full of rubbish; and the brickwork in the wall of the vault running parallel with the court was fractured, and had started forward below the spring of the arch. The mortar there was quite white, which showed that the fracture had been caused recently. He could only account for this fracture by an explosion in the vault. He noticed that the ceiling was blackened in one corner; and he thought this had been done lately. The lower portion of the wall bulged from the court inside the vault.

The CORONER: There could not have been an explosion in the ground outside the wall; and if there was an explosion inside the vault, it would have caused the wall to bulge the other way.

By a JURYMAN: He did not notice any fracture in the arch of the vault. It had been used as a coal-cellar; but not recently.

Mrs. *Brands*, a married woman, who was living at 26, New Church Court, stated that she was in her room at the time of the explosion; and she was precipitated into the court with the wreckage. She noticed a smell of gas both inside and outside the house on the previous Friday, and spoke about it on the Monday to the landlord's rent-collector (Mr. Pollard). The smell continued to the time of the explosion; and it was worse just before it occurred. When witness made the complaint to Mr. Pollard, she did not hear his reply. There were no gas-fittings in the house. The explosion made a very loud report; and the house fell instantly. She afterwards observed flames issuing from the wreckage. Some two months ago, there was water in the cellar of No. 26.

By Mr. RUBINSTEIN: The Water Company's men were working in the court on the Friday before the explosion; and it was on that day, she first noticed the smell of gas. The men closed up the hole they made on the same day; but the surface was not left in its original state. Men were again working there on the Tuesday morning—the day of the explosion.

In reply to Mr. MONIER-WILLIAMS, witness said she had not had occasion to complain of the smell of gas before the Friday referred to.

Alice Gay, a single woman, also a resident in No. 26, deposed that there was a strong odour of gas in the house for some four or five days preceding the explosion. Witness was in one of the top rooms at the time it occurred. She had been out just before 6 o'clock; and, on returning into the court, she spoke to a Mr. Scourfield about the smell. Witness saw the watermen at work on the Friday; and it was after that she first noticed the smell of gas.

Mr. MONIER-WILLIAMS (interposing) said he had just received information that the Water Company's men were opening the ground in the court to discover a leakage of water; and he thought, if the Coroner had power, it would be well to stop any interference with the court until every person who was interested in this matter could be present to see the condition of the mains.

The CORONER did not know what his powers might be under the circumstances; but he thought it was a very improper course to open up the main in the absence of an interested Company.

Mr. DEBENHAM undertook that the work should be suspended; and shortly afterwards he announced that this had been done.

C. E. Neal, one of the tenants of 27, New Church Court, stated that, when his wife called at the rent-collector's house to pay the rent, he remarked: "Mrs. Neal, it's a wonder you have not all been blown up before this." He saw the Water Company's men digging a hole; but he was more interested in the rats taken out than anything else.

James Scourfield, an engineer and caretaker at the *Weekly Times and Echo* offices, which back on to the wrecked buildings, deposed that he noticed the smell of gas on the 18th ult.—a week previous to the time that the New River Company's men commenced working—and detected it here and there all through the court. On the following night, the office was filled with gas. He was very anxious about it; and, on inquiring of Mrs. Neal whether she had detected gas, she said it was very strong in her rooms. He had had water under the boilers in his machine-room; so that he knew there was something wrong with the water-mains. When the watermen had the hole open on the 25th, they tried the joints of the exposed portion of the gas-pipe; and he was satisfied there was no escape from them. Between 12 and 1 o'clock on the Monday, he spoke about the smell to some of the Gas Company's men who were in Burleigh Street; and they visited the place, but failed to find the leakage. Witness told them that, if they returned in the evening when the pressure was increased, they would smell it much stronger; but he did not see them afterwards. Val de Travers's men were in the court on Tuesday (the 29th). In the evening, about 6.20, witness spoke to one of them with reference to the matter; and the man told him he had noticed the smell of gas all day, but it did not come from the hole that had been made. When the explosion occurred, he was indoors. He ran out, and saw a blue flame rising about 10 feet from the ground. He was sure this was from the hole that had been opened, or, at all events, it was pretty close to it. However, he did not think the leakage of gas was at that spot; but, in his opinion, it travelled there. The ground had sunk underneath the pipes where the hole was made; and he should think it was through this that the breakage of the pipe occurred.

Questioned by Mr. RUBINSTEIN, witness said the first time the water ran into his place was on the Friday. The hole made by the New River Company's men was, roughly, 4 or 5 yards long and 2 yards wide. The gas and water pipes were 10 to 12 inches apart, and some 16 to 18 inches deep.

By Mr. MONIER-WILLIAMS: The hole was a large one; and the men brought four or five loads of material to fill it up, independent of what they took out. The earth had subsided quite 10 inches beneath the main. There were two gas-lamps in the court; but frequent trouble was experienced with one of them, and it was constantly extinguished. It was possible that, when it was not alight, some of the escaping gas might get blown down. He did not see the Gas Company's men in the court on the Monday evening.

Mr. MONIER-WILLIAMS said he should produce evidence to show that the Company's men were there on two occasions that evening, and took every possible precaution. To witness: If you smelt gas so strongly, why did you not give the Gas Company notice before?

Witness: I did not think it my duty.

In answer to Mr. DEBENHAM, witness said he heard there were some dead rats taken out of the hole.

Mr. DEBENHAM: When the hole was opened, four or five dead rats were found, which points to the fact that there was a sudden rush of water, which drowned them.

Mr. *T. Hawkins*, a builder, said he repaired the two houses for Sir John Hutton in 1893; and he subsequently rented them from Sir John. The rents were collected for him (witness) by Mr. Pollard; but he had never had any report from him as to an escape of gas.

Captain *J. S. Simonds*, the Chief Officer of the Metropolitan Fire Brigade, who arrived on the scene of the explosion within half an hour of its occurrence, described its effects and the extent of the damage. In searching for the deceased fireman, they had to proceed with the utmost caution, owing to the dangerous surroundings. He testified to the earnestness with which the men worked in their endeavour to extricate their comrade, and showed that it was owing to the peculiar manner in which Sprague's legs and feet were wedged that so much time elapsed before he was released.

It was then agreed to adjourn the inquiry for a fortnight. In the meantime, the mains in the court are to be stripped for examination, in the presence of representatives of The Gaslight and Coke Company, the New River Company, the County Council, and other interested parties.

"RINGS" FOR THE PURCHASE OF RESIDUAL PRODUCTS.

In the report which was published last week of the proceedings at the meeting of the Manchester City Council on the previous Wednesday, it was stated that the Gas Committee had passed a resolution to obtain statutory powers to enable them to undertake the manufacture of residual products. We learn that an explanation was given on the occasion by Mr. Alderman Gibson, the Chairman of the Committee, as to the reason they were proposing to engage in this—to them— new business. He remarked that he was one of those who for a long time was opposed to the Gas Committee undertaking the manufacture of residual products, especially with regard to the making of sulphate of ammonia. So long as they had an open field and an open market, he was much opposed, as a general rule, to local authorities becoming manufacturers of anything that could be done as well by private enterprise. But when private enterprise got the Committee by the throat, and said they would only be allowed to live under certain conditions, and only permitted them to do what it pleased, the time had arrived when the Committee must look out for themselves. On the last occasion when they advertised for tenders for the ammoniacal liquor, they only received one offer, which had to be accepted. This led them to think that a sort of "ring" had been formed by the manufacturers; and the Committee were determined to show that they could carry on this manufacture themselves. By the powers they sought, they would also be able to use some of their residuals. Under the same circumstances, the Committee could distil their own tar. The Committee's action was (as mentioned last week) approved by the Council.

The *Manchester City News*, commenting upon the above decision, says: "The reason given for the proposal was that only one tender had been received for the ammoniacal liquor produced at the gas-works; the conclusion being that a 'ring' of chemical manufacturers had been formed for the purpose of arranging amongst themselves as to the price that should be paid and who should be the purchaser. . . There is good reason for believing that 'rings' exist for the purchase of other products of the gas-works—tar amongst the rest—and that these nefarious arrangements are not confined to Manchester by any means. It is apparent that Alderman Gibson and his colleagues of the Gas Committee are fully aware of the existence of these rings, and have taken the only course to defeat them, by asking for powers which will enable the Committee to be entirely independent of outside users of gas residuals."

The Supply of Water at the East-End of London.—At the meeting of the London County Council last Tuesday, the Parliamentary Committee presented a report on a resolution of the Council, asking them to take measures with a view to obtaining legislation to raise the limit of the East London Water Company's supply to a height of (say) 70 feet from the nearest pavement. The Committee stated that they thought it preferable that the Company should be made subject to the provisions of the general law contained in section 35 of the Water-Works Clauses Act, 1847, which requires that a supply of water shall be constantly laid on at such a pressure as will make it reach the top storey of the highest houses within the limit. They said they had instructed the Parliamentary Agent to draft the Bill and prepare the notices on these lines; and their action was approved.

Stonehouse and the Devonport Water Company.—Negotiations are on foot for the transfer to the Stonehouse District Council of the rights of water supply exercised within that township. It is stated that, though the Company have statutory rights of supply in Stonehouse, and have laid down a number of mains, they have never had a large body of customers outside the Government establishments which they supply. Under the powers of their recent Act, the District Council have arranged for a present and future supply from Plymouth, which will practically make them independent of the Devonport Company. Before, however, they can claim the right to supply all consumers, the Council must, of course, buy up the Company's rights and the mains. These, it is said, were offered to the late Local Board for £10,000—a price which was considered too high. The Company now, however, claim £74,000; and the probability is that the question will be referred to arbitration. Mr. G. F. Deacon, M.Inst.C.E., has been engaged by the District Council. Mr. Bidder, Q.C., and Mr. Balfour Browne, Q.C., have been retained to represent the Council in the event of the failure of the negotiations for a friendly settlement of the matter.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

The Half-Yearly Ordinary General Meeting of the proprietors in this Association was held at the Cannon Street Hotel, London, E.C., on Tuesday last, under the presidency of the Rt. Hon. Sir JULIAN GOLDSMID, Bart., M.P.

The SECRETARY (Mr. G. F. Thompson) read the notice calling the meeting, and the following report of the Directors:—

The following summary shows the results of the Association's operations for the half year ended the 30th of June last:—

	Millions Cubic Feet.
The quantity of gas made in the half year ended June 30 was	4,347
The quantity made in the corresponding half year of 1894 was	4,196
being an increase of	151
or at the rate of 3·6 per cent.	
The total number of lights on June 30 amounted to there being at that date 163,963 consumers on the books of the Association.	2,250,974
At the close of the corresponding half year of 1894, the number of lights was	2,172,428
which gives an increase of . .	78,546
or at the rate of 3·6 per cent.	
	Miles.
The entire length of mains on June 30 was . . .	1,806
The length of mains laid on June 30, 1894, was . .	1,763
an increase of	43

The profit of the past half year exhibits a small increase upon that of the corresponding period of last year; and the Directors are pleased to report that signs are not wanting, in most of the towns lighted by the Association, that business activity is increasing, and a healthier tone prevailing than has existed for some time.

The consumption of gas shows a gratifying increase; and the receipts have augmented. But, as this increased consumption is principally due to the more extended use of gas for purposes other than lighting—for which purposes a reduced charge for gas is made—the ratio of profit to working expenses is somewhat smaller.

During the half year under review, the cost of coal has been somewhat less; and the receipts for coke and tar have increased. But the heavy fall in the market value of sulphate of ammonia has adversely affected the revenue derived from the sale or treatment of ammoniacal liquor.

The winter of 1894–5, as remarkable on the Continent as here for the severity of the weather, subjected the power of production of the plant and the capacity and condition of the mains, to an exceptional test; and the Directors are glad to report that, due to their liberal provision of producing plant, and the constant supervision of the engineering staff over the mains, both plant and mains stood that test in a most satisfactory manner.

At Berlin, the new gasholder at the Association's Schöneberg works was completed; and further progress was made in remodelling the principal works in the Gitschinerstrasse.

At Antwerp, the new gasholder-tank at Berchem was completed; and further additions to plant, rendered necessary by the contemplated closing of the Esplanade works (referred to in the last report), were proceeded with.

The Directors are pleased to report that where they have been enabled to introduce the system of supplying gas through prepayment meters, it has so far met with a fair measure of success.

They have sold surplus land at Amsterdam, Ghent, Rotterdam, and Vienna.

The Directors desire, in conclusion, to draw the attention of the proprietors to the accounts for the half year ended the 30th of June last. These have been duly audited; and from them, the Directors have, in accordance with the provisions of the Companies' Clauses Consolidation Act, prepared a scheme showing the profit of the Association and the portion thereof applicable to the purposes of dividend, which they now recommend to be declared, as follows: A dividend of 5 per cent. for the half year ended the 30th of June last, and a bonus of 1 per cent., both payable (free of income-tax) on and after the 2nd day of December next.

The CHAIRMAN, in moving the adoption of the report, remarked that it spoke for itself, and it was satisfactory—showing that the business of the Association for the half year had been good and sound. In fact, he could fairly say that, as far as his knowledge went, the business of the Association had never been more carefully looked after, or more thoroughly superintended in every detail; and he thought that the prospects were in every way good. Nothing of any importance had happened in the course of the period under review; and the same remark applied to the period which had elapsed since the closing of the accounts—namely, the 30th of June last. He would, therefore, go at once to a matter which he desired to mention to the shareholders for the first and last time. He was elected a Director of the Association 27½ years ago; and he had worked for it as, he believed, he had never worked for anything else. At that time they had arduous law-suits at Berlin. They had as Chairman Mr. Attwood, with whom it was not always easy to get on; and subsequently, when that gentleman resigned, they had as Chairman Mr. Twells, who was a charming man, but whose health constantly prevented him from attending to business. The result was that for two years he (the Chairman) discharged Mr. Twells's work when that gentleman was Chairman. Then, nineteen years ago, he (the speaker) was honoured by his colleagues in electing him Chairman. Therefore, one way and another, he had served the Association for 21 years as Chairman, and 27½ years as a Director. This year, unfortunately, he had had a most serious illness—so serious that, at one time, it was thought utterly impossible that he could get over it; and although the malarial fever from which he had suffered had left him, as had also other troubles, he had rheumatic gout, which troubled him greatly, and which the doctors assured him would, in all probability, trouble him for a long time. The effect was that he was very much incapacitated from any business or any worry—in fact, any occupation. The doctors had further said that it was his duty to give up everything involving going away from home, and everything which induced worry or excitement. He had, therefore, had to give up a very large number of engagements; and, to his intense regret, it had become his duty to resign that day the chairmanship and directorship of the Association. He would like to say—and this was why he had come to the meeting that day—that he had been most loyally supported by excellent colleagues during many years. They had worked with him with willingness, readiness, and heartiness; and the staff, both at home and abroad, had always been ready to do anything he had desired. At the same time he was one of those men who felt that, if there was anything important going on, he must be there. When negotiations were pending for contracts and other serious matters, he used to rush off, and at a moment's notice travel sometimes for 48 hours, in order to attend to the business. All this, of course, he could not possibly do now; and, under the circumstances, the only course that remained for him to adopt was to leave the work in more capable hands. He had the same confidence in the future of the Association that he had frequently expressed from that chair; and if the past conservative policy was continued, as he had no doubt would be the case, he was sure that the opportunities of successful work would be as good in the future as they had been in the past.

Mr. T. H. G. NEWTON, the Deputy Chairman, seconded the motion, observing that he did so with very different feelings to those which had actuated him on any previous occasion. The Board had heard for many years the remarks of the Chairman with pleasure, even greater than the shareholders had experienced, because the Directors had known beforehand the tale which the storyteller was going to relate. As those who best knew the play, could best value the talents of the actor, so it had been in the case of the Directors. To-day their pleasure was mingled with, if not overcome by the pain all must feel at the physical effort by which the Chairman had endeavoured to give them that pleasure again; and at his announcement of the termination of his connection with the direction of the Association. He (Mr. Newton) would not now venture to say anything as to the influence which the Chairman had exercised over the destinies of the Association for the long period he had mentioned; though as he had been Sir Julian's colleague ever since the Chairman had been on the Board, he knew how great that influence had been. The Directors collectively, himself and other members of the Board individually, had done all they could to stave off the resignation of the Chairman—even on any terms as to work and service. But knowing the Chairman as he did, he could very well understand that Sir Julian felt that the time had come when his resignation was inevitable; and as such they must, therefore, one and all receive it. He thought that the prolongation of the meeting for one unnecessary minute was trespassing unduly on the kindness of the Chairman in having attended the meeting at all.

The CHAIRMAN invited discussion; but no questions were asked. Thereupon he put the motion, which was carried unanimously. He afterwards proposed a dividend of 5 per cent. for the half year ended June 30 last, with a bonus of 1 per cent., on the £3,800,000 stock of the Association, payable (free of income-tax) on and after the 2nd prox.

Mr. J. HORSLEY PALMER seconded the motion, which was carried unanimously.

Mr. M. S. PILCHER, on behalf of the shareholders, expressed the deep regret with which they had heard the announcement by the Chairman of his resignation. He proposed a resolution recording the shareholders' sincere regret, and cordially thanking the Chairman for his great services to the Association in the past.

Mr. R. HESKETH JONES, J.P., seconded the motion. He could thoroughly endorse what had been said respecting Sir Julian's great capabilities, and the way in which he had managed the companies with which he was connected. It was with sincere regret that the shareholders heard of his resignation.

The motion was carried unanimously.

The CHAIRMAN briefly expressed his obligations for the resolution.

Mr. G. BARRETT then proposed, and Mr. A. MANSER seconded, a vote of thanks to the Chairman and Directors for their services during the past half year.

The CHAIRMAN, in reply, assured the proprietors that the Directors were all much obliged to them. He afterwards proposed a vote of thanks to the staff—remarking that they had some most able men, who had served the Association for many years, who were devoted to the interests of the Association, and who had made it the great success it had been. They would remember that, when he joined the Association 27½ years ago, they paid 10 per cent. upon a capital of £1,200,000; while they now paid 12 per cent. on a capital of £3,800,000, and they had a considerable issue of debentures and debenture stock. This showed how largely their operations had extended, and yet (if he might say so) how well their business had been managed—a fact owing, to a great extent, to the care, attention, diligence, industry, and devotion of the staff.

Mr. BASSETT seconded the motion. Incidentally, as an old Director, he said he had never worked with any Chairman who had given himself up so entirely to the interests of a company as their Chairman had done to the interests of the Association. It was with profound regret that he and his colleagues parted with so excellent a Chairman.

The resolution was carried unanimously; and the proceedings then terminated.

COLONIAL GAS ASSOCIATION, LIMITED.

The Annual General Meeting of this Association was held on Monday last week, at the London Offices, Clement's House Clement's Lane, E.C.—Mr. SAMUEL SPENCER in the chair.

The SECRETARY (Mr. G. J. Gray) read the notice convening the meeting. The Directors' report, which was taken as read, showed that the profit for the year ended June 30 last amounted to £3096, including the dividend on the shares held by the Association in the Charters Towers Gas Company. The Directors also mentioned that the Managing-Director (Mr. J. Coates, M.Inst.C.E.) had strongly advised that the Association should take immediate advantage of a specially favourable opportunity which presented itself for the erection of gas-works in Western Australia; and for this purpose they proposed to issue £5000 of debentures.

The CHAIRMAN, in moving the adoption of the report and accounts, expressed regret that the Association had not met with the amount of success in the past year for which they had hoped. But the troublesome times Australia had been passing through during the last two or three years was still being felt; and, although there were now most

encouraging signs that a better state of things was gradually arising, he had to confess that it had not reached them. Their excellent Manager (Mr. G. Swinburne), in a full report to the Directors, lamented that, with all the economy he had exercised, he had been unable to show a better return than that now presented, which in effect gave about the same result as last year's working in the way of profit, and enabled the Directors to pay a dividend for the year at the rate of 3 per cent. The profit in the previous year was increased by a sum of about £500, which was made for the Association by the Managing-Director. Unfortunately, they had not been able to repeat this in the past year; and the consequence was they were not in a position to pay the same dividend by ½ per cent. The Directors had hoped that the consumption of gas would have increased sufficiently to have maintained the previous rate of dividend; but, through the causes already mentioned, and others, this had been impossible. The competition from oil lighting was still very keen, added to which the Directors had been obliged, in making the new contracts with the Municipalities, to grant a reduction in the price; and, in order to keep their customers, they were compelled to charge them a lower figure. He thought the soundness of this policy must commend itself to all the shareholders. It would have been most gratifying to the Board if these reductions had put them in the position to give a better return on the capital invested; but, under the circumstances, they were thankful it had not caused them to pay a less rate than that now recommended. They were now hopeful they might steadily improve the revenue, and gradually return to a higher percentage. He should like to mention that this was their seventh year of working; and, during that time, the average dividend had been nearly 5½ per cent. If the prospects of improving trade in the Colony continued (and they were entitled to think it would), they had every reason to hope that a better condition of things would ensue, to the delight of the Directors and the Manager, and to the satisfaction of the shareholders. This they were most anxious to see brought about, as it would enable them to ask the shareholders to sanction a further issue of shares for the purpose of acquiring more works; and, by this means, they would increase the revenue. It would have been noticed by the report that they had a favourable opportunity of extending their operations to a small extent. As, at present, they could not hope to make a further issue of shares, the Board were desirous of raising £5000 by means of debentures; and they trusted the shareholders would give them their assistance in the carrying out of such a desirable scheme. In conclusion, the Chairman said that he had received a letter from Mr. Swinburne, dated Sept. 26, in which he reported that all the works were in good order, and that the business was now assuming a more settled appearance. In his opinion, they had now reached the bottom, and might expect an increase in the consumption of gas. The leakage, he also mentioned, was about 9 per cent.; and it would be less in the current half year. Mr. Swinburne ended his letter by saying that he considered the Association had well weathered the storm; and time would slowly bring them into a more prosperous era.

Mr. Coates, in seconding the motion, said he had recently returned from a trip round the world, and had devoted most of his attention to Western Australia, which was advancing by "leaps and bounds," due doubtless to the wonderful gold boom in the colony. While there, he saw, in new and rising towns, excellent opportunities of extending the operations of the Association; so that they might make a profit which would certainly lead to a better dividend next year than this. He had also visited the American continent; and there he saw equally good opportunities of investment, especially in British North America. What they wanted was capital. If the Directors and shareholders could at once place at his disposal £10,000 to increase their operations in the Colonies, he would promise them that the Association would speedily occupy a far more important position in the gas world, and particularly in the eyes of the investing public. With regard to their present operations and works, the majority of which happened unfortunately to be in the Colony most affected by the fearful depression—viz., Victoria—he found everything going on excellently and well. It had only been with the greatest economy on the part of their able and energetic Manager (Mr. Swinburne) that a dividend of 3 per cent. on the year could be declared. He had visited some of the stations, and found them to be in good working order. The chief fault he had to find was that kerosene lamps had been largely substituted for gas. Kerosene was a considerable competitor; and his hope was that the Welsbach light would kill that business. He found that in Canada the incandescent light had, in the case of another Company with which he was connected, increased their consumption of gas by 10 per cent.; and they were continually supplanting the electric light. They were fighting electric lighting there on the best possible terms—the best for electricity, and the worst for gas. For instance, they had three electric light companies, whose plant was driven by water power; and he did not know of any place in Australia or England where the electric light had water power for a town of 50,000 inhabitants. If the Association could only get these incandescent burners in Australia at 10s., instead of £1 or £1 5s., they would soon make a difference in their consumption. He found that the Melbourne Gas Company, who used to divide 22½ per cent., were now paying 10 per cent.; and he was afraid this year they would only pay 8 or 9 per cent. Taking the average of the past five years, the Colonial Association had paid 5 per cent. He did not believe there was a more economically managed Company than theirs existing in London. He had seen signs of returning prosperity; and he thought the worst had passed.

There was a little discussion regarding the proposed issue of debentures. It was thought by Mr. Curry to be an inopportune time to extend the operations of the Association; and he considered it would be better to make an effort to raise the money by ordinary shares. Mr. Coates, however, argued that the only way to advance the interests of the Association was by taking up new and rising towns; and he was supported by Mr. Barker and Mr. White.

The motion was carried.

On the proposition of the Chairman, seconded by Mr. W. C. Parkinson, a dividend at the rate of 3 per cent. per annum (free of income-tax) was declared.

The retiring Directors (Mr. A. G. Hammack and the Hon. Thomas Bent) and the Auditors (Messrs. Alfred Lass, Wood, and Co.) were re-elected.

On the proposition of the Chairman, a hearty vote of thanks was passed to Mr. Swinburne and to the Australian Committee; and, on the motion of Mr. Saward, a similar compliment was paid to the Chairman and Directors.

CAPE TOWN DISTRICT WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Wednesday, at Winchester House, E.C.—Mr. J. S. Prince in the chair.

The Secretary (Mr. G. H. Rippin) having read the notice convening the meeting, the report of the Directors, briefly alluded to in the Journal last week, was presented.

The Chairman, in moving the adoption of the report, stated that the gross revenue for the year ending in June was £13,380, as compared with £10,411 in the preceding twelve months; and the sale of water had produced £12,420, as against £9022. In this, however, was included a sum of £2490 received for water supply to the Cape Town Municipality, as compared with a sum of £1000 the year previous. This source of income might not, however, occur again, as the municipal reservoirs on Table Mountain were approaching completion; and should the supply prove sufficient for the requirements of the increasing population, there might then be no occasion for any further application to the Company. The number of houses supplied for the year ended June 30, 1894, was 1544; whereas for the past year it was 1907, showing an increase of 363. Since that time, fresh applications had been constantly received. In addition, there were more than 1200 houses in the Municipality of Woodstock which were supplied in bulk. There had been 4518 yards of new mains laid, at a cost of £1229, and upon satisfactory terms as regarded the minimum guarantee. The whole of the Company's property was in excellent order. Referring to the accounts, there had been a considerable reduction in the cost of pumping last year, as compared with the preceding twelve months, owing to certain alterations in the engines suggested by the Manager; and when the additional cylinders were attached, the Directors had every expectation that further economies would be shown. In the meantime, it was gratifying to have to record an increase in the quantity of water pumped of 33 million gallons, at a lessened cost, as far as coal alone was concerned, of £342. In conclusion, he expressed the opinion that the business of the Company would continue to increase, perhaps beyond the expectations of some persons. South Africa was rapidly advancing in progress and prosperity; and the attractions of the discoveries of gold and diamonds were inducing large numbers of people to try their fortunes and settle there.

Mr. Gibson seconded the motion.

The Chairman, in putting the motion, said he had omitted to refer to the local Directors and Managers. He wished to bear testimony to the great interest they took in the affairs of the Company, and the very earnest manner in which all the members of the staff carried out the duties entrusted to them.

The motion was carried unanimously; and a dividend at the rate of 3 per cent. per annum on the ordinary shares was declared.

NEW WATER-WORKS AT LAUNCESTON.

A new water supply for Launceston was inaugurated on the 31st ult. by a ceremony in which the Mayoress (Mrs. Kittow) took the principal part. The new works were rendered necessary by the inadequacy of the supply, and the extension of the towns on the levels which the old works were not high enough to reach. After much consideration, the Corporation decided some time ago to seek a new source, rather than attempt to extend the old works. The site selected was Carne Down, in the parish of Altarnun, about ten miles from Launceston. Here a number of springs rise direct from the granite formation. These have been collected into clear-water tanks; and they yield a supply equal to the present wants of the borough. But, in order to provide for future contingencies, the Corporation have acquired the entire rights to a stream which flows near, and can be used to supplement the springs. At the intake, the water passes through filter-beds, and flows thence through a 6-inch main to a service reservoir on Windmill Hill—a lofty eminence within the borough. This reservoir, which is circular, has a capacity of 350,000 gallons, which is equal to about three days supply. Its bottom and sides are of clay puddle, with a concrete lining coated with cement. A pressure-reducer has been fixed; but, by means of a bye-pass, the water can, if necessary, be made to run direct from the source into the town. There is a fall of 203 feet from Carne Down to Windmill Hill; and the service reservoir is 360 feet above St. Thomas's Bridge, the lowest part of the town, and 140 feet above the centre of the business quarter. The works have been carried out under the direction of Mr. S. Jenkin, of Liskeard. The land required for the intake works and the stream were given to the Corporation by Mr. T. Hugh Spry; but they have had, at considerable cost, and after long and tedious arbitration proceedings, to compensate millowners, whose rights in the lower portion of the stream are interfered with. The total cost of the works, including water rights and easements, and the purchase of the Windmill Hill, part of which will be laid out as pleasure grounds, is £10,500. At the inaugural ceremony, the Mayoress was presented with a gilded key by Mr Jenkin; and she turned on the water. An address was presented to the Mayor (Mr. John Kittow), by members of the Council, in which it was stated that the scheme owed its initiation, and mainly its successful termination, to the practical and energetic assistance he had given to it. A gold bracelet suitably inscribed was also presented by the Corporation to the Mayoress, as a memento of the occasion. The Mayor, in a short speech, said he had no misgivings as to the works. Gaugings taken in the driest season showed that 200,000 gallons per day would flow into the reservoir—sufficient to give 30 gallons per head until the population reached 5000; and then they could easily, from the same source, double the supply.

METROPOLIS WATER SUPPLY.

Proposed Alteration of the Metropolitan Water Supply Regulations.

In response to a request from the London County Council, Colonel DUCAT, R.E., opened an inquiry on behalf of the Local Government Board, at the Guildhall, Westminster, on Thursday, the 31st ult., as to the efforts which the London County Council are making to secure certain alterations and amendments in the regulations made by the Water Companies under the Metropolis Water Act, 1871, the chief one relating to the substitution of a three-gallon flushing-cistern for water-closets in place of one of two gallons now generally employed.

Mr. G. M. FREEMAN represented the London County Council; Mr. PEMBER, Q.C., Mr. C. A. CRIPPS, Q.C., M.P., and Mr. RICKARDS appeared on behalf of the associated Water Companies.

Mr. FREEMAN said this was an application by the London County Council to the Local Government Board to alter, amend, and add to in certain respects, some of the regulations made by the Water Companies, under the 19th section of the Metropolis Water Act, 1871.

Mr. PEMBER interposed to ask Mr. Freeman if he were sure he and his department were right in proceeding absolutely under that section; and to suggest a doubt as to whether section 22 had not a bearing on the matter.

Some further conversation followed, in the course of which the Inspector expressed the opinion that only one—the Kent Company—came under that section; and Mr. Pember said he merely mentioned the point in order that the Council might not, by proceeding under section 19, find the inquiry abortive.

Mr. FREEMAN (continuing) said the original authority in respect of making regulations was contained in the Metropolis Water Act, 1852, by section 26 of which it was provided that the Companies could from time to time, and with the approval of the Board of Trade, make such regulations as might be considered expedient for preventing waste, misuse, &c., of water. Section 19 of the Act of 1871 gave the power under which the present proceedings were taken. The regulations under the Act of 1871 were made in 1872, and had therefore now been in force some 23 years. They were framed at an inquiry at which the Metropolitan Board of Works and the Corporation of London were present. But a very considerable change in engineering science and requirements had taken place since then, particularly in regard to the sanitation of houses; and what was then thought to be satisfactory and sufficient, had turned out to be inadequate and dangerous. The question of increasing the capacity of the flushing-cisterns of water-closets arose in 1892 out of a communication sent to the London County Council by the District Board of St. Giles's. This letter was considered; and the Council consulted their Engineer and Medical Officer of Health. A reply was sent entirely concurring in the Board's views, and stating that the Council would take what steps were possible to support them. Since that time, the Council had received communications from nearly every Vestry and Board of Works in the Metropolis, practically endorsing those views. Having satisfied themselves that there was a substantial case, the Council communicated with the Solicitors for the associated Water Companies. Besides this particular matter of the increase in the size of cisterns, the officers of the Council found, in the course of their inquiries, that there were several others of great importance which it would be desirable to include in the alteration of the regulations. The result was that they now had four proposals before them. There were in many places, particularly in buildings of a public nature, sinks which were used for the reception of solid and liquid matter—not slop sinks, but sinks where perhaps chamber utensils were emptied from time to time. The Council therefore desired that, wherever this was the case, the sinks should be brought under the same regulations, as to having a flush of water, as if they were closets. The next regulation was to prevent cisterns which supplied closets or sinks such as he had described from being used for directly furnishing water for domestic purposes or for the consumption of animals. Under the present regulations, such cisterns could not be constructed; but there were no regulations which prevented cisterns already in existence from being used for these purposes. The last of the alterations was very important. It was that, in all cases where a constant water service was now being given, there should be placed on the rising main one or more cocks or taps for obtaining drinking water for domestic use. This was a matter to which he was happy to say the Water Companies seemed to have no practical objection. On Feb. 28, 1894, the Council sent a circular-letter to each of the Companies, embodying the four matters of which he had already spoken. To this they received a letter from the Companies' Solicitors, dated April 16, 1894, stating that the proposed increase in the quantity of flushing water would cause an enormous addition to the consumption, and that at the time the regulation was fixed two gallons were taken as the outside quantity that would be required. The letter went on to state that the Companies confidently anticipated being able to show that two gallons were sufficient for one flush; while, as regarded the other matters mentioned in the Council's letter, it was the desire of the Companies to comply with any requirements that would add to sanitary efficiency without involving waste. Counsel contended that the two-gallon flush did not clean out the pan sufficiently; the result being that something remained. In these circumstances, a man would use the flush again; so that, instead of two gallons, probably four would be used. If, however, three were sufficient, one would be saved if the three-gallon cistern were used; and this must be set off against the statement of the Companies regarding the enormous increase. Passing on, Counsel referred to the case of Bradford, where it was found necessary, for the well-being of the town, to increase the capacity of the flushing-cisterns from two to three gallons; and there were other places where this had been done. The Council wrote again to the Solicitors to the Companies; and on May 31 last they received a reply to the effect that the proposed regulation for preventing cisterns connected with water-closets being used to supply water for domestic purposes did not appear to concern the Companies, and that they would have no means of enforcing compliance, while in regard to placing taps on the mains they had no objection to offer. Other correspondence followed; but as the last letter of the Council was not answered, the Local Government Board were applied to in October, 1894, to order an inquiry. Letters had been received from some twenty local authorities in the Metropolis generally supporting the Council's proposals. In conclusion, he said that the Companies were not supplying the water by meter, but on the basis of the rating of the houses; and it was their bounden duty to furnish such a quantity as was reasonably and properly required for the adequate treatment of the sanitary appliances in those houses. If, therefore, it was made clear that the present supply was not sufficient, it was the duty of the Companies to accept such regulations as would make it so.

Mr. *C. F. Doll*, architect and surveyor, of No. 86, Gower Street, said he was a member of the St. Giles's District Board of Works and of the St. Pancras Vestry. Before living at No. 86, he lived at No. 74, Gower Street, where was a two-gallon flushing-cistern. A stoppage occurred; and on the drain being opened, he was so struck with the insufficiency of the flush that he had a three-gallon cistern put up in place of the two-gallon one. The Inspector of the New River Company objected at first; but he eventually consented to the larger cistern. Witness went on to detail the steps by which the matter was taken by him before the St. Giles's District Board, and through that Board to the Board of Trade, the County Council, and other bodies; and he epitomized the correspondence which ensued. Continuing, he stated that, as an architect, he had frequently had to consider the present question, and had come to the conclusion that the two-gallon flush was insufficient, because, by experiment in his own house, he had found that this would not clear the drain, or even, in many cases, the pan. In his experiment, he used a wooden ball in a 50-feet drain, with a 1½-inch flush-pipe and a wash-out tank. Even then the ball did not get as far as the interceptor. The drain was a 6-inch stoneware pipe; and the inclination was about 1 in 50. He then substituted the three-gallon cistern, and brought the matter into the interceptor without difficulty. Two gallons might clear out with absolutely new pipes, if laid at proper inclination. In his experience, it was the general rule that the 1½ or 1¼ inch flush-pipe, suggested by the Companies, was used; and this was the smallest size supplied. The efficiency of a flush depended rather on its force than on the quantity, as regarded clearing the apparatus. As to the increase in the consumption of water which it was thought would result from the adoption of the proposal, he asserted that, where a two-gallon flush was in operation now, the majority of people used it twice; so that there was a loss of a gallon of water.

Cross-examined: In his experiment, he had a downflow pipe of 1¼ inches. The cistern was about 5 feet above the pan. The outlet went into the falling soil-pipe. The ball was made of deal, and was 1¼ inches in diameter. He could not say how many seconds the flush took to operate, though this was a matter of great importance. The closet used was a patent; but he did not know that it required avowedly a three-gallon flush. The bulk of the houses on the Bedford Estate in Bloomsbury were fitted with 1¼-inch pipes, and he had not had any complaints from the residents there, because, in defiance of the regulations, he had placed three-gallon flushing-tanks in the houses. He knew very few two-gallon closets; and such as he did know were constantly being complained of. He should be astonished to hear that the Water Companies were specially exempted from flushing sewers or drains.

Mr. PEMBER stated that this was so in the case of all the Companies but one.

Witness (continuing) said he agreed that the bath water and slops helped to flush the drains; but the soil-pipe from the closet usually entered the drain above the pipe from the bath-room, which was therefore of no assistance.

In re-examination, witness stated that the New River Company took no action in regard to the three-gallon cisterns on the Bedford Estate until the present proceedings were threatened.

Dr. *J. F. Sykes*, the Medical Officer of Health for St. Pancras, strongly supported the proposed substitution of three-gallon cisterns in place of those now existing. The change would, he said, be beneficial in clearing the basin, the trap, and the drain. After a two-gallon flush, the pan was often improperly cleared. He had had this experience that morning in that very building. The larger flow would be of immense advantage in poor districts. In general, witness confirmed the evidence of the previous witness.

Mr. *W. J. Berry*, Surveyor, of the Estates and Valuation Department of the County Council, said he had charge of the artizans' dwellings of the Council. He also supported the three-gallon system, which he said he had tested. In a block of the Council's buildings at Yabsley Street, Poplar, there were 50 closets and 50 tenements; the population being about 170. There was a three-gallon flushing system geared down to supply two gallons. In Beachcroft Buildings, Ratcliff, which were also Council property, there were 40 tenements and 40 closets, and the population was about the same as at Yabsley Street. Here the cisterns were of three-gallon capacity. Roughly speaking, the arrangements at the two places, except as to the size of the cisterns, were similar; yet at Yabsley Street Buildings there had been 21 stoppages in seven months, while not one occurred at Beachcroft Buildings.

Mr. *S. Buck* and Mr. *Le Brun*, the superintendents in charge of these buildings, confirmed this statement.

Mr. *A. R. Binnie*, M.Inst.C.E., the Chief Engineer of the London County Council, stated that, while he was the Engineer to the Corporation of Bradford, exhaustive inquiries were made in regard to water supply, and a regulation was framed raising the quantity to be used for flushing from two to not more than three gallons. In his opinion, nothing less than this quantity would suffice for London. He thought it would rather lead, as it did in Bradford, to a saving, because now practically two flushes of two gallons each were used to do what three gallons would effect.

Cross-examined: In nearly all of the cases in Bradford where the two-gallon flush was unsatisfactory, the pipe was a 1¼-inch one, and the fall varied from 3 to 10 feet—5 feet being the average.

On the resumption of the inquiry on the following day,

Dr. *Shirley F. Murphy*, the Medical Officer of Health for the County of London, was the first witness called. He said he had considered the matter of the cisterns; and his impression was that the two-gallon

flush was insufficient for the purposes sought to be effected. He spoke from general experience, and not from any special experiments. In various institutions, notably hospitals, there were slop-sinks, which were practically water-closets, and should be brought under the regulations applying to them. Witness supported the proposal that no cistern used for domestic purposes or for cattle should be allowed to communicate with a closet.

Mr. PEMBER pointed out that this was a matter with which the Water Companies had nothing to do.

Mr. FREEMAN asserted that they could make a regulation to enforce this proposal, and, in case of non-compliance, could decline to lay the water on to such a cistern.

Mr. PEMBER said the contamination of water which it was sought to prevent was not contamination which would occur while the water was in the Companies' mains, but would take place after its delivery. The Companies did not say it was not important; they merely contended that they had nothing to do with it—that it was outside the scope of their Acts of Parliament.

The INSPECTOR intimated that he rather took Mr. Pember's view of the matter; but he wished to have time to consider it.

Witness went on to express approval of the proposal of the Council in reference to fixing taps to the rising-main, when,

Mr. PEMBER said he doubted very much whether this matter was a proper regulation to be added to those made in 1871. He was anxious to repudiate any notion that the Companies differed from the public generally as to the advisability of this proposal, or of the one last mentioned, being carried out; but he did say that both proposals had nothing to do with the matter in hand.

Witness was then cross-examined. He stated that a flush should thoroughly clear the pan, and empty the trap; and the emptying of the drain, so far as it could be done, should also be included in the list of requirements. He knew houses where the closet arrangements complied with the requirements of the Companies, but where the two-gallon flush was insufficient. He could not, however, give off-hand any instances. It might be possible to construct a closet with a two-gallon cistern which would go far towards securing what was wanted; but, in practice, things did not do what they were supposed to do. He thought, therefore, that water must be found by the Companies to flush all closets which came within a reasonable regulation. He did not, however, say he should give up the task of making suitable fittings, and rely upon the water. The fitting which used the least water, if it was equally good in other respects, was the best. There were structures called "slop-sinks," and were definable if regard were had to their use. Scullery sinks were used for receiving solid or liquid filth.

Some discussion followed as to what was meant by the word "filth."

Mr. FREEMAN, in order to make what the Council desired clear, said the new regulation he would ask for in regard to this matter would be: "The expression 'water-closets' in these regulations includes any sinks used for the reception of any solid or liquid excreta." He also asked to have struck out of Regulation 20 the words "other than water-closets in which flushing is employed."

Mr. *W. E. Groom*, the Sanitary Inspector to the Camberwell Vestry, said in his district, where there was much poor property, the two-gallon flush was insufficient to clear the water-closets. It was a very ordinary thing for the flush not to carry the contents through the trap, and sometimes not to clear the pan. The small supply of water was not merely an inconvenience, but a danger to health. He had complained of this for a long time, and had formed an opinion that the three-gallon flush would remedy the defect.

Mr. *C. Tagg*, the Clerk to the Vestry of Camberwell, gave evidence as to the Vestry being in favour of the alteration.

Mr. *F. Blashill*, F.R.I.B.A., the Superintending Architect for the London County Council for Metropolitan Buildings, said he had much to do with large blocks of houses; and, in his opinion, two gallons of water were insufficient to flush a closet, as excreta often remained in the pan afterwards. Three gallons would, he thought, be effectual. Even if the fittings were proper, two gallons would be insufficient. In designing artizans' dwellings, he had had to consider what sort of closets he should place in them; and to do this he had tried the waste-preventers and closets of as many as ten different makers. He selected five as apparently efficient. They were used in the Yabsley Street Buildings and the Beachcroft Buildings; and he thought they would give a fair test if the set in one block were compared with the set in the other. It was the duty of the Companies to supply a reasonable quantity of water; and this, in his opinion, was not done with a two-gallon flush.

Cross-examined: Knowing that closets were frequently not scientifically perfect, there should be a margin in the amount of flushing-water. It depended a great deal on the class of persons using a closet as to whether or not it acted properly, because very often, with children and ignorant people, a large quantity of paper was used. He thought the Sanitary Institute would have no difficulty in arriving at a correct conclusion as to the best form of closet to be employed, regard being had to the fact that only two gallons of water were to be used for flushing purposes. It would, however, be monstrous to make the class of closet selected compulsory for the future. He said this because all closets up to the present had not proved to be perfect; and he did not suppose that that one would be absolutely satisfactory.

Mr. *Keith D. Young*, F.R.I.B.A., said he had had considerable experience as an architect, chiefly in connection with hospital work. In order to thoroughly flush out the pan, the trap, and the soil-pipe of a water-closet, they must have a flush of 2½ gallons at least. Even in regard to the best form of closet known, the amount of the flush ought to be increased. Slop-sinks should be flushed; and the majority of such sinks in hospitals should have a tap as well.

Cross-examined: There was a closet in existence which, when used by ordinary persons, would be sufficiently flushed by the flow of two gallons of water. But in cases of illness, or in unusual circumstances, that flush would not operate properly. Hospital slop-sinks were flushed by means of a "jelly bag" arrangement and a tap, which was not sufficient. He should not put up a slop-sink anywhere, except in a hospital or some similar institution.

Mr. *J. W. Clarke*, a registered plumber and a Liveryman of the Company of Plumbers, said that in 1881 he became Honour Medallist in plumbers' work. He was a member of the Sanitary Institute, and a lecturer on plumbing at the Polytechnic Institution. He had had 28 years' practical experience, and had come to the conclusion that, even with a good closet, a two-gallon flush was insufficient. It did not always clear the basin, particularly when this was dry. The cleanliness of a closet was added to very much if a three-gallon, instead of a two-gallon, flush were used. The trap, moreover, was generally cleared with a three-gallon flush.

Mr. *Rogers Field*, M.Inst.C.E., said he believed he was the first member of the Institution of Civil Engineers who took up the study of the details of the sanitation of buildings; and he had had large experience of drainage arrangements in connection with public institutions and private houses. The inquiry in 1872, when the regulations of the Water Companies were drawn up, was conducted before a Commission. He studied the report very carefully, to ascertain precisely why two gallons were fixed as the proper quantity of water to flush with; but he had been unable to discover any reason. It appeared that someone proposed a gallon and a half. The City Corporation suggested two gallons; and the Companies said: "Let it be so." The waste-preventers were wanted in order to avoid the waste caused by the old stool taps, which was simply immense. His attention being called in his work to the fact that closets of the best form which he had erected were not working satisfactorily with a two-gallon flush, he increased it wherever he was not stopped by the Companies—first to two-and-a-half and then to three gallons. He was strongly desirous of seeing the three-gallon cistern used. Scientific experiments were good, if they were controlled by practical experience; but no experiments could give the information that could be obtained from daily practice. He was a member of the Committee of the Sanitary Institute, which, in 1893, carried out certain experiments in regard to the quantity of water necessary to flush a closet. They showed the advantage of a three-gallon over a two-gallon flush. Gradients were laid, partly of pipes and partly of open channels; and into these drains, which were of different lengths and inclinations, water was turned from a closet-basin and flushing-cistern—the basin and cistern being chosen as good ones. The two-gallon flush passed away in about five seconds; and the three-gallon flush in seven seconds. The same apparatus was used throughout. The cistern was 4 ft. 3 in. above the pan, and a 1¼-inch pipe was used. The efficiency of the flush was tested by means of soft soap, cocoa fibre, and clay, placed in the basin. The two-gallon flush did not always clear the trap and drain-pipe. It left 5 per cent. of the material there; while only 1 per cent. was left by a three-gallon flush. His experience in regard to the closet at his own house agreed with this result. The Committee came to the conclusion that two gallons were not sufficient for a flush, and that the minimum should be placed at three gallons. Witness then dealt with other experiments which had been made by the New River Company and by the Kent Company in reference to the same matter. Continuing, he said one of the chief reasons for adopting the three-gallon flush was its effect on the drain, apart from the pan, &c. In order to ensure the excrement falling into the water, the water surface had to be increased in area, with the result that more water had to be used. With reference to slop-sinks, he supported the Council's proposals, and stated that it was only recently that he had been able to procure proper apparatus to flush them.

Cross-examined: He could not give the names of any closets which were kept out of the market owing to the two-gallon flush being insufficient for them. The experiments of the Sanitary Institute were not stopped because the County Council wanted the results by a certain date, but because the land on which they were being carried out was required.

Dr. *W. Y. Orr*, the Medical Officer of Health for the Wandsworth District Board of Works, said his Board were in favour of the regulations being altered so that the discharge from each waste-preventing apparatus should not be less than two, nor more than three-and-a-half gallons at each flush.

Dr. *W. Corfield*, Professor of Hygiene, and Medical Officer of Health for St. George's, Hanover Square, said that, even with a closet having a 1¼ or 1½ inch fall pipe, and with a full opening into the pan, a two-gallon flush was not sufficient. The way in which the handle or plug was pulled made a difference as to the effect of the flow. Where there was only a two-gallon flush, it was necessary to use automatic flushing-tanks to keep the drain clear. They were placed at the head of the drain, in the back yard, so that there would be no saving of water used for the whole of the drain. It was desirable, however, that the whole flush should be "in one hand." For pan, trap, soil-pipe, drain, and disconnecting trap, the three-gallon tank was requisite.

Cross-examined: He knew of automatic flushing-tanks to the extent of some hundreds. They were located practically all over London, and particularly at the West-end. Some were in the district of St. George's, Hanover Square; and the Water Companies covering the district were the Grand Junction and the Chelsea. He thought the best form or type of closet was one of the sort required under the model bye-laws of the Local Government Board—one which had a large water service.

The inquiry was then adjourned till the following Monday.

On the resumption of the inquiry on the 4th inst.,

Mr. *Blashill*, recalled, gave the names of the makers, ten or eleven in number, from whose samples the closets for the model buildings of the County Council were selected. They were all tried with a three, not a two gallon flush, as he had previously stated. The five which were selected worked well with a three-gallon flush.

Cross-examined: They were all of the wash-out or short hopper type of closet.

Dr. *L. Parkes*, the Medical Officer of Health for Chelsea, said he had been requested to attend the inquiry by the Metropolitan Branch of the Incorporated Society of Medical Officers of Health. He had had much experience of the flushing of closets, especially in connection with the London Hospital, Whitechapel. All the closets in that building had been removed; and, on his recommendation, new ones of the short hopper type substituted, with flushing cisterns of three gallons capacity. The closet he selected was one in which there was a large area of water into which the excreta could fall without touching the sides. In a closet

where there was not such a large water area, the sides became foul very much more quickly. Where there was a deep seal, as would be more likely with the three-gallon than the two-gallon flush, there was less liability to syphonage. A three-gallon flush would permit of an increase of seal from 1 inch to 1½ inches. It was important to have a flush which would not only clear the pan, but prevent syphonage. He did not think there was any advantage, except in special cases, in having a larger pipe than one of 1¼ inches in diameter.

Cross-examined: He believed the two-gallon flush was common over nearly the whole country. If syphonage could be avoided, it was better to have the water in the trap as shallow as possible. The best, but most expensive, way to prevent syphonage was to ventilate the trap.

Mr. *H. Robinson*, M.Inst.C.E., Professor of Civil Engineering at King's College, said he had been in practice as a sanitary engineer for the past thirty years. His attention had been particularly called to the fact that household drains were often very foul. This, he thought, was due mainly to the insufficiency of the flush. Rods and automatic flushing-tanks had been constantly used to remove the obstructions. With regard to the experiments of the Sanitary Institute, they were unreliable, owing to the conditions under which they were made. The proposed increase in the flush would not augment the consumption of water to so great an extent as was thought, because with the two-gallon flush there were, in many instances, twice as many flushings as there would be with one of three gallons. If the size of the flush-pipe were altered from 1¼ to 1½ inches in diameter, the difference would not be appreciable, because it would only make the flow about half a second shorter.

Cross-examined: One of his reasons for advocating the three-gallon flush was that house drains were often defective. The proper remedy for clearing the drains in the present state of the law was an automatic flushing-tank. A three-gallon flush would be sufficient to cleanse the drains in small houses—at all events, it would be more effective than two gallons; and in the larger houses there would be assistance from bath water.

This concluded the case for the County Council. Evidence on behalf of the Water Companies was immediately taken; and this will be reported next week.

The Water Supply of Perranporth and St. Agnes.—It is reported that the scheme for supplying these villages with water obtained from Silverwell, to which reference was made in the JOURNAL for the 29th ult. (p. 892), has been abandoned.

Exhibition of Gas Appliances.—An exhibition of Messrs. Richmond and Co.'s gas stoves and appliances is now being held at the Armoury, Huddersfield. It was opened, on the 1st inst., by the Corporation Gas Engineer (Mr. W. R. Herring), in the absence of Alderman Stocks. Mr. Herring made a few appropriate remarks, in which he described coal gas as the universal artificial illuminant. He said that possibly within the next twenty years people might be supplied with gas without what was called illuminating power at all; that being derived from the mantle of the incandescent light. The cost of gas chiefly arose from having to put into it a high illuminating power; but, if his surmise should prove to be correct, then gas could be supplied by the Corporation at half its present price. In connection with the exhibition, cookery lectures have been delivered by Miss Richmond.

Rosario Water-Works (New) Company, Limited.—The seventh ordinary general meeting of this Company was held last Tuesday, at the London Offices, 52, Moorgate Street, E.C.—Mr. J. Morris presiding. In moving the adoption of the report and accounts, the Chairman said there was an increase in the profits of £1090; but additional working expenses left them with only £415 to the good. There was a net balance of a little over £9000. After debiting the net revenue account with debenture interest in full, trustees' fees, and interest on loans, there remained a deficiency of £4575 for the year, which increased the total debit against net revenue account to £40,620. He commented on the hopeless position in which the ordinary shareholders were placed, and remarked that, in the opinion of the Directors, the time had come when something should be done, if possible, to make an arrangement with the debenture-holders, with a view to putting the Company on a better basis. The motion having been carried, a resolution was brought forward to the effect that a Committee composed of debenture stockholders be appointed to confer with the Directors as to a scheme for dealing with the existing and future arrears of interest, with a view to an equitable arrangement as between debenture stockholders and shareholders. This was unanimously agreed to.

Basingstoke Water Supply.—An inquiry on behalf of the Local Government Board was recently held in the Town Hall, Basingstoke, in reference to an application by the Corporation for power to raise £16,000 for the construction of new water-works according to a scheme prepared by Mr. H. Rofe, M.Inst.C.E., under the instructions of the Corporation. The Town Clerk (Mr. W. H. Bayley) stated that the Corporation had purchased the works from the late Water Company; but they did not include a pumping-station and engines. They had to pay a heavy rent for having the water pumped; and it had been considered that it would be better to have their own establishment and do their own pumping, &c. The interest on the money they would lay out would not be so much as they were now paying; and they would, moreover, be acquiring a valuable property. They also proposed, under the new scheme, to provide a more constant supply for the higher parts of the town. Two members of the Corporation, as well as the Mayor (Alderman W. Powell), gave notice of opposition to the scheme on behalf of different sections of the ratepayers, who, in public meeting, had passed a resolution adverse to it. Mr. Rofe submitted his plans, specifications, estimates, &c. He proposed that a pumping-station should be erected at Sherborne Bottom, on the north side of the town, and the water pumped to a reservoir about three miles on the south side, which would ensure a constant supply to the highest parts by gravitation. Mr. Dowling, the Chairman of the Water Committee, also gave evidence in support of the scheme; while Mr. Smith, a councillor, strongly opposed it as unnecessary and too costly. The inquiry was ultimately adjourned for a month.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The workman gas director question, which Mr. George Livesey raised a few months ago, has been advanced a stage at Leith. At the municipal election on Tuesday, they elected as a Town Councillor Mr. Patrick Kelly, gas worker. Mr. Kelly stood, of course, as a working man candidate. His opponent was a wine merchant; and the majority by which he was returned was 107—567 to 460. So far Mr. Kelly, as a Town Councillor, has nothing to do with the gas-works; but he is eligible for appointment to the Edinburgh and Leith Gas Commission, as one of the representatives of Leith on that body. The election is fixed by statute to take place on the third Tuesday of November, which, this year, will be the 19th inst. If the Leith Town Council should send Mr. Kelly to the Gas Commission, the position would be that he would be virtually the superior of Mr. Linton, in whose employ he is, and whose orders he is bound to obey. If he were endowed with common sense, there might be no harm in the arrangement; but should he become a demagogue and a meddler, the consequences might be unpleasant—to himself chiefly, I should say. Should he not be placed on the Gas Commission, he might, were he so disposed, take up a position from which to harass the Gas Commissioners; or he might, on the other hand, endeavour to promote their interests in the Town Council. The position must be a very trying one to Mr. Kelly; and in consideration of its bearing upon Mr. Livesey's question, his doings will be worth keeping in view.

The municipal elections are now over; and matters which have been stirred up during the contests will for the most part retire into obscurity. It is satisfactory to note that in none of the large cities in Scotland was there much more than a passing reference to matters connected with gas supply. It was only in the smaller places that these subjects were prominent. The electors of Dunfermline were singularly quiescent, when it is considered that the Corporation are contemplating acquiring the gas undertaking. That was due to the notion having been circulated that it was not necessary, though they should adopt the Gas Act, that they should proceed with the transfer. There has been great heat over the gas question at Forfar. I am afraid the result of the election does not improve matters much, but that we may look for a renewal of the bickerings which have of late made the meetings of the Forfar Gas Corporation very different from what business meetings should be. At Hamilton there has been a great deal of speaking upon the Corporation gas undertaking. The question which agitated the candidates was that of extensions at the works, with an occasional incursion into the regions of finance and the quality of the gas. I know no place where there is less occasion for cavilling at the gas supply. Both sides of the question have been dealt with at Broughty Ferry; some asserting that the gas undertaking is being well conducted, and others that it is not. In all these instances, whatever question of public interest was raised, the Gas Manager was dragged into the discussions. That was not fair, because in the circumstances the Manager could scarcely afford to take notice of attacks made on him. The gentlemen who were thus dragged before the public will, however, have the satisfaction of knowing that the worst has been said against them in the meantime, and that they will now have comparative peace in which to tackle their winter's work.

I observe that Mr. Mitchell has been retained as Convener of the Glasgow Corporation Gas Committee, with Mr. Stevenson as Sub-Convener. At Aberdeen, Mr. Johnston has been retained as Gas Convener. The only change I know of as yet is at Hamilton, where Mr. Brown has retired from the convenership of the Gas Committee after holding it for three years. He did good work in his time; but he was notwithstanding subjected to a good deal of nagging.

On Saturday last, Provost Chalmers, of Gourock, laid the foundation plate of the new gasholder which the Corporation are erecting to plans by Mr. J. M'Gilchrist, of Dumbarton. The holder is the one which the Corporation last April obtained the sanction of the Sheriff to erect without the necessity of obtaining the consent of the owners and occupiers of property adjoining. At the ceremony, Provost Chalmers was presented by the Contractors (the Airdrie Iron Company) with a silver trowel, by the aid of which he carried through the necessary formalities. He then gave a short address, in which he referred to the formation of a Gas Company in the primitive watering place of Gourock in 1842; and traced the progress and development of gas production down to 1886, when the Commissioners took over the works. Their subsequent tenure had been profitable all round; and now, with increasing requirements, they had to extend their storage capacity. When the prospective tank, which would cost about £3500, was completed, Gourock would be in a position to meet demands for gas for whatever purposes for a considerable number of years to come. In the evening, a large number of gentlemen were entertained to dinner by the Provost in the Ashton Hotel.

On Tuesday of this week, an inquiry was held at Dumbarton into the circumstances attending the death of a lad named Wilson, in the Dawsholm works of the Glasgow Corporation, which are within the jurisdiction of the Sheriff of Dumbartonshire. The narrative of the accident is to the effect that the deceased was an apprentice boiler maker with the Airdrie Iron Company, and belonged to Airdrie. He was employed, along with several other workmen, at the construction of hoppers in the Dawsholm works. The hoppers were on a raised platform; and on a level with them, but on another platform, was a steam travelling crane, which was used for lifting material required in the construction of the hoppers. The casing of the crane, when it was swung round, came about 6 inches over the hoppers, so that anyone coming between the crane and the hoppers would be crushed. In view of this danger, the foreman on the job gave the craneman instructions not to move the crane unless by orders from him; and the other employees were also told that they were not to order the craneman except through the foreman. On Oct. 11, the lad Wilson was standing between the hoppers and the crane, when the latter was swung round, with the result that he was crushed and killed instantaneously. Three witnesses examined at the inquiry were employed on the job at the time of the accident; and they each swore that no order was given to swing the crane, and that there was no

necessity for it at the time. The craneman was not examined. The jury found, in accordance with the evidence, that the lad was accidentally killed by being crushed between the crane and the hoppers, through the jib of the crane being swung round.

An unfortunate accident happened in the Tradeston works of the Glasgow Corporation, on Monday afternoon, by which one man was killed and another injured. A new gasholder is being erected; and workmen were engaged in the removal of a steam crane which had been used in part of the work. They were working with a hand crane, the pinion of which broke off when they began to wind. The jib of the hand crane, when the pinion snapped, came down; and in its fall it struck one of the workmen on the head, killing him instantaneously. Another workman was injured on the legs and left arm. A melancholy feature of the accident was that the poor man who was killed only started work at the breakfast hour that day, and nobody connected with the place knew his name.

Mr. W. Penman, C.E., of Edinburgh, who has introduced a method of applying the Welsbach incandescent gaslight to optical lantern work, by enriching ordinary gas with oxygen, described and illustrated his invention before the members of the Edinburgh Photographic Society on Wednesday. It is just announced, too, that the Royal Scottish Society of Arts have awarded Mr. Penman a silver medal for his discovery.

On Saturday last, the members of the Aberdeen Amalgamated Society of Engineers, to the number of about fifty, visited the Aberdeen Corporation gas and electric light station. The Convener of the Gas Committee (Mr. Johnston) and the Engineer and Manager (Mr. A. Smith) received the visitors, and showed them round the place.

A curious affair happened at Dreghorn, in Ayrshire, on Tuesday night. The gas lights in the district went out; and on a visit being paid to the gas-works, it was found that the gasholder was empty. The Manager could not be found, which gave the occurrence a mysterious aspect. A man with a knowledge of gas making was obtained from Kilmarnock; and the gas supply is again restored.

Dr. John Clark, of Glasgow, the Chairman of the Scottish Section of the Society of Chemical Industry, delivered the opening address of the winter session of that body in Glasgow on Tuesday night. Dealing with the subject of black smoke, he said that very little progress had been made in the movement for its abatement. Even with the use of mechanical appliances, he thought the remedy would be very partial, as there were many fires to which mechanical stokers could scarcely be applied. Unless, he considered, the citizens were prepared to use gas-fires, or to burn coke in suitable stoves, the problem of getting rid entirely of black smoke seemed to be as far from solution as ever.

I am very pleased to be able to refer to the satisfactory working of the Renfrew Corporation Gas-Works, of which Mr. Thomas Lighbody is Manager. The output of gas rose during the year from 11 to over 12 million cubic feet; but the sale of gas increased in a greater proportion, the unaccounted-for gas having been reduced from 13·33 to 8·26 per cent. The coal carbonized amounted to 1345 tons, which, though the output of gas was greater, was 50 tons less than the amount used in the preceding year. This points to a higher yield per ton of coal, which I find increased from 8563 to 8956 cubic feet. There was a total income of £2586, and a gross surplus of £886. Out of this the Commissioners have paid £213 for interest upon capital, and have placed a like sum to the sinking fund. They have also written off arrears to the amount of £69; leaving a balance of £390 to be carried forward. The Commissioners have, in Mr. Lighbody, a gentleman eminently qualified to carry on their work. He passed first-class last year the examination in gas manufacture of the City and Guilds of London; and the Commissioners, in recognition of his services, have advanced his salary.

The municipal election in Arbroath was fought upon the one question of the water supply to the burgh. At present this is pumped from wells in the Nolt Loan; but the supply is only about nine gallons per head per day, and there are doubts as to whether even that can be kept up. A Committee of the Town Council obtained a report by Mr. James Wilson, of Edinburgh, recommending that a gravitation scheme should be adopted. The Town Council, at a recent meeting, agreed to this recommendation. Thereafter the elections came on; and the subject of water supply was made the test. There is a bequest of £200 a year from the estate of a deceased neighbouring gentleman, which the town holds as long as they take the town water supply from the Nolt Loan. The bequest was doubtless a generous one when made; but its folly is seen in that, circumstances having now altered, it places the temptation before the inhabitants of doing with an insufficient supply of water rather than lose a contribution of £200 a year to the rates. This temptation was too strong to be resisted. There are six wards in the town, and all were contested; literal oceans of oratory being poured forth on the subject. The result has been that in every one of the wards the supporters of the Nolt Loan scheme were victorious; and the gravitation scheme is, therefore, in the meantime, at an end. For how long, it is impossible to say, because that depends upon the Local Government Board. They will not continue to tolerate a water supply of only nine gallons per head per day.

Proposed Water-Works for North Walsham.—Mr. J. C. Melliss, M.Inst.C.E., has lately visited North Walsham, with the view of investigating the existing water supply; and he has reported on the subject to the District Council. The district includes several minor outlying hamlets; and the whole parish contains 4252 acres, with about 900 houses and an estimated population of about 3800. The present water supply is obtained from shallow wells, of which there are 170 in the town itself; and they all derive their water from the sand and gravel formations. Mr. Melliss is of opinion that the time has come to obtain water from a purer source; and he recommends sinking a well into the chalk (which may probably be met with in the locality at a depth of 150 feet), care being taken to exclude water from the overlying strata. In addition to a well, a storage reservoir will be required; and this might be placed on high land (144 feet above Ordnance datum) on either the Westwick or the Smallburgh Road. The Council have asked Mr Melliss to submit an estimate of the probable cost of a scheme of water supply for the district.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 9.

Sulphate of Ammonia.—Throughout the week the market has been quiet; consumers' orders being still rather scarce, and operators for the most part hanging back. Prices have, in consequence, been scarcely maintained. On the other hand, after the larger selling up to late October, there is no great pressure on the part of makers to sell; and they show no disposition to follow the decline further in the meantime. The closing quotations are £8 15s. to £8 17s. 6d. per ton f.o.b. at the ports. There does not appear to be much actual business doing for forward delivery; the views of sellers and buyers as to values having become somewhat divergent. The quiet spot market has made buyers less inclined to purchase ahead, unless at a concession on recent current prices, which makers are not disposed to give.

Nitrate of Soda remains quiet. Spot value of fine quality is still 7s. 9d. per cwt.; and autumn shipment cargoes are worth 7s. 9d. to 7s. 10½d.

LONDON, *Nov.* 9.

Tar Products.—There is more activity in this market. Even carbolic acid, which has so long been a "dead letter," is now very freely inquired for; crystals realizing a slightly better price, while 1d. per gallon more is asked for crude 60's. Pitch is moderately firm. Benzols are in good request; 50 per cent. quality now having come up into line with 90's as regards price. There is a better trade both for xylol and cumol, which points to the production of the old-fashioned scarlets again. A somewhat better tone exists in the anthracene market; and sales of considerable importance are recorded at the full prices quoted by the Committee. The following prices have been noted during the week: Tar, 19s. to 23s. 6d. Pitch, 35s., west coast; 38s., east coast. Benzols, 90's and 50's, 1s. 4d. Solvent naphtha, 1s. 2½d. Toluol, 1s. 4d. Crude, 30 per cent., naphtha, 5d. Naphthalene salts, 25s. to 40s., according to quality. Cresylic acid, white, 1s. 2d.; brown, 10½d. Carbolic acid, 60's, 1s. 7½d.; 75's, 1s. 11d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia.—Notwithstanding the excellent shipments that are going on, and the undoubted increased demand for the article, there seems to be no backbone in respect to its value. Sulphate has changed hands during the week at from £8 12s. 6d. at north-east ports to £8 15s. to £8 17s. 6d. western ports, and £8 17s. 6d. to £9 London—all less 3½ per cent., except Beckton terms. Dealers are anxious to buy for forward delivery; but makers' ideas are largely in advance of current prices.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—The upward movement in prices with the commencement of the month has scarcely been so strong as was anticipated. It has barely gone beyond a levelling up to list rates; any appreciable advance upon these being very exceptional. For the better qualities of round coal, the demand has rather fallen off, as compared with the pressure of orders that was in many cases coming forward towards the close of last month. The house-fire coal pits are, however, mostly on five days per week, which is practically full time. As a rule, 10s. 6d. per ton at the pit is now being got for best Wigan Arley; 9s. to 9s. 6d., for Pemberton four-feet and seconds Arley; and about 7s. to 7s. 6d., for common house coals. The lower qualities of round coal still show no improvement; and excessively low prices are now being quoted to clear away surplus quantities—sellers in some instances being willing to take 5s. 6d. per ton at the pit mouth, with 6s. to 6s. 6d. remaining about the average quoted figures. With regard to the Belfast gas-coal contracts, of which I gave some particulars a week or so back, I hear that the prices taken by the Lancashire collieries—who, as previously stated, secured about 80,000 tons—do not average more than 6s. 3d. per ton at the pit mouth for Arley gas coal. The shipping trade in common coals also continues exceedingly depressed, with 7s. to 7s. 6d. per ton taken for ordinary qualities, delivered at the ports on the Mersey, and about 7s. 9d. for delivery at the Partington tips on the Manchester Ship Canal. Engine classes of fuel are meeting with rather more inquiry for iron-making purposes, which is helping to move away the increased quantities of slack now coming upon the market; and prices are steady at 3s. 6d. per ton for medium sorts, and 4s. 6d. to 5s. for best qualities, at the pit mouth.

Northern Coal Trade.—Increased dulness has shown itself in the coal trade of the North during the last few days, more especially in the steam coal branch; and in consequence the range of prices has been lower. On the other hand, there has been a larger demand for gas and household coal. The tendency of the trade may be seen from the fact that many of the best steam coal collieries have not more than half work; while some at least of the gas coal collieries are not only fully employed, but have full work ahead for most of the winter. Best Northumbrian steam coals may now be quoted at 8s. per ton f.o.b., though there have been sales both above and below this price. Second-class steam are about 7s. 6d. to 7s. 9d. per ton f.o.b., and small steam coals, 4s. per ton, with a good demand for the latter, owing to the limited supply. In manufacturing coals, most of the transactions are now for next year's delivery; and for these the price is substantially the same as in the contracts that expire with the year, though for one or two kinds that are preferred for chemical works an advance of 1½d. per ton has had to be paid by several buyers. Gas coals are now nearly at the time of the heaviest deliveries, both locally and for distant ports; and most of the best gas coal collieries are fully employed in the seams that yield gas supplies. The deliveries are, of course, mainly under contracts that are at moderate prices; but for odd cargoes, the general quotation varies from 6s. 6d. to 7s. per ton, while one of the large Wear shipping collieries now asks 7s. 3d. per ton f.o.b. Stocks, however, of gas coal are increasing with some of the companies, though they will be drawn upon in a few weeks. Coke is very firm. The consumption at the local blast furnaces is at about the highest point known, and fair quantities are being sent to the north west; while the shipments show an increase both from the Tyne and from West Hartlepool. For best coke for export, the price is 14s. 6d. to 15s. per ton f.o.b. Gas coke is being increasingly made now; but the consumption is also higher, and even

the inland companies seem to have smaller stocks than they had a few weeks ago. There is no alteration in the price of gas coke.

Scotch Coal Trade.—Little change is perceptible in the coal trade in Scotland. There is, if anything, a slackening of demand, on account of the shipbuilding dispute which has now extended to the Clyde. Should it last for several weeks, coal will very soon be overstocked, with the probable result of a fall in prices. While this state of matters lasts, the coal trade is being conducted under conditions which have a paralyzing effect. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 164,134 tons—a decrease as compared with the preceding week of 16,627 tons, but an increase over the corresponding week of last year of 25,284 tons. For the year to date, the total shipments have amounted to 6,267,032 tons—an increase as compared with the same period of last year of 2,065,953 tons, but a decrease on 1893 of 473,555 tons.

Suffocated by Gas.—A young woman, named Mary Durkin, died at Rochdale, on Monday last week, from the effects of inhalation of gas. She was found apparently dead in her bed-room with the gas-jet turned on, and the room full of gas. After much exertion, two constables restored her to consciousness; but she relapsed into insensibility again and died. It is believed to be a case of accident.

The Public Lighting of Crayford.—At a meeting of the Crayford District Council last Friday, it was resolved to adopt an extended system of public lighting. Mr. Peill moved that tenders be obtained for oil as well as gas lamps; and Mr. Pruden seconded the motion. Mr. Battison and Mr. Miles thought oil would be too dear in the long run. Mr. Brown said oil was certain to be the dearest as well as the most unsatisfactory illuminant. The Erith Council had, by their miserable oil-lamps—"smoky doubtfuls" as they were called—saved £300; but they had had thousands of pounds' worth of grumbling, to the prejudice of the place, because where there was grumbling there was discontent, and people would not live in the place if they could help it. The Gas Company at present charged about £3 per lamp for the year. It was resolved to advertise for tenders for public lighting by gas or oil.

The Proposed Electric Lighting Scheme for Swansea.—As already mentioned in the JOURNAL, the Swansea Corporation have, by a majority of one, decided to adopt an electric lighting scheme. With the view of assisting the ratepayers in forming a sound judgment on the matter, a local paper obtained from "one of the foremost electrical experts in the kingdom" a report in which he gave particulars of two plans which he thought might be advantageously carried out. In the first, provision is made for the production of electrical energy alone by means of steam power produced in the ordinary way; in the second, this is combined with the destruction of ashbin refuse. The estimated capital outlay for the first scheme is £22,625; and a profit of £1539 is reckoned upon the working. This, of course, will have to meet the sinking-fund charges and interest on the capital sunk. Allowing for these matters, the actual profit is put down at £50 per annum, with the certainty of acquiring the plant at the end of 25 years, by which time the capital will have been redeemed. The second scheme involves an additional outlay of £7500 for the destructor, and engineering expenses amounting to £1506; making a total of £31,631. But there would, it is estimated, be a net saving of £762 10s.; and the town would get rid of about 13,500 tons of refuse, which is now more or less publicly collected in Swansea.

The Richmond Main Drainage Works.—A few years ago, the Richmond Main Drainage Board carried out works for dealing with the sewage of Richmond, Barnes, Kew, Mortlake, and Petersham. The whole of the main sewers converge to a point on the south bank of the Thames between Kew and Mortlake, where they are 45 feet below ground-level. The sewers end in a deep sump, in which there were originally three pumps, with space for two more. The wet-weather flow was calculated at $5\frac{3}{4}$ million gallons a day; but, owing to an increased number of houses in the district, and, perhaps, to the inclusion of more storm water than was anticipated, the pumping power has sometimes been only just able to cope with the flow. The original plant could deal with 11 million gallons a day. This has now been increased to 26 million gallons, by the erection of a pair of triple-expansion vertical Worthington pumping-engines. In addition, a centrifugal pumping-engine has been provided to deal with 5 million gallons on a 20-feet lift, if the sewage-level should rise unduly in the pump-well. A new outfall, capable of delivering 40 million gallons daily, has been constructed to the river, together with bye-pass channels, screening-well, and other works. The whole has been designed by Mr. W. Fairley, Assoc.M.Inst.C.E., Engineer to the Board; Mr. W. B. Bryan, M.Inst.C.E., being Consulting Engineer.

Kingsbridge Water Supply.—The question of the water supply of Kingsbridge has got into a delightful state of confusion. After discussing rival schemes without being able to decide upon any one of them, the District Council recently decided to take the opinion of Mr. Beesley, of London. At a meeting on Wednesday last, Mr. Beesley reported that, in his opinion, it would be useless to continue the excavations at the Loddiswell source; for it yielded only 200 gallons per hour, whereas the town required at least 1500 gallons. He advised the purchase of the Courtland spring for the sum of £3365, excluding compensation. Several members of the Council, however, favoured a resort to Morleigh, whence water could be obtained by gravitation, while pumping would have to be resorted to in the case of the other sources. On the other hand, the Chairman of the Council and other members were strongly in favour of going on with the Loddiswell scheme. A resolution to the effect that steps be taken to purchase the Loddiswell mill, and obtain water from the River Avon, was submitted; but it was rejected. The Chairman suggested that it was now the duty of the majority against that scheme to tell them what was best to be done. To this one of the members replied with the obvious retort that they had the opinion of an expert in favour of one scheme, and immediately proceeded to advocate another. Consideration of the matter was adjourned for a month, on the understanding that the majority against the Loddiswell scheme would be expected to propose a solution of the difficulty.

Enlargement of the Water Storage at Redcar.—The Redcar District Council have resolved to increase the storage capacity of their water reservoir, from $1\frac{1}{2}$ to 2 million gallons, by deepening it. The estimated cost is £1200.

Drainage Works for Arundel.—On Monday, the 4th inst., the Duke of Norfolk laid the foundation-stone of the drainage works now being carried out in connection with Arundel at a cost of between £6000 and £7000. The work is in the hands of Mr. Hill, of Peterborough; and it is expected that it will be completed by June next year. The Duke, after giving the borough a full water supply, has also consented to bear two-fifths of the cost of the drainage work up to £6000.

The Charge for Water.—The following is an extract from a letter which recently appeared in *The Times* on the subject of the charge for water: "It is difficult to make a comparison between the charges of the Metropolitan Companies and those made by municipalities, because in many instances the apparently low rate charged by the latter to the consumer is supplemented by a public rate levied upon all property. For instance, the Liverpool Corporation levy 6d. in the pound for water upon all property in addition to the charge for water supply, which in the case of private houses is $7\frac{1}{2}$d. in the pound, or a total charge of $12\frac{1}{2}$ per cent. more than the East London Company's charge of 5 per cent. The Liverpool Corporation also charge (let the suburban districts of London note the fact) an additional 50 per cent. in all places outside the city, and 5s. 10d. per 1000 gallons for shipping, as against the charge of 6d. by the East London Company, or nearly twelve times as much. Taking gross income, including trade, into account, the average income per supply amounts in East London to £1 13s., and in Liverpool (City) to £1 19s. per annum. Moreover, the East London Company pay 9·59 per cent. of their gross income back to the consumers in aid of rates. Again, in Manchester there is a public rate of 3d. in the pound in addition to the domestic rate of 9d. Curiously, the 3d. rate produces as much as the 9d. rate; so that if the charge were made only on the consumers, it appears that their rate would be 1s. 6d. in the pound, or $7\frac{1}{2}$ per cent. upon the annual value, as against 5 per cent. in East London. In many other towns the charges are greater than in London."

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 969.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	$10\frac{1}{2}$	Alliance & Dublin 10 p. c.	10	22 - 23	−2	4 11 4
100,000	10	,,	$7\frac{1}{2}$	Do. 7 p. c.	10	$16\frac{1}{2}$—$17\frac{1}{2}$	$+\frac{1}{2}$	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	1 May	$6\frac{1}{2}$	Bombay, Limited	5	$7\frac{1}{4}$—$7\frac{3}{4}$	..	4 3 10
40,000	5	,,	$6\frac{1}{2}$	Do. New	4	$5\frac{1}{4}$—$5\frac{3}{4}$	..	4 10 3
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	205—210	−2	4 5 8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	27 Sept.	$11\frac{1}{2}$	British	20	$54\frac{1}{4}$—$55\frac{1}{2}$	$+\frac{1}{2}$	4 1 1
50,000	10	29 Aug.	$11\frac{1}{2}$	Bromley, Ordinary 10 p. c.	10	$22\frac{1}{2}$—$23\frac{1}{2}$	..	4 17 10
51,510	10	,,	$8\frac{1}{2}$	Do. 7 p. c.	10	$18\frac{1}{2}$—$19\frac{1}{2}$	$+\frac{1}{2}$	4 7 2
328,750	10	12 June	4	Buenos Ayres (New) Limited	10	$8\frac{1}{4}$—$8\frac{3}{4}$	$-\frac{1}{4}$	4 11 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	$8\frac{1}{2}$	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	26 Oct.	$13\frac{1}{2}$	Commercial, Old Stock	100	320—325	+7	4 3 1
165,000	,,	,,	$10\frac{1}{2}$	Do. New do.	100	247—252	+10	4 3 4
160,762	,,	12 June	$4\frac{1}{2}$	Do. $4\frac{1}{2}$ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	278—283	−2	4 11 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	..	4 11 10
535,000	Stck.	29 Aug.	$5\frac{1}{4}$	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	$25\frac{1}{2}$—$26\frac{1}{2}$	..	4 3 0
351,060	10	,,	11	Do. Partly paid	$7\frac{1}{2}$	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	$12\frac{3}{4}$	Gaslight & Coke, A, Ordinary	100	292—297	$+\frac{1}{2}$	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	282—287	..	3 9 8
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	$7\frac{1}{2}$	Do. G, $7\frac{1}{2}$ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	,,	,,	$4\frac{1}{2}$	Do. $4\frac{1}{2}$ p. c. do.	100	147—152	+2	2 19 2
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	10 May	12	Imperial Continental	100	245—250	..	4 16 0
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6—$6\frac{1}{2}$	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4 6 2
511,920	20	12 June	5	Monte Video, Limited	20	18—19	..	5 5 3
150,000	5	24 May	8	Oriental, Limited	5	$7\frac{1}{2}$—8	$+\frac{1}{4}$	5 0 0
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—$5\frac{1}{2}$	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	$1\frac{1}{2}$—$2\frac{1}{2}$	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105 110	..	5 9 1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11—12	..	5 16 8
500,000	Stck.	29 Aug.	$15\frac{1}{2}$	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	308—313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325—330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	..	2 16 2
60,000	Stck.	12 Sept.	$11\frac{1}{2}$	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	294—299	..	3 6 10
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	223—228	..	3 1 5
654,740	,,	26 June	$4\frac{1}{2}$	Do. $4\frac{1}{2}$ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118—122	..	2 17 5
708,000	Stck.	29 Aug.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	$7\frac{1}{2}$	Lambeth, 10 p. c. max.	100	250 255	−1	2 19 1
406,200	100	,,	$7\frac{1}{2}$	Do. $7\frac{1}{2}$ p. c. max.	100	208—213	..	3 10 5
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 13 4
500,000	100	14 Aug.	$12\frac{3}{5}$	New River, New Shares	100	385 390	..	3 2 9
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	146—151	−1	2 12 11
126,500	100	,,	4	Do. D $7\frac{1}{2}$ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	295—298	..	3 7 1

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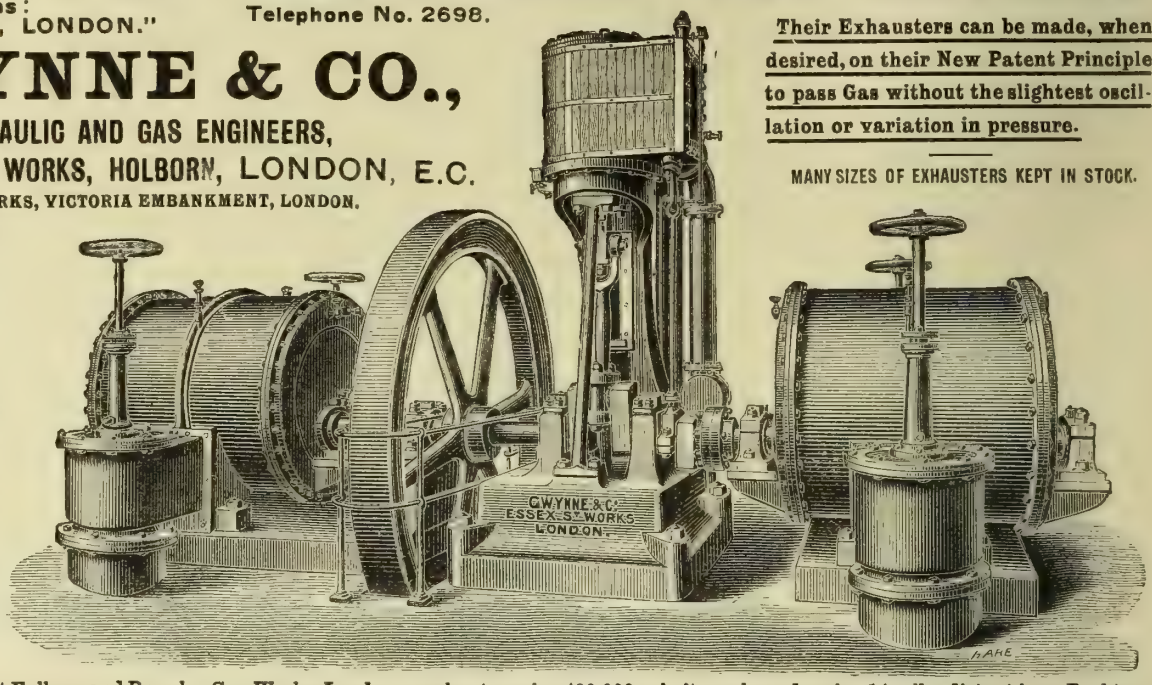

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EDITORIAL NOTES.

The Southern District Meeting—The Amalgamation Proposal.

THE members of the Southern District Association of Gas Managers held their autumn meeting last Thursday, at the Holborn Restaurant, under the presidency of Mr. S. W. Durkin, of Southampton, who is to be succeeded in the chair by Mr. A. F. Browne, of the South Metropolitan Gas Company. Two papers were read on this occasion, by Mr. C. C. Carpenter and Mr. A. E. Broadberry respectively; and both were discussed. Besides this formal and technical business, Mr. F. G. Dexter, of Winchester, gave the members a brief but interesting account of his triumphant progress in the substitution of incandescent gas-burners for the oil street-lamps which have characterized, without adorning, the streets of that city for many years past; and the proceedings wound up with a short but pregnant discussion of the proposal emanating from the South-Western Association for amalgamating this body with the Southern organization. It will be gathered from this summary of the transactions of the meeting, that there was plenty to occupy and interest the members for the couple of hours of their assembly; and this was so conspicuously the truth, that anyone who might have happened to be present just as a visitor, would have formed the opinion that the Southern is a particularly lively and successful example of the order of Associations to which it belongs. We shall not now discuss the papers read, which were both good in their degree, and raised interesting questions; but take the opportunity for offering a few observations on the topic of the amalgamation proposal.

The meeting presented a good opportunity for bringing a project of the kind "within the range of practical "politics;" being well attended, and favoured, as usual, with the presence of several of those who founded the Southern Association, and have never ceased to interest themselves in its organization and transactions. Immediately the subject of the proposed amalgamation was broached, it became apparent to the whole company that if the more active spirits hitherto identified with the South-Western experienced a desire to join their forces to those of the Southern Association, there existed, among the members of the latter body, no very great feeling of reciprocity in this regard. It was rather understood than expressed that the advantages of the proposed formal union were sought by the South-Western representatives for their own benefit, while there was not so much as a pretence that the Southern Association could gain anything by the fusion. Still, the Southern men took the overtures of their neighbours and would-be allies in good part, and paid them the compliment of remitting the question of union to a Special Committee, with instructions to consider and report upon it to the next meeting of the Association.

Without pretending to forecast the result of the deliberations of this Committee, it is easy to perceive why the South-Western men, or some of them, would like to come into the scope of the Southern organization, and also why such an extension of the range of the Association as would be involved in the appropriation of the whole South-Western district would not be favoured by the members of the Southern society. These reasons are identical with those to which the success and vitality of the one technical society, and the failure and moribund condition of the other, are to be attributed. It is not merely because one of these Associations happens to include London in its district that it is living and doing well; although, of course, this consideration has something to do with it. As a matter of fact, with a few brilliant exceptions, the London gas engineers and managers, strictly so called, are not a "clubbable" set, and are rarely to be seen, and more rarely heard from, at technical society meetings. Even of greater importance to the Gas Managers' Association which includes it in its sphere of influence is the fact that London is a centre, in the same sense as Birmingham and Manchester are centres, of the industry of gas lighting —only more so. The prosperity of the Southern Association is largely due to the circumstance, upon which Mr. J. L. Chapman laid due stress in his weighty speech on Thursday, that all its business meetings have been held in London, the natural centre of the district, to which all roads lead. One great weakness of the South-Western Association has been the absence of any such headquarters. Bristol might have been made to serve the

purpose of such a centre for the West of England and South Wales. But the necessity for such a central rallying point was not recognized by the South-Western Association, which has suffered from the character of the region of country from which its title was drawn. In following up the geographical idea, the Association got into the way of losing itself in inaccessible spots all over the sparsely-peopled kingdom of Wessex, with the natural result that its hold upon the allegiance of its widely-scattered members has now waned to the vanishing-point. And there has been nobody in the part of England supposed to be served by the Association to take much interest in its maintenance.

It stands confessed, by the acceptance by its members of the suggestion for amalgamation with the Southern Society, that the South-Western Association cannot carry on its independent existence. On the other hand, there is no hard-and-fast line of delimitation of the sphere of influence of the very active Southern Association; and it is not to be supposed that any otherwise duly qualified candidate for membership of the latter body will be held disqualified merely through there being a high degree of "westering" in his "southing." But—and this is the *sine quâ non*, as Mr. Chapman well put it—those who contemplate coming to the Southern, for their own reasons, must not expect the Southern to go to them, even for a holiday outing. The prospects of District Gas Managers' Associations are not so bright everywhere that the prosperity of one of the most fruitful and well-supported of them all can be jeopardized by laying it under geographical disabilities that have already proved disastrous to their natural victims.

The Truth about the Clyde Lock-Out.

MATTERS remain pretty much as they were in connection with the Belfast and Clyde engineers' strike; but since we wrote on the subject last week, information has come to hand that fully justifies the reserve we then showed in respect to the apportionment of blame for bringing about a condition of affairs in these shipbuilding centres which almost amounts to a national peril. According to a communication from the special correspondent of *The Times*, published last Wednesday, there is no foundation for the allegation, so freely made by Mr. Frederic Harrison and others who have hastened to take the "popular" view of the matter, that the action of the Clyde employers was a "sympathetic" lock-out, in the same sense as the qualification bears when applied to a strike. In this sense, as *The Times* correspondent observes, the word "sympathy" is a synonym for "criminal folly." It is a great relief to those who could not bring themselves to believe the Clyde shipbuilders capable of following the example of the discredited leaders of the New Unionism, to receive the assurance, supported by incontrovertible evidence, that the allegation in question is baseless. The facts as stated, and nowhere contradicted, are briefly that the engineers employed at Clydebank began the whole business so long ago as March 29, by preferring a demand for an increase of wages by ¾d. per hour, coupled with the proviso—here the "cloven hoof" of militant Trade Unionism showed itself—that the advanced rate of pay should be regarded as the "irreducible minimum." The employers were given four days to make up their minds whether to submit to these terms or be subjected to a strike. The firm replied by declaring that the matter must be referred to their Association. But this did not at all satisfy the men, who, for all their habitual clamouring for "recognition of the Union," replied to the effect that they did not wish to have anything to do with the Association, but preferred to settle the question with their employers individually. The Association did, however, look into the matter, and found that full wages were being paid at this particular works, and that, although there was a press of work in this yard, there were plenty of engineers idle along the Clyde. With regard to the question of the minimum wage, moreover, the Association ascertained that the principle did not work satisfactorily anywhere; and they declined to recognize it. The men put up with their defeat on this occasion, and the threatened strike did not come off. The questions of a minimum wage and an increase were raised again in August; but no settlement was arrived at—the only positive result of all this agitation being to show the employers what was in preparation for them if they allowed themselves to be cornered piecemeal. Consequently, the Association was cemented; and the shipbuilding interests of Belfast and the Clyde were federated. The next move on the part of the Union was made at Belfast; but the demand was substantially identical for both centres of employment, and was treated as such, with results that need not be further described. It is thus an absurdity to accuse the Clyde employers of having been inspired by any other motive than that of self-defence when they showed, to the amazement of the Trade Unionists, that they were able to see through the "change of venue" of their agitation from the Clyde to Belfast.

For the present, no settlement of the difficulty is in sight. It is not to be regretted that, so far, neither party has welcomed the intervention of would-be conciliators from without; and it is greatly to the men's credit that they would not allow a notorious agitator, whose object can hardly be imagined to be pacification, to address them. We cannot help thinking that, if the employers will only remain true to themselves and their cause, the Trade Union will eventually give way. Some readjustment of wages may be arranged for, if and when an improved state of trade shall permit. But there will be no victory of Trade Union principles in this eventuality. On the other hand, the Amalgamated Society of Engineers are not in a position, financial or otherwise, to stand out long for any such proviso as that of the "minimum" wage, which is only another name for the socialistic "fad" of the "living" wage. Perhaps when this demand is finally abandoned, the rank and file of the Society men, in whose supposed interest it is preferred, will begin to ask themselves whether this and other asserted Trade Union "principles" that might be named are not figments belonging rather to the stock-in-trade of the professional agitator than elements at all necessary to the prosperity of national industry and of those who live by it.

Deputations to Ministers.

THE coming parliamentary session is now being preluded in the usual way by public meetings at which party leaders enjoy opportunities for expounding their policy that are not always so fruitful of information in this regard as the conveners would like; and the season of daily deputations to Ministers popularly supposed to be incubating next year's legislative programme has also set in with particular severity. The latter kind of overture to a session of Parliament appears, indeed, to be growing in popularity among the large and increasing classes of people who either charge themselves, or are charged by others, with attempts at directing the course of legislation. In order to discern the reason for this growth of the deputation system, which is quite a modern feature of political and administrative life, it is necessary to inquire into the nature of the motive power of Parliaments and Governments. This is no other than that public opinion, which is as great a mystery as electricity, energy, matter, or any other of the cosmic forces by the rightful direction and employment of which men and nations live, and in consequence of the misuse or ignorance of which they perish. The poet who asked in melodious numbers to be told where Fancy is bred, raised an easy question in comparison with that which would ascertain the sources of public opinion. Statesmen and legislators can do nothing unless they are in accord with, and supported by, this living force. Wherefore it is their first duty to make sure of establishing their connection with it. Happily, or the reverse, there is never a lack of voices claiming to express public opinion respecting everything under the sun, for the guidance of those who are expected to employ this force to the general advantage. Newspapers and printed publications of every description and character ask for public patronage simply on account of the fidelity and skill with which they represent current opinions regarding the subjects of which they treat. But nobody accepts the words of a writer as conveying the truth, the whole truth, and nothing but the truth of the matter he takes in hand. There is a strong, and, on the whole, a laudable desire on the part of whoever desires, in these days of much speaking and writing, to arrive at the truth of a social, political, or industrial problem, to get behind and beneath all the verbiage which inevitably gathers round the issue, and apply his powers of comprehension directly to the facts. It is, in principle, this process of gathering knowledge which deputations to responsible administrators of the affairs of a nation profess to aid. Have we a new Home Secretary reasonably suspected of designing some fresh piece of factory legislation? Then it is obviously desirable that he should be

informed at first hand what those who will be affected by such legislation really do or do not require.

At its best, a deputation to a Minister of the Queen is the most trustworthy means that the wit of a practical people has devised for making known the actual opinions of those for whom its spokesmen act as mouthpieces. It is unnecessary to say what it is at the worst. In the course of their day's work, Ministers have to receive all sorts and degrees of deputations, good, bad, and indifferent. Some go for wool, and depart shorn. Some enlighten counsel, others darken it. It is for the Minister to know with whom he has to deal; and the type of man who comes to Cabinet rank in a country of free institutions can generally be depended upon to know more about such things than it is always policy to tell. The present Home Secretary, Sir Matthew White Ridley, was interviewed last week by the deputation organized by the Trade Union Congress; and a strange team they were, with Mr. J. H. Wilson, M.P., at their head, and Mr. Pickard, M.P., at their tail. The speeches on this occasion are worth reading. When the Home Secretary, in the course of his address, said something about the desirability of fostering a friendly feeling between employers and employed, he was interrupted by violent exclamations of dissent, at which he expressed surprise. But what else was to have been expected? If such feelings were to become universal, who would pay the Tilletts, the Pickards, and other independent-of-labour parties, for deputationizing at Whitehall instead of working for their living? Upon one point, it is satisfactory to learn that the Home Secretary is firm. He assured Mr. Pickard that, in any Bill for the amendment of the law of employers' liability which the Government may introduce, they will "at least go as far in the "protection of mutual insurance societies as they did when "they were in opposition." Fortunately, the Government are not likely to repeat the mistake of the last Administration in taking the wire-pullers of the Trade Union Congress at their own valuation, and being willing to perpetrate an act of injustice at their bidding.

Municipal Questions.

Last week, Sir H. H. Fowler, M.P., attended a complimentary dinner given to the Mayor of Wolverhampton; and he took the opportunity for saying some comforting, and not a few trenchant, things about the condition and prospects of English municipalism. He first referred to the movement that has become known as the "municipal "revival"—the most striking sign of which is the widened scope that has been given to the position of Mayor. This is, indeed, one of the most hopeful aspects that has been presented of late years by our local authorities. It is a great thing for England that, as Sir H. Fowler said, there should at the present moment be a Mayor of an English borough who is an ex-Viceroy of Ireland, another who is an ex-Viceroy of Canada, and others who have been either a Viceroy of India or a Cabinet Minister, are peers of the realm, and men of mark in more respects than that of merely possessing an hereditary title. It is not that these distinguished personages can be expected to do much more in the mayoral chair than can the most insignificant townsman called to the same position by his colleagues and equals. The great thing is that they will exhibit in their own persons the operation of that unity of sentiment among all ranks of the people which is the best guarantee for the permanency of the State; and the next greatest thing is that they will help to check the growth of the evil of machine politics in municipal affairs. It is a right and proper feeling that points to the desirability of making fuller use of men of rank and wealth in our scheme of local self-government than that of drawing revenue from them in the shape of rates. Upon this subject of the rates, moreover, Sir H. Fowler made some memorable remarks. He told his audience that the more power English municipalities are entrusted with, the more money they will need. He admitted that the contributories to local treasuries should be increased; and he deprecated the way in which aid to local rates has hitherto been given, under the system of Imperial subventions, upon the ground that this system tends to extravagance. "When local authorities discussed certain classes "of expenditure, they were apt to think, 'Government will "'pay half, and we need only consider how to meet the "'other half.' This was a very natural view to take. But "he held to the doctrine that the power which spent "money should have the responsibility and the discomfort, "it might be, of raising it. Nothing promoted economy, "whether in public or private affairs, so much as the "knowledge of the spender that he would have to find the "money." Include in the term "subventions" the subsidies to rates out of gas profits, and Sir H. Fowler's point is one that has been urged in these columns again and again.

Society of Arts.—The first meeting of the 142nd session of this Society will be held to-morrow evening, when the opening address will be delivered by Major-General Sir J. Donnelly, K.C.B., the Chairman of the Council. Previous to Christmas, there will be four ordinary meetings, at one of which (on Dec. 11) Mr. F. A. Anderson will read a paper on "Water Purification by Means of Iron." Among the papers set down for reading after Christmas is one by Mr. W. J. Dibdin, F.I.C., F.C.S., Chemist and Superintending Gas Examiner of the London County Council, on "Standards of Light."

Management Changes.—Mr. A. W. Elton, the Manager of the Matlock Bath Gas Company, has been appointed, out of 110 applicants, Manager of the Littlehampton Gas Company. Mr. Elton takes with him to the South a good record; for, during the three years he has been at Matlock Bath, the consumption of gas has increased 50 per cent., and the works have been entirely remodelled under his supervision, with the co-operation of the Chairman (Mr. J. Reeds) and the Secretary (Mr. A. Clark).——Mr. G. B. Smedley, jun., a son of Mr. G. Smedley, of Buxton, has received the appointment of Manager of the gas and water works at Beaumaris.——Mr. A. B. Walker, who has been Manager of the Berwick and Tweedmouth Gas Company for the past eight years, has been appointed Manager of the Walker and Wallsend Union Gas Company. Mr. Walker was trained by Mr. G. R. Hislop, of Paisley.

Personal.—Mr. J. Shiress Will, Q.C., who has for some years represented the Montrose Burghs in Parliament in the Radical interest, has intimated his intention of retiring, for entirely personal reasons. Mr. Shiress Will, as our readers will probably remember, was associated with the late Mr. W. H. Michael in the production of their well-known work on "The Law Relating to Gas and Water," the fourth edition of which, issued under the editorship of Mr. Will, includes the law as to electric lighting. He was called at the Middle Temple in 1864, took silk in 1883, and was made a Bencher of his Inn in 1888.——Mr. J. T. Bond, the Chairman of the Water Committee, has been elected Mayor of Plymouth, and also appointed to a vacancy on the aldermanic bench.——Duty has been paid on £39,105, as the value of the personal estate of Mr. C. Overton, of Croydon, son of one of the original proprietors of the Croydon Gas-Works, whose death was announced in the Journal on the 1st ult.——Mr. H. Willis Smith, the Engineer and Manager of the gas-works at Singapore, has been compelled to send in his resignation, owing to the climate being detrimental to the health of Mrs. Smith, whom many of our readers may remember as Miss Agnes Kelman, one of the most popular of the lady lecturers on cookery. Mr. Smith will leave Singapore at the end of March.——The Davy Medal of the Royal Society has been adjudicated by the President and Council to Professor W. Ramsay, F.R.S., for his share in the discovery of argon, and for his discoveries in regard to the gaseous constituents of terrestrial minerals.

Institution of Civil Engineers.—The first meeting of the Institution for the present session was held last Tuesday, when a portion of the new building in Great George Street (comprising the theatre and approaches, with tea-room, &c.) was made available for the purposes of the evening. The chair was taken at eight o'clock by Sir Benjamin Baker, K.C.M.G., LL.D., F.R.S., the new President, who delivered his Inaugural Address. After some preliminary observations referring to the position of the Institution in the domain of engineering, and the necessity of British engineers acting together in a true spirit of comradeship throughout the world, the President proceeded to discuss the question why engineering, unlike other liberal arts, was an essentially modern profession. Towards the close of his address, the President dwelt upon the work done by physicists in the borderland of engineering; and he expressed the opinion that, long before the coal-fields were exhausted, some way would have been discovered of tapping the inconceivably great reservoirs of force in Nature still untouched. In conclusion, the President sounded a note of warning against the growing disposition to overrate technical education. Education would, he said, do much; but it would not endow a man with common sense, nor would it make his opinion on a multitude of important subjects worth more than that of any naturally observant person. There were contractors and manufacturers who contended that some of the highly-trained young engineers of the present day were no wholly free from a tendency to over much reliance on formulæ,twithout due regard to the sufficiency of the data upon which the se were based. Such faults were best remedied by joining in practical discussions with other engineers, such as it was a province of the Institution of Civil Engineers to encourage. After the delivery of the Address, the President presented to the recipients or their representatives the medals and premiums awarded for papers read last session or printed in the Proceedings.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1052.)

LAST week was an intensely exciting one for the Stock Exchange. No one could tell what might be the state of things at the end of it. But it has come and gone; and the markets breathe much more freely at the close than at the opening. The settlement was got through a great deal better than had been expected. True, eight unfortunates have been hammered. But then they were not of much importance (except to themselves); and, as it was manifestly impossible to save all, perhaps the fittest have survived. At all events, they have been helped to live a little longer. A good many people have been taught a salutary lesson upon plunging which will last them—till they forget it; and then they will plunge again. The recovery in prices has been universal, from Consols downwards; and they exhibit a striking contrast with the figures they cut a week ago. The Money Market was firmer; and good rates were created by the requirements of the Stock Exchange. During this agitating period, business in the Gas Market has been quiet and unemotional; transactions on the whole being considerably below the average. The general tendency is to firmness at something like the existing figures, despite the weakness of a commanding stock. In Gaslights, the "A" was fairly active in the earlier portion of the week at about middle prices, afterwards relapsing into inactivity. But the latest prices at which business was done were the best of the week; and, in fact, the best obtained in the last three weeks. The secured issues were brisk, and very strong, realizing high figures. The "C," "D," and "E" 10 per cent. preference changed hands on Wednesday at 288, which, we believe, is a "record" price. South Metropolitans were not particularly active; but prices tended to be a little better, especially for the "A" stock. Commercials were quieter; but a few parcels of the old stock changed hands, and 324 was obtained more than once. There was scarcely anything doing in the Suburban and Provincial division; but Alliance and Dublin old made a slight recovery. Crystal Palace was done as high as 130. Among the Continentals, none was conspicuous but Imperial, which fell away until it dropped a couple of points *ex div.* The rest presented nothing calling for special remark, except Monte Video, which had a slight relapse. The Water Companies moved somewhat irregularly. New River was freely offered, and dropped 5; and East London and Lambeth were weaker. But Chelsea and Kent were firm.

The daily operations were: On Monday, business in Gas was moderately active, mostly in Gaslights; the secured issues being specially strong. "C," "D," and "E" rose 1½. East London Water fell 3. Transactions on Tuesday were more restricted; but prices, on the whole, were very steady. Monte Video was ½ lower. In Water, New River receded 5. Business in Gas grew quieter still on Wednesday; and quotations did not move. In Water, Chelsea rose 1; but Lambeth tens fell 1. On Thursday, prices for Gas stocks were good, except for Imperial Continental, which dropped 2. Alliance and Dublin recovered ½. Business was quiet on Friday; but prices held up steadily. Saturday's transactions were very limited; and quotations closed without further change.

ELECTRIC LIGHTING MEMORANDA.

The Electric Lighting Affairs of the St. Pancras Vestry—The Cause of the Dearness of Electric Light—An Old Expedient Revived.

ANOTHER official publication has been issued by the St. Pancras Vestry concerning their electric lighting undertaking, in the form of a report by the Chief Clerk (Mr. A. E. Pycraft) on the work of the Electricity and Public Lighting Department during the year ending May, 1895. This period covers a great extension of the undertaking, as well as the introduction of the five-wire system of distribution, by which it is claimed, among other advantages, that current can be distributed at a pressure of 440 volts, and therefore, if desired, the public street-lamps could be supplied from the private lighting mains. Up to the end of May last, there were 373 consumers on the books; representing 16,751 incandescent lamps of 16-candle power, 129 arc lamps, and 27 motors aggregating 103½-horse power. It is noteworthy that the Vestry do not adopt the principle followed by the Metropolitan electric lighting companies, of expressing the number of lamp-connections in terms of the so-called standard 8-candle lamp. So far as this report shows, the 8-candle lamp is not much used in St. Pancras; the chief business done being in supplying 16-candle lamps. The total cost of generating a unit of electricity during the year 1894 is stated to have been 5·053d., which includes generation, distribution, management, and interest and repayment of loans, but not depreciation. Reference is made in the report to the culvert explosions in the vicinity of the Euston Road, which are ascribed to coal gas; and it is observed that the Vestry, having carried out Major Cardew's recommendations as to conduit ventilation and protection at considerable expense, it now remains for them to "consider what action should be taken against The Gaslight and Coke Company to compel them to keep their mains in such a condition as to prevent leakage of gas into the Vestry's culverts, as well as the question of recovering the cost of the works carried out; as, both the Company and the Vestry having legal statutory rights to lay mains in the same thoroughfares, it is manifestly unjust that the Vestry should be required to carry out works necessitated by the negligence of the Gas Company." We were under the impression that the works in question were necessitated by the negligence of the Vestry; but this point may be passed over until such time as the Vestry may take steps to have the "legal and statutory" rights of the question determined by the proper authority.

An article on reducing the cost of electric light appeared some months back in the *Engineering Magazine;* and since the conclusions of the writer (Mr. Nelson W. Perry) have gone uncontradicted, they may probably be taken as not far from the truth of the matter. He declares that it is so easy to prove on paper, by means of apparently legitimate assumptions, that the electric light can be made to sell at a considerable profit at a figure which is but a fraction of that usually charged, that the public have been "easily convinced that a bonanza attended the procurement of an electric lighting franchise in almost any municipality." Unhappily, "the rude awakening to the investor when the annual statement has shown a balance on the wrong side of the ledger, in the face of the brilliant promises held out by lead-pencil prophecies," has brought the electric lighting industry into disrepute. Mr. Perry sets himself to disclose the reason for the disagreement of promise and fulfilment in the industry; and he finds it where other inquirers have found it before him—in the variable load-factor of central lighting station experience. He develops the point, however, to an unusual extent, with a view to show that electrical engineers who might be supposed to be well posted in this regard seldom understand its full bearings. It means, in the first place, an altogether disappointing return for the fuel consumed in generating current; and, secondly, it seriously affects the capital charges, which are sometimes of more importance than the coal bill. "It is these," he observes, "which so often render the employment of water power uneconomical, and which must militate so largely against the economical results from the great Niagara electrical power scheme." Again, as to the cost of distribution, Mr. Perry states that "probably nine out of every ten to whom the question was propounded would answer unhesitatingly that energy for lighting purposes could be delivered more cheaply at a distance by electrical means than by gas transmission; and, under some conditions, this is true. But I find by calculation that, if the distance involved were a mile, it would require considerably more metal to supply the electric lights by means of the direct current than would be required for pipes to convey a supply of gas for the same number of lights with the same efficiency of transmission." He confesses, therefore, that the bane of the electric lighting industry is the peculiar service which it is required to supply, with its uneconomical load factor. Mr. Perry does not see how to escape from this trouble by the way of encouraging a heavier day load, because anything of the kind must of necessity overlap the lighting load during the winter season. In the same unhopeful spirit he discusses the Brighton system of charging for current, and suggestions for manufacturing some bye-product of the electrical machinery during the hours of light load. His ultimate conclusion is that "the demand of the day therefore is not better dynamos, better engines, or better methods of transmission, but steadier jobs for the apparatus we have; and he who will invent that job will do a better service to the electrical industry than he who invents a new electrical system." There is nothing at all novel in this opinion; but it goes to confirm the belief of those who hold that there is no present prospect of any considerable cheapening of the electric light by improvement of the lamps or any other part of the equipment of a central supply undertaking.

For the reason given in the foregoing paragraph, it is possible to read with equanimity the claims that have been recently advanced in certain newspapers on behalf of the Jandus "semi-incandescent" arc lamp. This wonderful apparatus has been promised to "prove itself in electric lighting as distinctive a competitor as the Welsbach light in the gas lighting industry"—whatever this confused statement may be intended to mean. It is further stated that "the new lamp is the result of prolonged and costly experiment. A period of eight years, and a sum approaching £30,000, have been consumed in bringing a theory into practical utilization." In a general way, when an article is "puffed" in this style in the newspaper press, one knows what to expect, since really good things are offered for sale for what they are worth, not for what has been spent in putting them upon the market. The case of the Jandus lamp appears to be no exception to the rule. It is an arc arrangement enclosed in a double globe; the idea being that when the arc is started it will use up the oxygen contained in the enclosed space, and thereafter nothing but carbon monoxide and nitrogen will remain, in which event, of course, the carbon rods will not burn away. It would be difficult to say how many times this plausible idea has been taken in hand by would-be improvers of the arc lamp in the direction of giving increased durability to the carbons, since Mr. Henry Woodward took out a patent for a lamp on this principle so long ago as 1876. We do not, at

any rate, anticipate any marked revulsion of feeling on the part of the people of this country in regard to lighting by the electric arc, from the appearance of a lamp which, instead of combining the advantages of the arc and incandescent principles of electric lighting, is more likely to fail to realize either.

IMPROVEMENTS AT THE HUDDERSFIELD GAS-WORKS.

The Huddersfield Corporation Gas-Works just now present a more interesting aspect to the engineer visitor than has been the case for many years; and therefore we judge the time opportune for the publication of a short account of what the Engineer and Manager, Mr. W. R. Herring, has recently been doing with a view to bringing the establishment up to date. We are indebted to Mr. Herring himself for the heads of the information contained in this article, as well as for the photographs from which illustrations appearing on pp. 1032-3 are reproduced; but it should be understood that Mr. Herring is not responsible for the shape in which the information in question is conveyed to our readers, and also that the comments we have to offer upon the works and their equipment are our own.

With this preamble, we venture to commence our observations with the statement that the condition into which the Corporation of Huddersfield had allowed their gas-works to sink when the present Engineer and Manager was appointed to take charge of the undertaking, would constitute an object-lesson to illustrate and confirm the truth of everything we have had to say at different times respecting the ineptitude of municipal gas administration. The works had simply been starved, in order that the rates of the town might be spared. We are not in a position to state just now precisely how much money the gas-works have been forced to contribute to aid the municipal treasury; but the salient features of the situation in which Mr. Herring found himself when entrusted with the sole responsibility for keeping up the supply of gas to the district, are no secret to our readers. The works were utterly incapable of producing the output of gas demanded; they were destitute of every modern facility for economically producing and purifying such gas as they could supply; and nothing had been done to reduce the onerous capital burden which kept the supply dear, and rendered the prospect of having to make costly improvements and extensions a truly formidable one. Just in time, however, and only just, a new spirit entered into the Corporation Gas Committee. Mr. Alderman Stocks was elected Chairman of the Committee; and to him more than to any man living in Huddersfield to-day is it due that what should have been a splendid piece of corporation property—and will yet become so, in a few years' time—is not now a discredited concern, only existing by virtue of an Act of Parliament. For the present, the large sums of money that have been expended by the Gas Committee in carrying out Mr. Herring's plans for remodelling and modernizing the works, have made this body a mark for much ill-informed local cavilling. We trust to be able to show, however, that if the people of Huddersfield have only themselves to thank for the existence of the arduous conditions as regards the burden of capital under which the improvement of their gas-works has to be effected, the money is being spent to advantage, so far as the carbonizing department of the works is concerned; and the new improvements are bound to pay for themselves in a short period of time.

Mr. Herring has himself told how he first introduced the inclined retort system of carbonization into Huddersfield. [See Journal, Vol. LXIV., p. 419.] Although the application of the system in this first instance was hampered by local difficulties—such as the absence of a stage-floor retort-house, and so forth—yet its success was such as to determine Mr. Herring to recommend its extension under conditions more favourable to the realization of the best results. The advice was taken; and the suitable conditions were prepared by the erection, upon the site of one-half of an old retort-house destitute of all reason for being preserved, of a fine, boldly-conceived retort-house, not merely of one but of several stages, and measuring 86 feet wide in the clear inside. When completed to the full length permitted by the site, this house will be 350 feet long; and it will then accommodate sixty settings of nines. At present, but one-half of the house is finished, including the tall, handsome chimney which has been erected to serve the steam-boilers, and is also used for the retort-furnaces. In modern gas engineering practice a tall chimney for a retort-house is regarded as a superfluity likely to do much more harm than good. But in Huddersfield, the gas-works are in such a position as to necessitate a lofty chimney, in order to carry the products of combustion above the level of the high ground in the neighbourhood. The chimney is built in two entirely separate skins of brickwork—the outer of ordinary bricks, built in octagonal form; and the inner, in a circular ring of fire-bricks of the same diameter from top to bottom. The annular space between the two is ventilated by air-inlets at the base and outlets at the top. The inner fire-brick ring strikes the inner lining of the outer casing about 20 feet from the top, owing to the "batter" of the latter; but it is in no way connected with it. The portion of the chimney in direct contact with the heat is thus free to expand, both laterally and vertically, without causing the least stress upon the chimney-shell.

The new retort-house, like every other building in Huddersfield, is of stone; but as the foundation was none of the best, it was desirable to lighten the weight of the walls as much as possible. To effect this, and yet obtain the necessary head-room, Mr. Herring adopted the device of covering the retort-house with a semi-circular girder roof, which, being glazed at the crown, gives a particularly light and airy appearance to the whole structure. The girders are absolutely self-stayed, throwing no side stress whatever upon the walls, to which they are anchored by means of holding-down bolts. A light wall is carried up above the springing of the girders, and carries the ends of the straight secondary roof-girders; the ventilated spandril space between the top of the main girders and the actual roof covering being made to accommodate the primary condensing mains, which consist of five lines of 18-inch piping. The secondary condensing mains, consisting of two lines of 24-inch tubing, are suspended from the inner side of the roof girders. The chief object of the secondary condenser is to encourage the final deposition here of all aqueous and tarry matters, by reason of the slower travel of the gas through the enlarged area of the tubing. The retort-house building is a very creditable architectural effort; being, as all such structures should be, plain, substantial, and well adapted to the purpose it is intended to subserve.

The carbonizing plant installed in this house consists of a double range of inclined 15 feet taper retorts. The middle or charging stage is 22 ft. 6 in. wide; and each drawing or discharging stage is 18 ft. 10 in. wide. These widths are found to be ample. Inasmuch as coal elevating and conveying machinery is as integral a part of the system of carbonization as the retorts themselves, the house is provided with several floors, or stages, to facilitate the use of such machinery. On the ground floor, which is the stoke-hold, run tip-waggons on a tram-line, so disposed that they receive the coke as it falls from the stage above. Here likewise the furnace-doors are found. On the first stage stand the men who open the retort discharging lids—placing in front of them a traversing screen which directs the coke into the basement. When we saw these retorts at work, they had only been in operation for a few days; the new plant having been provided for the needs of the coming winter. It was thus too early to say much about the carbonizing results. We can, however, testify to the satisfactory charging and discharging of the retorts, which, of course, is the main thing.

The settings, as already stated, are nines; and the difficulty of the ascension pipes is met by making two pipes upon each setting take two mouthpieces—the size of pipe being enlarged accordingly. Thus there are only seven ascension pipes for every nine retorts. The dip-pipes are hydraulically sealed in liquor; the tar being automatically drained out of the main. Particular care is taken to ensure the staunchness and durability of all the retort-fittings, to which end the weight of the retort ironwork is supported independently of the retorts.

The charging is effected from a second-floor stage, occupying the middle space between the benches. The coal, stored in overhead hoppers, kept full by push-plate conveyors travelling ten hours a day, falls from these into measuring chambers, which can be regulated to any desired weight of charge, and are then locked up. When a retort is charged, the measured quantity of coal is released by a lever, and falls into the shoot which directs it into the mouthpiece. To the bottom of every measuring chamber is fitted a Graham's patent balanced flap, which prevents any possibility of tampering with the quantity of coal put into the retort. It has been found that, where the simple "shot-pouch" device for charging the retort is employed, it is within the power of the operator to allow much or little coal to pass into the retort at will; but Mr. Graham's attachment obviates this completely. It is merely a counterbalanced flap, which, being so placed as to receive the impact of the descending charge, will not allow any of it to escape until the whole is through the measuring chamber, when it opens, and so prevents the shutter of the charger being pushed in again until the whole charge has gone into the retort. It is an invaluable check upon the operator, if he is disposed to be tricky. One smart lad to charge, and a couple more to see to the lids and traverse the coke screen below, complete the working staff engaged upon the stages.

A word must be devoted to the coal elevators and conveyors, which are as complete as they are simple. All coal has to be carted into the works at Huddersfield; and the carts tip their loads at the top of a shoot which will convey the coal to the mouth of one of a pair of crushers. Thence one of a pair of elevators will take it up to the top level of the system, where it can be diverted to either or both lines of push-plate conveyors commanding the service hoppers, which are designed to take about 14 hours' supply. All the elevating and conveying plant is in duplicate, to guard against risk of breakdowns; and it has been the Engineer's aim to make the whole plant as nearly as possible self-regulating and automatic. As an indication of the care with which Mr. Herring has worked out his plans, it should be mentioned that his buckstaves are fitted with hinged brackets of T iron, which are available instantly for supporting a couple of planks or a bar should any work be required to be done upon the front of the settings. The contractors for the carbonizing plant at Huddersfield—inclusive of the elevators and conveyors—were Messrs. Little and Graham, Limited, of London, who have done their work well and punctually.

Finally, it may be noted that a new oil-gas plant has been

put down to Mr. Herring's latest design, which (in conjunction with the oxygen process) is employed to carburet the common coal gas produced throughout the works. The amount of enrichment supplied in this way is 2½ candles; and this is stated by Mr. Herring to have been accomplished, during the past twelve months, at a cost of one-fifth of a penny per candle per 1000 cubic feet—including oxygen and royalties.

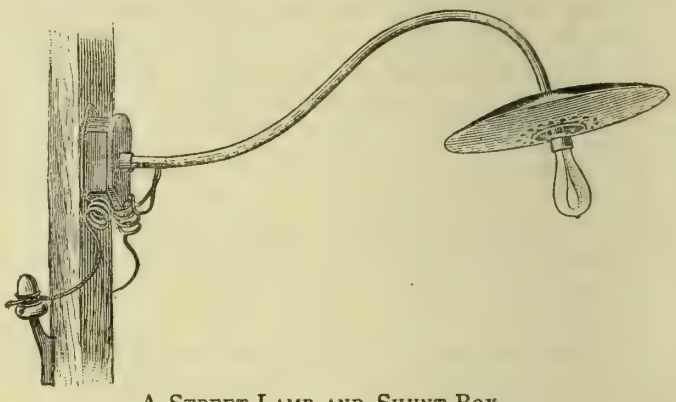
AMERICAN VIEWS OF PUBLIC LIGHTING SYSTEMS.

A USEFUL article upon "The Illumination of Streets and Public Places," by Mr. Franklin Leonard Pope, has appeared in the *Engineering Magazine*. Its utility consists chiefly in the freshness with which the writer discusses the problems of street lighting which, though partly solved for the United Kingdom in our grandfathers' time, are nowhere completely disposed of by a consensus of practice even at the present day. Such examples as that of Wimbledon are constantly coming under notice, to prove that the fundamental principles of public lighting are by no means generally understood, even in localities the inhabitants of which would consider themselves grossly insulted if they were accused of being behind the times in this or any other respect.

Mr. Pope commences with a reference to the lighting of villages—remarking that in the United States, when a neighbourhood has become of sufficient importance, in the estimation of its inhabitants, to justify the provision of a sidewalk and two or three street-lamps by voluntary public subscription, it has advanced to the status of a village; while the introduction of gas or electric lighting in its streets and places of business ought to entitle it to the distinction of being called a town. Strictly, village public lighting is properly a matter of petroleum lamps. Of the reasonableness of this view of the necessities of the case, and the best way of satisfying them, there can be no doubt. We agree with Mr. Pope that there is now a disposition to underestimate oil-lamps as means of public lighting; people tending to go to the other extreme, and call for the electric lighting of localities that have never enjoyed any public lighting at all. It is not so well appreciated as it ought to be that oil-lamps, when properly installed and intelligently managed, are capable of furnishing a really excellent lighting service at moderate expense. Upon this head, Mr. Pope states that "lanterns are now so constructed that the enclosed lights are not materially affected even by violent winds and storms; while by the use of oil, wicks, and chimneys of the best quality, and by conscientious care in cleaning and trimming, results may be attained little, if any, inferior to those usually realized from gas and electricity." He is also right in urging that, when village lighting is attempted, the common mistake is made of installing too few lamps, and not fixing them sufficiently high above the ground. He estimates that, in a country town of average compactness, it may be estimated that one lamp to every twenty-five inhabitants will be found sufficient. The most economical and satisfactory plan for maintaining oil street-lamps is "to put the whole matter in the hands of a single responsible person, who should be able to clean, fill, and trim eight or ten lamps per hour, and to light twenty-five or thirty in an equal period of time." For village communities, public lighting is not required after midnight nor during the four or five nights of full moonlight. The efficiency of the whole system, however, depends upon the quality of the attendance and supervision, and its effectiveness upon the number of lamps erected. Seeing that the cost of attendance bears a high proportion to that of the lighting material and repairs, the provision of the few lamps more, which makes such a difference to the general effect, is, or should be, a small consideration.

Mr. Pope asserts that, before the advent of electric lighting, the public gas-lamps in common use in United States towns were both costly and unsatisfactory. The average price charged for the gas supplied to the public lamps was as high as $2, or 8s. 4d. per 1000 cubic feet; while the regulation 5 cubic feet per hour seldom gave more than a 10 or 12 candle power flame. "Widespread dissatisfaction with the results of public gas lighting existed in the community, which was often due, it is but fair to say, in no small degree to the absence of proper care and inspection on the part of the municipal authorities. This feeling of dissatisfaction had the effect of hastening the adoption of electricity for public lighting in many of the larger towns of the United States, within a very short period after the necessary apparatus had been placed upon the market in a commercial form." In support of this observation, the writer offers the following contribution to the history of street lighting: "The first attempt to illuminate a town by electricity was made at Wabash (Ind.), in March, 1880. Arc lamps were used; two being placed upon the tower of the Court House, and two more on a mast erected for the purpose. The trial run was visited by hundreds of visitors from all parts of the country. The plant, consisting of four lamps and the dynamos, is said to have originally cost $18,000. It has operated continuously for six years, after which it was taken down and ultimately sold for $40 as a historical curiosity." When Mr. Pope speaks of the "first town" lighted by electricity—to the extent of four arc lamps—he refers, of course, to American examples only; for the application of the same means of public lighting to European and English city thoroughfares upon a much larger scale dates back to 1878, the then pioneers of this development—Jablochkoff, Werdermann, and others—having been working and experimenting in this direction for some years previously.

Mr. Pope goes on to remark, very sensibly, that the first arc lamps employed for street lighting in the States were denominated 2000-candle power lamps—"a meaningless and deceptive rating enormously in excess of their actual illuminating power, which, as recent investigations have shown, seldom exceeds one-fourth that amount." It is incontestable, however, that to the "happy thought" of the individual who first applied this denomination to electric arc lamps is due the remarkable success of electricians everywhere in obtaining street lighting contracts at prices greatly in excess of the previous charge for gas; and the useful imposture is not yet abandoned. Mr. Pope admits that, for all the hundreds of thousands of electric arc lamps that have been used for public lighting during the past fifteen years, "they are by no means so well adapted to that purpose as their extensive use would lead one to suppose." A full-sized arc gives, he admits, a brilliant and showy light, so that a row of them imparts "a decidedly metropolitan aspect" to the streets of a small town or an ambitious suburban village; and it is shrewdly suggested that it is for such reasons that the popularity of the arc lamp has always been greater than its intrinsic merit would seem to justify.



A STREET-LAMP AND SHUNT-BOX.

Mr. Pope describes the method of generating the arc light, in order to explain the unevenness of its distribution. "Directly beneath the lamp is always a circular dark shadow 30 or 40 feet in diameter; encircling this is a zone of brilliant light, the maximum intensity of which is found at a horizontal distance from the vertical axis of the lamp equal to its height above the ground. Beyond this zone of maximum illumination, the effective light rapidly diminishes, until, at a distance of some 300 feet, it is merged in the surrounding darkness." As very commonly applied to the ostensible purpose of lighting streets, such a system is worse than no light at all. "The alternate areas of intense light and opaque shadow, and more especially the blinding glare of the arcs themselves when viewed at certain angles, frequently render it impossible for either horse or driver to discern an obstruction until too late to prevent an accident." This consideration led to the suggestion of "tower lighting," which Mr. Pope says was at one time "quite in favour," especially in Western cities having broad streets with few high buildings or shady trees. The best example of this arrangement, now obsolete, was once afforded by the City of Elgin, Illinois. Here the central tower was 150 feet high, and carried five lamps. It was surrounded by six other towers, each 125 feet high, carrying four lamps. The towers were, roughly speaking, located something like half a mile apart. In this case, the area "lighted" was about four square miles; the population numbered about 16,000.

Mr. Pope observes that the standard arc lamp for street-lighting purposes—the traditional 2000-candle power lamp—operates with a difference of potential between its terminals of from 45 to 50 volts, and takes a current of from 9·5 to 10 ampères; so that the energy expended in each arc is approximately 0·6 of a horse power. The smaller type of arc lamp, nominally of 1200-candle power, which has an extensive sale and some popularity, "especially in ambitious communities of an economical turn," does not recommend itself to Mr. Pope, who confesses his inability to see, as an electrical expert, where its supposed economy comes in. It takes only 6·8 ampères of current. But the lighting effect is unsatisfactory—the falling off in this respect being considerably greater than the proportionate saving of fuel at the central station, and every other expense of erection or working is the same as for the full-sized arc. The alternating arc he does not like at all, and does not think it will ever become popular; being noisy, and wasteful of current for the light produced.

Lastly, Mr. Pope bears testimony, in a manner that should encourage the Wimbledon enthusiasts, to the promise of the series incandescent system, which he ventures to think will meet with general adoption for street lighting in all except possibly the very largest cities and towns. "Under the conditions which are met with in most localities, experience indicates that the lamps should not be less than 20, and need not be

more than 32 candle power to combine economy and good distribution of light. In most cases, a 25-candle lamp, if run at its full rated voltage, will be found to give excellent results." In order that the full value of this testimony to the beauty and economy of incandescent electric street lighting may be appreciated, we have given on the previous page an illustration, taken from Mr. Pope's article, of the "plain, neat type of fixture" for this method of lighting, which he placidly recommends as "perhaps as good as any." It is made of ¾-inch gas-pipe, curved into a goose-neck, and screwed into a cast-iron socket upon the supporting pole. The lamp is set into a protecting sheet-metal hood, and fitted with an annular convex reflector. "Such lights ought to be located at intervals of from 250 to 300 feet, which in the central district of the town may be reduced to 125 feet. Along suburban roads, lights 350 to 400 feet apart will often serve the purpose sufficiently well." This must be a pleasing prospect for the denizens of such suburban neighbourhoods as Wimbledon.

We have given prominence to Mr. Pope's article and to his recommendations in respect of public lighting by means of incandescent electric lamps, in order that we may not be accused of keeping our readers in ignorance of the best that can be advanced on behalf of the system by those American practitioners who are so much more "advanced" in such matters than the benighted people "on this side." Of course, it is open to anybody to argue that Mr. Pope's ideas of what is seemly in a public lighting service are crude to the verge of the barbarous; but it must be remembered that the "neat poles," the "lines of thin, black-coated wire," the "goose-neck of gas-pipe," and the rest of the appurtenances of the system he advocates so artlessly, are identified with the possibility of getting the lighting service at anything like the price he estimates, which is from $20 to $24 per lamp per annum—say, £4 3s. 4d. to £5 per point. It is quite in the true electrical apologist's vein that Mr. Pope urges that "a 25-candle lamp will give in practice from twice to three times as much effective light as the average gas-lamp *formerly* found in the public streets of our cities and towns." When will gentlemen of his persuasion awake to the necessity of making their account with the latest and best, instead of the worst and oldest competitors in the shape of gas-lamps? It is very certain that the general public, to whom purveyors of every kind of light must look for support, are not so astigmatic of vision as most of those who pose as their leaders in such matters, so far as they may be supposed to require leading in the direction of the realm of electricity.

The Preston Carburetted Water-Gas Plant: A Correction.—In the account of the Preston Gas Company's Moor Lane station published in the JOURNAL for the 5th inst. (p. 918), it is stated that the Humphreys and Glasgow carburetted water-gas plant in course of installation at these works is rated to manufacture 135,000 cubic feet of gas per day. By inadvertence, a cipher was dropped from this figure, which should read "1,350,000 cubic feet." We regret the error, which, if uncorrected, might be the means of spreading a false impression as to the producing capacity of this example of Messrs. Humphreys and Glasgow's speciality.

Carbon Compounds of the Metals of the Rare Earths.—Carbon compounds of some of the rarer metals have been prepared recently by Herr O. Pettersson (*Deut. Chem. Ges. Ber.*, 1895, Vol. XXVIII., p. 2419) by reduction of the oxides electrically. The dried oxide, best prepared by ignition of the oxalate, is mixed with finely powdered charcoal, and the mixture is submitted to the electric arc from a current of 60 volts, and 45 to 100 amperes. There were thus obtained carbides of lanthanum, yttrium, cerium, and niobium. They are crystalline bodies, brittle, and yellow in colour. A newly-exposed surface rapidly becomes covered by a thin grey film of oxide, and loses its metallic lustre. It is not stated what gas is evolved when these carbides are decomposed by water. Heated in a stream of hydrochloric acid gas to a bright red heat, the carbides are converted to the neutral chlorides, which volatilize. In their general behaviour, these carbon compounds resemble the calcium and aluminium carbides.

Profit-Sharing.—One of the first gas companies to follow the lead of the South Metropolitan and Crystal Palace District Gas Companies in adopting the system of profit-sharing is the Columbus (Ohio) Company. We learn from the following paragraph, taken from *Employer and Employed* (a Boston publication) for the past month, that at the meeting of the Directors of the Company on July 23, "they authorized the adoption of the plan for profit-sharing recommended to the Company at the March meeting by President Emerson M'Millin. The dividends will be based on the amount of their pay during the period for which the stock dividend is declared for stockholders, and in the same per cent. At present the dividend is 5 per cent., payable semi-annually at the rate of 2½ per cent. The conditions imposed are that the employees are to receive scrip exchangeable for stock until their holdings amount to $300, when it is optional whether they take cash or scrip. A further condition is that the profit-sharing applies to men more than a year in continuous service. The next dividend under the plan will be in November, when it will be paid to stockholders and employees alike for the six months ending Oct. 1." This matter was mentioned at the recent meeting of the American Gaslight Association.

NOTES.

Oxide of Iron Paint and Sulphuretted Hydrogen.

In connection with the subject of the preservative painting of ironwork and recent articles in the JOURNAL upon the subject, it is of interest to note that Mr. Henry Green, the Engineer and Manager of the Preston Gas Company, has a special way of preparing the paint used in the gas-works under his control from the after-effects of sulphuretted hydrogen. He simply exposes the paint paste, composed of natural oxide of iron and linseed oil, to the action of sulphuretted hydrogen before it is thinned down for use. This is effected by burying the paste, in pots, in the oxide of iron purifier attached to the sulphate of ammonia plant, until the sulphuretted hydrogen has had all the effect upon it that is possible under these highly favourable conditions for chemical action. After this, nothing further of the same kind of influence can hurt the paint, which exhibits no other alteration of character from the treatment than a slight darkening of colour. Mr. Green was led to adopt this expedient by observing that when oxide paint is used in gas-works, sulphuretted hydrogen is certain to get hold of it sooner or later; and he has found, from many years' experience, that, after well seasoning the paint in the manner described in the first instance, no deleterious after-effects are to be feared.

The Uniformity of the Carbon Arc Crater.

Professor J. Violle is unremitting in his endeavours to obtain a reliable standard of light. His performances with solidifying platinum having turned out hardly even a *succès d'estime*, he has directed his attention, with more hopeful prospects, to the phenomena of the electric arc as offering a means of establishing a standard of light upon a sound basis. Having ascertained by previous experiments that the brilliancy of the crater in the carbon arc is the same for currents between 10 and 400 amperes, Professor Violle was desirous of making this assurance of constancy doubly sure by experiments with currents of 1000 and 1200 amperes. The desired corroboration was obtained; the intrinsic brilliancy of the carbon crater being "rigorously constant at every range, from 10 to 1000 amperes, and from 110 to 75 volts." Photographs in evidence of these conclusions were shown by Professor Violle at an exhibition of the French Physical Society. These photographs showed images of two arcs, taken upon the same plate, one over the other. One was of an arc of 10 amperes and the other of an arc of 1000 amperes; and they were photographed by white, red, and green light—the plates being developed all over in exactly the same manner. The reproduction of these photographs, published by the *Electrician*, certainly indicates that Professor Violle is justified in his contention that the light emitted from the crater of the carbon arc is equally brilliant under all conditions of current, from which it would follow logically that a known unit of area of the crater would always supply a standard of light, if the carbons could be relied upon, and there were no other objections to the method.

A Chain Rule for Testing Boiler Data.

In a recent letter to *Engineering*, Mr. W. B. Muserling, of the Hague, Holland, offers a valuable commentary upon the published results of Dr. Kennedy's and Mr. Bryan Donkin's steam-boiler tests. He points out that the principal data relating to the working of any steam-boiler are: 1, Pounds (*a*) of coal (lb.C) burnt per hour per square foot of firegrate surface (G.S.). 2, Ratio (*b*) of boiler-heating surface (H.S.) to firegrate surface. 3, Pounds (*c*) of water (lb.W.) evaporated per hour per square foot of boiler-heating surface. 4, Pounds (*d*) of water evaporated per pound of coal. These four quantities are closely connected with one another; and their necessary connection is most clearly shown by the "chain rule." According to the method of writing this rule, we have—

lb.C.	*a*	1	G.S.
G.S.	1	*b*.	H.S.
H.S.	1	*c*.	lb.W.
lb.W.	*d*	1	lb.C.

$$a\,d = b\,c$$

This simple equation, Mr. Muserling observes, ought to be always used for controlling the chief data which have to be considered when designing a steam-boiler. The method was introduced, and has been for many years taught by, Professor A. Huet, in his course of lectures on machine design at the Royal Polytechnic School of Delft. The equation also gives a check upon the experimental data obtained from boiler trials. Mr. Muserling accordingly applies it to the data of Mr. Donkin's summary (*ante*, p. 777). Taking for example the data deduced from the East London Water Company's Cornish boilers with Galloway tubes, the figures would appear in the chain rule as follows:—

lb.C.	15·7	1	G.S.
G.S.	1	19·3	H.S.
H.S.	1	7·43	lb.W.
lb.W.	9·16	1	lb.C.

$$143{\cdot}81 = 143{\cdot}40$$

The greater number of the experiments have led to exact results, which proves their reliability within the limits imposed by experimental errors.

Mr. A. L. Steavenson on Boiler Duty.

Commenting on the subject of the preceding communication, of which he professes admiration, Mr. A. L. Steavenson, of Durham, observes that the method admits of a little extension. Applying it to Mr. Donkin's list of Lancashire boilers, and comparing the pounds of water evaporated per pound of coal with the ratio of heating surface to firegrate, we get an average of 1 lb.C to 12·43 lbs.W, with grate surface and heating surface of 1:44·6; and 1 lb.C.to 9·97 lbs. W. with a ratio of grate to heating surface of 1 : 38·8. This shows very clearly the benefit of the larger ratio of heating surface; and it leads Mr. Steavenson to remark upon the great quantity of statistics which are available upon boiler "efficiency" compared with boiler "duty." He says he has been looking into the matter for some time, and is surprised at the fewness of the writers who treat of the question, "What should a boiler do, when working at its best—meaning both capital involved and working efficiency?" Take for example a Lancashire boiler 30 feet by 8 feet. This will evaporate, according as it is pushed, any quantity of water up to 80 tons in 24 hours from 200° Fahr. Mr. Steavenson knows of some which are actually doing nearly this amount of work, and others of the same size doing less than half of it. The latter give the higher efficiency, and no wonder; for their gases leave the boiler at a temperature which hardly exceeds 500° Fahr., while in the others the temperature at the same point is 1150° Fahr. Mr. Steavenson declares that this question of final temperatures has been almost entirely neglected; and he puts the question of how many boilers are needed to supply, say, 2000-horse power? Five 30 feet by 8 feet Lancashire boilers would do it, if pushed to the top limit of 400-horse power each, which means an evaporation of 80 tons of water in 24 hours. But Mr. Steavenson considers that it would be more economical in the long run to have six or seven such boilers, and work them quietly, having regard to the point of final temperature.

Magnesite Fire-Bricks.

The familiar makes of fire-brick are threatened by a new kind of refractory material occurring on the coast of Eubœa, Greece, in the form of magnesite ore—a dazzlingly white stone, which is actually being largely worked by a French company. The ore is shipped both crude and calcined; being eminently suitable for lining furnaces. It is also used for certain purposes as a substitute for china clay. The most promising application of the material, however, is the making from it, after grinding and calcination, of fire-bricks by machinery. These bricks are fired at a great heat by Siemens gas-furnaces, using a local lignite for fuel. They are reputed to stand extremely high heats for a long period. Their composition is guaranteed to be 95 per cent. of pure magnesia; analysis frequently giving the purity as high as 97·80 per cent. Magnesia powder is shipped from the same locality to lay the bricks with. The magnesia bricks are somewhat high-priced; but this will not be a serious hindrance to their coming into extensive use in the arts if the material is really better for the construction of furnaces (to say nothing of crucibles and retorts) than the commoner materials employed for these purposes.

The "Engineer" Road Carriage Competition.—Particulars in regard to this competition, to which reference has already been made in our columns, are now furnished in the *Engineer*. The competing vehicles are to be divided into four classes; and the prizes will be 150, 250, 250, and 350 guineas. The trials are to consist of a run of 200 miles out and home; the speed not to exceed ten miles an hour. The weight of the carriage is limited to two tons. The Judges are to be Sir F. Bramwell, Bart., F.R.S., Mr. J. A. F. Aspinall, M.Inst.C.E., and Dr. Hopkinson, F.R.S.

Laying Pipes under Water.—At a recent meeting of the Engineers' Club of Philadelphia, Mr. W. H. Dechant read a paper on "The Submerged Pipe-Line for the Pennsylvania Sanitary Sewerage Company, at Reading (Penn.)," in which he fully described the method of constructing the submerged pipe-line across the Schuylkill River at Reading. The width in this particular part of the river along the line is about 400 feet, and the deepest part about 10 feet below extreme low water; the average depth being about 8 feet. A 30-inch cast-iron pipe was used, weighing a little over 2 net tons per length of 12 feet. The channel was excavated across the bed of the river to lay the pipe in, so that the bottom of it would be about 2 feet below the ordinary river bottom. Previous soundings with a pointed steel rod had shown the bed rock to be far enough down to allow the proper depth of trench, though the rock was scraped at several points in the dredging. The line of pipe was laid by first joining the sections suspended from trestle-work across the river by means of long screw-rods, attached to each pipe so that the entire length occupied the position it was to have in the bottom of the trench. The whole thing was then lowered uniformly by a man at each screw keeping time in the turning. The methods of setting the trestle-work, suspending the sections of pipe from the screw-rods, making the joints, and lowering the pipe, were all described in detail. Three days were occupied in the erection of the trestles, and four more in getting the pipe ready for lowering, which occupied altogether about five hours. The iron screw rods and couplings were afterwards removed by wires attached to the keys and pins which held them to the suspension bands.

COMMUNICATED ARTICLES.

ACETYLENE AS A POSSIBLE STANDARD OF LIGHT.

By H. Leicester Greville, F.I.C., F.C.S.,
Chemist to the Commercial Gas Company.

It is only natural that, with a possibility of procuring practically pure acetylene without difficulty from the reaction of calcium carbide on water, there are rumours of the possible use of the gas as a standard of light. The only practical suggestion which has as yet been made is that of burning the gas under the conditions of air supply previously demonstrated by Professor Lewes, with a perforated screen placed in front of the flame so as to afford a constant light somewhat on the principle of the Methven screen. This might possibly be a reliable standard; but details of the actual construction of the apparatus, and of the efficiency of the working, are not as yet forthcoming.

No doubt in calcium carbide—which may now almost be regarded as a practical commercial product—we have a means of easily preparing a hydrocarbon of definite composition, which might be made available as a standard of light, if consumed under proper conditions. The suggestion of consuming the gas in a specially devised flat-flame burner, provided with a screen having a definite aperture, may be useful, and possibly accurate; but this scheme is not necessarily the best system by which acetylene might be employed as a standard. It might surely be possible to invent an Argand burner with exceedingly small holes (such as is already used in the Dibdin Argand), and provided with a suitable chimney which would enable acetylene to be used in a similar way to that in which the vapour of pentane is employed in the Dibdin standard; the height of the flame being adjusted to certain limits, and the proportion of light required being regulated by a due adjustment of a cut-off screen. Whether the pure gas could be used for this purpose, or whether a certain admixture of air would have to be employed, is obviously a matter for investigation.

The principle of using a hydrocarbon flame in which the upper portion of the light is screened off, has been proved to have the advantage that sensible variations in the height of the flame can take place without affecting the illuminating value of the standard, and that no accurate check on the consumption of gaseous material consumed is necessary. This principle is obviously conducive to accuracy of manipulation, as it eliminates any possible errors of observation of gas consumption. If it were not for this fact, it might be recommended with a suitable burner for the consumption of acetylene, that a definite and accurate unit of light might be obtained by consuming the gas at a specified rate. In a recent contribution to the JOURNAL, it has been shown that acetylene, prepared by the action of water on calcium carbide, contains a small proportion of hydrogen phosphide. This is of great scientific interest, in explaining the fact that the gas obtained in this manner has an abnormal odour. But the proportion of hydrogen phosphide found was so exceedingly small, that it is an open question whether, in considering the possibility of employing acetylene as a standard of light, this minute amount of impurity need be taken into account.

In seriously regarding acetylene as capable of development under suitable conditions to an accurate standard of light, it is obvious that the gas must be obtainable in sufficiently pure condition to practically afford an even degree of illumination under stated conditions. Although there is at present an absence of evidence on this special question, it may be reasonably assumed that acetylene prepared from calcium carbide would be pure enough to meet all practical requirements. It is quite true that the commercial article does not yield the proportion of gas corresponding to theory; but the main impurity present in the raw product must be obviously calcium oxide, which on contact with water simply forms calcium hydrate, and does not evolve any gaseous products. In fact, it is somewhat surprising to learn, from published investigations, that so much hydrogen phosphide was found, as, to the best of my knowledge, calcium phosphate is an exceedingly small constituent of ordinary chalk. One almost feels inclined to suspect that the chalk employed in the manufacture of the particular sample of calcium carbide which was examined, must have had an abnormal composition with regard to the proportion of phosphates. Whatever may be the respective merits of pentane and acetylene as available materials for use as standards of light, the latter is obviously, to use a common expression, handicapped by the fact that pentane has already been accepted under specified conditions by the Standards of Light Commission. In addition to this, after a specific agreement has been arranged between opposing parties on such an important question as the adoption of a new standard of light, any suggestion of replacing pentane by acetylene would seem like starting the subject *de novo*.

An endless amount of tedious investigation would have to be made in order to establish the value of any proposed new standard in terms of the existing candle. Of course, having already fixed the value of the pentane Argand in mean candles, the value of any other standard could be ascertained by comparison on an ordinary bar photometer. But when every circumstance is taken into consideration, it is exceedingly doubtful whether it is expedient to re-open the subject of a new standard

of light simply on the ground that, since the advent of the practical employment of pentane for this purpose, another hydrocarbon has become available. In making this statement, the question of pure scientific interest is ignored. But the scientific and the practical, although intimately connected, are not necessarily identical. In the ten-candle pentane standard we have a practical unit of light, of which the value and the necessary details of manipulation have been most thoroughly investigated, and are now well understood. We also have a simplicity of working which is, in itself, not only an attraction, but a guarantee of correctness; as in scientific work—especially for practical purposes—it can generally be accepted as an axiom that freedom from complication is inevitably conducive to accuracy. This statement involves no reproach to the capacity of the scientist to obtain the highest degree of accuracy under the most difficult conditions. It is simply intended to convey the fact that in cases where a scientific operation is conducted for commercial purposes, not by the very highest class of experts, but by somewhat less pretentious and more poorly-paid workers, it is certainly desirable to eliminate as far as possible all sources of error, more especially when the fact is recognized that *extreme* scientific accuracy has often to be sacrificed to the exigencies of having to perform the maximum amount of work in the minimum amount of time.

In considering the possibility of using acetylene as a means of producing a standard of light, it should be remembered that solid calcium carbide need not necessarily be employed. Acetylene is readily liquefiable, and therefore liquid acetylene would be as practically possible as liquid pentane, with the exception that in the case of the liquefied gas a strong receptacle, capable of withstanding a considerable amount of pressure, would be requisite. This is, however, in these modern times, a mere mechanical detail easily met, and not necessarily occasioning any practical difficulty. In fact, it is a matter for serious consideration, *quoad* acetylene, whether, with a view of using the gas as a standard of light or simply as an ordinary illuminant, it would not be advisable to supply the compressed or liquefied gas in place of the raw material for its production.

ON THE ALLEGED ESCAPE OF CARBONIC OXIDE AND UNCONSUMED CARBON FROM COAL-GAS FLAMES.

By Lewis T. Wright.

In years gone by, a very popular charge brought against coal-gas lighting was the occurrence of certain oxidized sulphur compounds among its normal combustion products; but it has been left to quite recent times to discover in those products the toxic carbonic oxide, of which a very trifling amount would render the air we breathe positively dangerous, since its effects are cumulative in destroying the oxygen-absorbing capacity of the blood—a property upon which the animal economy depends. There also appears in certain quarters to be some tendency to revive an old scare of the passage of this deleterious compound through the iron of heating-stoves and their flues. This latter danger was much more felt in those countries where the iron stove with charcoal and coke as fuel is more popular than our open coal grate, and became the subject of serious inquiries, resulting in the conclusion that carbonic oxide did actually pass through cast and wrought iron, *but only when these were heated to redness.* As the gas-stoves in use do not commonly become red hot, either in their iron bodies or their flues, the danger of the contamination of the air of our apartments by these is not to be apprehended, *even if the products of combustion of the gas consumed in them did normally contain carbonic oxide.* There is also the efficient practical test of time and use, which abundantly proves that coal gas can be consumed in dwelling-rooms without giving rise to any evil effects. In spite of this general and proved immunity from the toxic effects of imperfect combustion of coal gas, we are all aware that, under certain circumstances, the atmospheric gas-flame will—if it light back, for instance, or if it be placed so as to be unable to obtain sufficient air—give products of incomplete combustion. But these circumstances are abnormal, and can be avoided; and, further, should they arise, the evil smell of the imperfectly consumed gas would give immediate warning.

The publication by M. Gréhant* of the results of some investigations showing that the products of combustion of the Auer burner contained carbonic oxide, caused some excitement among our Continental neighbours, especially as he stated that the products of combustion of lighting gas should be avoided, more particularly those emitted by the Auer burner. This was a very serious statement, coming from a chemist whose work on the detection of carbonic oxide in the blood was well known; and it could not be allowed to pass without criticism. Professors Renk and Boshard carried out elaborate investigations, and were not able to detect the presence of the deleterious impurity among the products of combustion from the Auer burner; and Dr. Bunte, in June of this year, in an otherwise valuable memoir, since it relates to other matters, such as the durability of mantles, &c., found that, with copper oxide, the indications of imperfect combustion were so slight as to be within the limits of experimental error.† The gas-burners tested by Bunte were the Welsbach, Argand, and flat-flame. M. Gréhant had, in the meanwhile, so modified his statement as to say in a later paper that the use of the Auer (Welsbach) mantle is unattended with any danger of poisoning by carbonic oxide; and this incident of the supposed danger to health attending the use of incandescent gas-burners may now be considered as closed.

In a paper read by Professor Vivian B. Lewes before the Chemical Society,* it is stated that from the tip of a flame (the class of flame is not mentioned) there escaped unburnt 0·39 per cent. of saturated hydrocarbons and 1·18 per cent. of carbonic oxide. It is an exceedingly difficult matter to collect for analysis the gases from any part of a flame or its immediate neighbourhood so as to enable one to state with certainty that they represent the gases that would be present at that particular point if the suction-tube were not there in operation. Landolt, in his classical investigation, "Ueber die chemischen Vorgänge in der Flamme des Leuchtgases," made at the suggestion of Professor Bunsen in the latter's laboratory, analyzed the gases collected at various parts of a rat-tail flame about 100 mm. in height. He placed the fine suction-tube used for the collection of the samples vertically in the axis of the flame, and found that the small amount of suction required to draw the gases through the apparatus reduced the length of the flame about 10 mm.; and he was not able to continue his investigations on the composition of the flame-gases beyond a height of 50 mm. above the bottom of the flame, on account of the obstinate obstruction formed by the free carbon. He found that a fine wire passing through the suction-tube used for clearing it of this deposit, caused an inconvenient deformation of that flame. It is probable that the gases escaping from the tip of the flame in the experiment cited by Professor Lewes were really drawn from an integral part of the flame *before the combustion was complete*, and do not represent the gases escaping from it.

The experiments made by Mr. W. Thomson, and described by him to the British Association in 1890,† on the gases escaping unconsumed from various burners, both lighting and heating, are of a very circumstantial character, and would indicate that combustion was not, in the cases under investigation, so complete as might be desired. He adopted the method of drawing them, after removal of the carbonic acid and water, over heated copper oxide, and determining the further amounts of carbonic acid and water formed by the complete oxidation of the combustion gases. This method, unless by blank experiments it be found that the atmosphere, quite apart from the gas-flames experimented upon, is free from carbon containing compounds other than carbonic acid, is somewhat uncertain, as, where there are gas-pipes and connections, it might happen that there would be some slight escape of coal gas into the atmosphere, quite independent of the flames employed; and this would be classed as coal gas escaping from the burners unconsumed. In Mr. Thomson's experiments, no attempt was made to show in what form the (in certain cases) very important quantities of unconsumed gas existed; and it would not therefore be correct to classify his trials among those that have shown carbonic oxide as an ordinary constituent of the gases leaving coal-gas flames. He merely proved that, in some of the cases studied, there were important quantities of carbon and hydrogen, not oxidized to carbonic acid and water, escaping from gas-stove burners. The following is a recapitulation of his results:—

Carbon and Hydrogen Escaping Unconsumed per 100 Parts of Carbon completely Burned.

	Carbon.	Hydrogen.
Petroleum lamp not burning at the full	—	—
Do. with flame turned full on	1·204	0·309
Argand gas-flame	—	0·025
Do.	0·011	0·254
Bray burner, consuming 4 c. ft. per hour	1·112	0·095
Welsbach burner	1·500	0·379
Marsh-Greenall's heating-stove, burning 5·62 c. ft. per hour	1·260	0·300
Do., burning 5·74 c. ft. per hour	3·760	1·180
Do., burning 7·10 c. ft. per hour	9·740	1·210
Thomas Fletcher's heating-stove, with eight Bunsen burners	4·330	2·460
Do., burning 6·81 c. ft. per hour	6·630	2·000
Do., with 20 Bunsen burners, with asbestos and fire-clay back, consuming 8·14 c. ft. per hour	13·890	1·170
Heating-stove	20·000	—

The amount of unconsumed carbon found in the one case of the Argand burner is too small to form the basis of a definite conclusion. It was represented by an increase of weight determined in a chloride of calcium weighing-tube of about 0·004 grain. The quantities of imperfectly consumed carbon escaping from the heating-burners used in the various stoves examined by him are far from being unimportant, even if no portion of it existed as carbonic oxide. That so much as 20 parts of carbon per 100 parts completely burned should escape from any gas-burner is almost incredible, and is quite opposed to the writer's experience. It is curious that the Argand burner, which is of a class that, under abnormal conditions—viz., when turned on too full—gives large quantities of unconsumed gas, is precisely the burner that, under normal circumstances, has been shown by those investigators, like Gréhant and Thomson, who have found important quantities of

* *Comptes Rendus*, Vol. CXIX., p. 146; JOURNAL, Vol. LXIV., p. 472.
† See JOURNAL, Vol. LXIV., p. 823; and *ante*, p. 179.

* See JOURNAL, Vol. LIX., p. 795; *Jour. Chem. Soc.*, April, 1892.
† See JOURNAL, Vol. LVI., pp. 602, 996.

unconsumed gas escaping from other burners, to be the one freest from suspicion.

The inquiry carried out in the *Lancet* laboratory, by a special Analytical and Sanitary Commission, on the products of combustion from Welsbach, Argand, and Bray burners,* gave a distinctly negative result as regards the occurrence of carbonic oxide and acetylene in the combustion products from the two former, and but a very doubtful indication of their presence in those from the Bray burner. The experiments were conducted under severe conditions, for the burners were placed in a "small chamber 3 ft. 1 in. by 3 ft. 1 in. by 2 ft. 4 in. (with no provision for any appreciable ventilation or outlet for the gases) for eight hours, during the whole of which time the air taken from above the burners was aspirated first over potash and soda-lime to remove carbonic acid and sulphur compounds, then through sulphuric acid to remove ammonia, and finally through a dilute solution of blood." Only in the case of the Bray burner was there the slightest indication of carbonic oxide. Nor could acetylene be detected in the case of the Welsbach and Argand burners; and the indication given by the silver nitrate test on the products from the Bray burner was at the best "doubtful." The result of the inquiry was thus entirely satisfactory in dispelling any fears as to the occurrence of the poisonous gases carbonic oxide and acetylene in the combustion products from such burners. The blood test applied for the former compound is positive, as it depends upon certain changes in the character of the blood as revealed by the spectroscope—changes which are only caused by carbonic oxide; and it is capable of confirmation by the after-expulsion of this gas from the blood in which it has been collected, and its examination by other reagents that would give further proof of its presence.

The writer has on two different occasions sought for, and endeavoured to find, traces of unconsumed gas escaping from the normal flames of ordinary gas-burners, both lighting and non-luminous. The atmosphere of an imperfectly ventilated apartment, where there is much gas being consumed, is unpleasant; but it does not follow that there is on that account unconsumed gas leaving the flames. On the occasion of fitting up the large show-room of gas appliances installed by the Gas Committee of the Nottingham Corporation, he tested a considerable number of cooking-burners, in order to ascertain whether, in their normal condition, there would be any traces of unconsumed gas leaving their flames; and he invariably obtained a negative result. The writer has always contended that it is necessary, wherever possible, to arrange gas-flames in such a manner that the products of combustion should discharge themselves directly into the outside air, not because such gas-flames imperfectly consume the gas, but on general considerations of comfort; and it was for this reason that he provided a system of flues whereby every gas-stove or gas-fire, &c., which was on exhibition, and which would from time to time be shown in action, was attached to a flue, wherein was always maintained a constant draught discharging itself into the outer air.

The burners were tested in the following manner: They were placed in a small room, the air of which was tested in order to ascertain that there were not present any carbon compounds (escaping coal gas) that would give the reaction sought for. A tube was placed over the flames (but so as not to touch them); and the products of combustion, mixed probably with some air, were drawn through vessels containing cotton wool, to remove dust, organic matter, &c., and then through a column of soda-lime, to remove the carbonic acid. The gases so purified were afterwards passed over copper oxide that had been prepared *in situ* by the oxidation of fine copper wire, and then through bulbs containing lime water. The results were in all cases negative; and not the slightest trace of carbonic acid formed by the oxidation of carbonic oxide or other products of unconsumed coal gas could be detected.

On another occasion, on discovering the facility with which the inner or primary flame of the atmospheric (or Bunsen) flame could be separated from the outer cone or secondary flame,† and, when so separated, the ready extinguishability of the flame, which then is represented by partially consumed gases containing as much as 11½ per cent. of carbonic oxide, it appeared to the writer that there might be danger from a too large pre-admixture of air to the Bunsen flame (approaching the mixture when the flame might strike back). Therefore his previous experiments with large Bunsen flames were repeated in this condition of maximum air supply; and again with negative results.

Coal gas has now been used in enormous quantities for a number of years, and in badly-ventilated rooms and workshops; and there have been no cases of poisoning from the unconsumed gas leaving the burners. The action of carbonic oxide on the blood is distinct, as it forms a compound with the hæmoglobin, and can even drive out the oxygen from the oxy-hæmoglobin, forming the carbon monoxide hæmoglobin compound from which the carbonic oxide cannot be afterwards displaced by oxygen. It is in the highest degree improbable that, if there were any such imperfect combustion from lighting-burners as has been suggested by the analytical results of the various observers mentioned, considering their great variety, and that many of them are sufficiently bad, the fact would have only been recently discovered; for, in the earlier years of gas lighting, there were critics quite as well informed, and quite as willing to discover defects and imperfections in the popular illuminant, as there are to-day. The weight of scientific and practical evidence is entirely against the view that carbonic oxide escapes from the flames used for lighting. It is possible to conceive a variety of circumstances in which the burners employed in heating are unable, by lighting back, or by being confined in a flue or chimney of too small capacity, to procure the quantity of air requisite for the normal combustion of the gas passing through them; but given a free air supply, the worst burner seems to have no difficulty in completing the combustion of the gas. Before accepting any evidence based on analytical methods, it will be necessary to show that these are above reproach; and in cases where the products of imperfect combustion are found in but very minute quantities, it will be more satisfactory to prove, by blank experiments, that such minute quantities would not be found if the suspected flames were absent. In any case, the writer does not believe that an instance of imperfect combustion has ever been substantiated against lighting-burners, nor even against heating-burners of good class when employed under their normal working conditions.

* See JOURNAL, Vol. LXV., p. 122; also *Lancet* for Jan. 5, 1895.

† *Proceedings Royal Society*, Vol. LXII.

The Toxicity of Acetylene.—In a recent number of the *Comptes Rendus*, an account is given of some experiments conducted by M. Gréhant in regard to the toxicity of acetylene. He tried mixtures containing 20, 40, and 79 per cent. of acetylene (the mixtures in all cases having 20·8 per cent. of oxygen as atmospheric air); and he found that it is poisonous if inhaled in large quantities, between 40 and 79 per cent. He ascertained, however, that it is much less deleterious than coal gas. Mixed with oxygen, it is highly explosive. Referring to these experiments, M. Berthelot says the toxicity of acetylene would be much greater than it is if it were mixed with carbonic oxide or hydrocyanic acid.

Hellriegel and the Sulphate of Ammonia Trade.—It is a truism to say that the world knows nothing of its greatest benefactors; and it is probable that when a short time ago the newspapers reported the death of Professor Hermann Hellriegel at Bernburg, Anhalt, very few of those connected with the sulphate of ammonia industry recognized in the announcement the name of the agricultural chemist who was mainly instrumental in establishing the growth of the sugar-beet in Germany. Professor Hellriegel devoted his life almost exclusively to the study of the phenomena of plant nutrition. His chemical researches had to do with the nature of soils; and his physiological inquiries embraced observations on the growth and development of roots, on the water required for the growth and maturing of crops, and on the minimum amounts of nitrogen, phosphoric acid, potash, and other ingredients required by plants. Supplemented by observations on crops grown in the open field, these investigations led Hellriegel to conclusions of great practical importance, notably in connection with the sugar-beet, a crop Germany grows more extensively than any other European country—its annual average area for the last twelve years having been 800,000 acres. Bernburg, where Hellriegel lived and died, is an experimental station established for the special investigation of problems bearing upon the cultivation of sugar-beet. It was here that he made his discovery as to the capacity of leguminous plants to take up and fix the free or uncombined nitrogen of the atmosphere through the agency of the micro-organisms of their root-nodules.

The London County Council and the Water Question.—The following observations on the recent action of the London County Council in regard to the water question were among the "Notes" in the issue of the *Builder* for the 1st inst.: "The way in which the London County Council deals with the water question is enough to make the public doubt if it will ever show real business capacity. Having rejected an amendment to the report of the Water Committee that the Bills of last session should be proceeded with, it last week passed an amendment in the following terms: 'That the Council, having decided not to proceed with the suspended Water Bills, and desiring that the Council should be the Water Authority for London, it be referred to the Parliamentary Committee to report without delay the lines on which they suggest the Government should be asked to legislate.' That is to say, having declined, as was quite right, to go on with these Bills, and to leave the matter in the hands of the Government, the Council gives directions to a Committee to prepare a scheme, or its outlines, which the Government is to carry out, based on the principle that the County Council is to be the Water Authority for London. The Government, which rightly should have the responsibility of settling this great question, must be left with a free hand to lay down the principles and the details of the change. It is obviously childish for the Council to suppose that the Government can accept the outlines of a Bill from them. When the Government measure is prepared, it will be reasonable to criticize it, and for the Council to lay their views before the Minister in charge of the Bill by the ordinary means of a deputation. It is improbable that the Government will accept the primary principle that the Council is to be the Water Authority. Even if it should do, it will be on its own responsibility, and not at the dictation of the Council, which has hitherto failed to effect any solution of this important matter."

TECHNICAL RECORD.

SOUTHERN DISTRICT ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The General Meeting of this Association was held last Thursday, at the Holborn Restaurant—the PRESIDENT (Mr. S. W. Durkin, of Southampton) in the chair. The attendance of members was exceptionally large.

The minutes of the meeting held at Southampton in May last having been confirmed, the members proceeded to elect

NEW OFFICE-BEARERS.

Mr. J. L. CHAPMAN (Harrow) said he had pleasure in proposing that Mr. A. F. Browne, the Engineer of the Rotherhithe station of the South Metropolitan Gas Company, be elected President for the year 1896. He had often, in days gone by, tried to induce Mr. Browne to take this office, but had not succeeded; and nothing delighted him more than that he should have now agreed to serve the Association in that capacity.

Mr. J. TYSOE (East Greenwich), in seconding, said he could speak of Mr. Browne from personal acquaintance. It was his modesty that had hitherto kept him in the background, because he was quite sure that Mr. Browne possessed fully the qualifications necessary to make a first-class President. The Committee had always exercised great care in selecting gentlemen for this position; and all would agree that, on the present occasion, they had nominated a fit and proper person for the chair.

The proposition was carried by acclamation.

Mr. BROWNE, in acknowledgment, said that, with whatever mixed feelings a man might contemplate his election to the presidential chair of the Association, there must always be two sentiments dominating him—the sense of the great honour conferred upon him, and the recognition of the fact that he possessed the good-will of his colleagues. Both these sentiments were influencing and swaying his mind at that moment. He sincerely thanked the members for the cordial way in which his appointment had been moved, seconded, and endorsed by applause. There was another side to this question, which he might be pardoned for mentioning briefly. When the Committee, in their wisdom, suggested that his name should be put forward for the office, he gave them several good reasons why he should be excused. The Committee did not refute those arguments, but pressed their proposal; and ultimately he consented, feeling that it was necessary to support the Executive loyally when called upon to do so. The Committee must then permit him to say to the members, as he had already said to them, that he did experience some feeling of unfitness for the high position to which it had been their pleasure to elect him; and when the time came for him to enter upon his official duties, he should look to the Committee, and especially to their able Hon. Secretary, for that light and leading which would enable him to discharge those duties in such a way that the interests of the Association might not suffer in the coming year from the fact that he occupied the chair.

Mr. T. MAY (Richmond) moved that Mr. J. W. Helps be re-elected Hon. Secretary. He was sure this motion needed no words from him to recommend it to the members, to all of whom Mr. Helps was so well known; and they were greatly indebted to him for his past services.

Mr. C. E. BOTLEY (Hastings) seconded the motion, which was unanimously carried.

Mr. HELPS thanked the members for this continued proof of their approval, and promised that he would try in the future, as in the past, to do his utmost to advance the interests of the Association.

Mr. D. IRVING (Bristol) moved, and Mr. C. C. CARPENTER (Vauxhall) seconded, the election of Messrs. A. E. Broadberry and C. E. Botley to serve on the Committee, in succession to Messrs J. Tysoe and W. A. Valon.

The motion having been agreed to,

On the proposition of Mr. CARPENTER, seconded by Mr. E. BAKER (Reading), Mr. W. H. H. Broadberry (Tottenham) and Mr. W. D. Child (Romford) were appointed Auditors.

NEW MEMBERS.

The following gentlemen were admitted as members of the Association: Mr. G. W. Anderson, of Caterham; Mr. T. A. Guyatt, of Ely; Mr. R. Watson, of Hertford; Mr. F. W. Torpey, of Uckfield; and Mr. J. Donaldson, of Tonbridge.

Mr. C. C. CARPENTER then read the following paper, entitled—

GAS EXHAUSTING AND CONDENSING.

As its title implies, the present paper has been written with a view to the consideration and discussion of what are ordinarily the first two stages in dealing with coal gas after it leaves the foul main of the retort-house. Though I am aware this order is not invariably adopted, yet in those cases where washing is antecedent to the exhauster, the arguments about to be adduced would apply, but still more forcibly; and therefore their consideration may for simplicity be neglected.

Condensers, washers, and purifiers were essential features of gas-making plant long before exhausters were thought about; and doubtless in the very early days of the industry their order was thus determined, and for obvious reasons. So, too, with the exhauster; its proper position appeared to be after cooling, and before the washers through which its power could be best utilized to force the gas. Since the time when this order was determined, however, very much greater attention has been bestowed upon maintaining a higher and more constant illuminating power without the use of so great a proportion of enriching material; and one of the factors in bringing this about has undoubtedly been the continual separation of the tar from the gas. Tar so treated is admittedly poorer in benzol, by which the gas is correspondingly enriched, though it would be difficult to attach a definite candle-value to the altered conditions. If this tar separation is thoroughly carried out, very little comes forward to the exhauster; and what does is so charged with naphthalene as to have a very buttery or cheese-like consistency. It is quite inefficient to provide the necessary lubrication for the working parts of the exhauster; and this has to be supplied by the addition of oil in more or less regular quantity. There is some trouble in finding a suitable oil for this purpose, as the majority do more harm than good, by throwing down pitchy matters from the tar. After many trials, I found a mixture of pure colza, tar oil, and naphtha the best for the purpose. The oil is fed in regularly by sight-feed lubricators, worked from a fixed head of water from a tank placed above the engine-room. Even then, however, the waste oil, which is very sluggish, has to be flushed out from the exhauster connections by warm liquor; and the exhausters require careful and regular cleaning at comparatively frequent intervals. Before the practice of taking off the tar came into vogue, exhausters would run for several years without opening, and with the use of very little oil.

It was found desirable this year to remove certain portions of the plant at the Bankside works of the South Metropolitan Gas Company. Its disposition was such that the foul-main from the retort-house ran through and past the engine-room to the condenser; thence back to the engine-room; and returned past the condenser to the washers. In order to continue gas-making, it was necessary to fix temporarily an exhauster; and the simplest way of doing this appeared to be to cut the foul-main at the engine-room, and interpose the exhauster, the outlet from which ran on to the condenser. This was done at the beginning of August, since when the exhauster has been at work drawing hot gas (at about 140° Fahr.), and forcing it through the condenser and following plant. Since it started, not a drop of oil has been used for lubrication; and the working parts, when the cover was removed a few days ago, were found to be perfectly free and clean, save for a coating of very thin fluid tar. That these parts worked with a minimum of friction, is also confirmed by the readings of the inlet and outlet thermometers, the latter of which has been only slightly the higher.

As far as the working of the exhauster is concerned, I think therefore that its best position is on the inlet of the condenser, instead of the outlet. But there are weightier reasons than this. I have in my mind a gas-works where the washers as well as condensers were on the inlet of the exhauster, and where sulphur purification was rendered impossible by the infiltration of air. At more than one London works, when difficulty with sulphur compounds arises, the first steps taken are to examine the plant for air-leakage between the exhausters and the retort-house. Speaking of another works where it was the custom—and a most desirable one—to stop on Sundays, one of our most eminent engineers told me that it was his duty as an assistant to put this part of the plant under pressure every Monday, so that drawn joints or other air-leaks could be at once detected. It is my own practice to do the same whenever any difficulties with illuminating power or sulphur arise.

But is it necessary to run this ever-recurring risk? Why have any part of the apparatus working at a pressure below that of the atmosphere when it works at least equally well, and all danger from air-leakage is obviated, if the exhauster is arranged to draw hot gas direct from the retort-house foul-main? It will, of course, be seen that exhausters either of larger capacity or run at a higher speed would be required. A cubic foot of gas at 70° Fahr. becomes $1\frac{1}{7}$ cubic feet at 140° Fahr. But this would be more than counterbalanced by the advantages set forth, to which may be added the increased rate at which the tar would be condensed by reason of the additional pressure to which it would be subjected.

Mention has been made earlier in the paper of the Sunday "stop," now almost universal in London. It has been urged as an objection to this that it necessitates the changing of so many valves, that it is more trouble than it is worth. This arises from a misunderstanding. A bye-pass governor fixed between the inlet and outlet of the exhauster, and weighted to give (say) $\frac{1}{2}$ inch of pressure on the retort-house, is all that is required; and the inlet of the exhauster is the only valve it is necessary to close. The only valid objection to the Sunday "stop," is in the disposal of "light" gas. But all trouble on this score is entirely obviated by the use of such enrichers as the Clark-Maxim, Kemp, Price, and others.

The concluding portion of this paper may be not unfitly appropriated by a few remarks upon condensing. As with exhausting, so too with condensing, taking off the tar has resulted in a considerable modification of the part played by the apparatus. At any rate, as regards Newcastle coal, the increased production of naphthalene is unfortunately connected with modern practice in the economical production of coal gas. Pending a much-

desired investigation into the circumstances of its formation in the retort, it behoves us to take all precautions that it does not become an unmitigated nuisance to our consumers. Hydraulic-main tar will, at a temperature of 130° Fahr., dissolve upwards of 70 per cent. of naphthalene. So that it will be seen what a powerful factor in removing this is eliminated by using liquor seals in the hydraulic mains. It is in the condenser, however, that the excess of naphthalene over and above what the gas will carry at normal temperatures should be removed. Indeed, were it not for this troublesome hydrocarbon, condensing might, perhaps, be dispensed with altogether. The fundamental difference between the serpentine or worm condenser and the vertical type (whether air or water cooled), is that in the one case the condensed fluids travel throughout the entire length; while in the other, each leg or each pair of legs is separately drained, and the products run straight away out of further contact with the gas. In both cases, naphthalene will be generally found in the outlet portions, and in larger quantities in the vertical than in the serpentine type, since the solvent tar is more frequently drawn off. In order to economically dissolve this naphthalene,

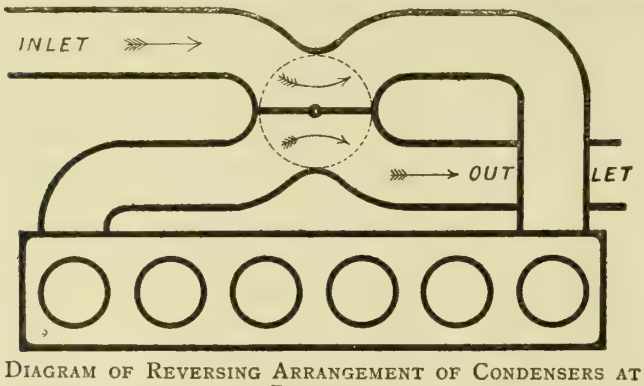


Diagram of Reversing Arrangement of Condensers at Bankside.

[The four-way valve, showing by dotted lines, on being turned one quarter round, making the diaphragm vertical, would reverse the current of gas through the condensers.]

I arranged one of the condensers at Vauxhall so as to be reversible. When the outlet became partly choked, it was made the inlet. The tarry vapours of the hot inlet gas dissolved the deposit, which was quickly run off through the seals. The arrangement has answered very well; and I had hoped to have an adaptation of it at work at Bankside sufficiently long to have laid before you some more exact data as to the quantity removed. The diagram shows the reversing arrangement, which is simply a four-way valve by which the condenser (in this case a vertical one) can be handled as described.

Before bringing to a conclusion this brief sketch, in which my object will be attained if I have laid the foundation of a good discussion, I should like to add one remark as to the practice of burying underground the various mains and pipes on a gas-

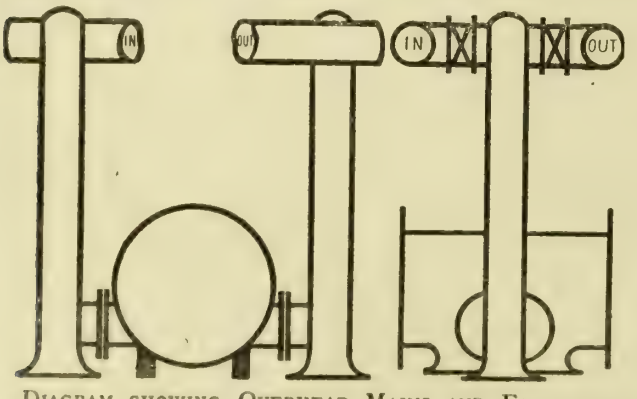


Diagram showing Overhead Mains and Exhauster Connections at Bankside.

works. Would they not be better overhead as much as possible, where they can be examined and cared for, instead of hidden out of the way? We should not treat steam-pipes in that way; why, then, gas-mains?

Discussion.

Mr. T. May (Richmond) said the paper was an interesting one; and it seemed to bear principally upon the question of naphthalene. Some time ago he found it practically necessary, in his works, to abolish the condenser; and he ran his exhausters at a somewhat similar temperature to that mentioned by Mr. Carpenter, with corresponding results. They had had no trouble from the sticking of the exhausters; and, as a matter of fact, his exhausters had not been opened for the past three or four years. As they were running all right, they left well alone. In his paper Mr. Carpenter seemed to recommend condensing as a new way of getting rid of naphthalene. This was a very important point. But he (Mr. May) could not say that they found the naphthalene trouble any greater from the fact that, to a large extent, they had done away with their condensing; and this was rather contradictory to Mr. Carpenter's experience. He supposed Mr. Carpenter had not had the arrangement in use long enough to say whether they felt any benefit in the district from its employment. That was where the trouble came, and there would be the crucial test, because they knew that the changes of temperature had so much to do with the deposition of naphthalene. During the short spell of cold weather a few weeks ago, they were bothered with it in his district; but, as soon as there was a change of temperature, the difficulty disappeared altogether. He endorsed what Mr. Carpenter had said as to a thorough investigation of this subject. If they could only induce someone to take up this naphthalene question, and settle something about it—how it was formed, and why—and introduce to gas managers some means of making gas without so much of it, they would be very pleased to support such an investigation; and no doubt gas companies would subscribe liberally towards the expense incurred in carrying it out. He would suggest to Mr. Carpenter that he would earn their gratitude by bringing about such an investigation. He might add that doing away with the condenser, in his case, had practically raised the illuminating power of the gas ¾ candle.

Mr. Helps said the paper was a very practical one; and, though short, it gave them a great amount of food for discussion. He should like to say a few words on the subject, inasmuch as last winter he made an experiment, which was partly prompted by talks he had had with Mr. Carpenter, and partly due to knowing what Mr. May was doing in this line. For some six or seven months, they entirely dispensed with the condenser at Croydon. This was not exactly what Mr. Carpenter was doing, as he simply altered the position of the condenser and exhauster—practically reversed them. Mr. Carpenter mentioned that one of the main reasons that led him to adopt this principle was the fact that he constantly had trouble with his exhauster. He (the speaker) could not say that they ever had difficulty with their exhauster. It never seemed to stick; and they never had deposits of anything solid or of a buttery consistency such as was referred to in the paper. He (Mr. Helps) used ordinary tar oil for the exhauster; and it ran very well. He must say this, as bearing out the concluding remarks of Mr. May, that they did their exhausting at 120°; and, passing the gas straight into the scrubbers, they obtained an increase in illuminating power of something like ½ to ¾ candle; and as it was only necessary to enrich to the extent of 1 candle at Croydon, it was a question whether they would not be able to do without enrichment altogether. However, they found very shortly that they were getting a serious increase of back-pressure in the scrubbers—especially the Kirkham, Hulett, and Chandler one. They tried warming the water. The difficulty then was that, instead of being able to extract the ammonia from the gas with 10 or 12 gallons of clean water, they had to go up to 20, 25, and even 30 gallons before the ammonia could be extracted. The consequence was that not only were they using a valuable commodity, water, but they were weakening the liquor to such an extent that their sulphate plant was scarcely capable of dealing with the amount of liquor produced. They had returned to the principle of putting on a condenser, and working in the usual way. He was much pleased with the latter part of Mr. Carpenter's paper, in which he suggested the reversal of the inlet and outlet of his condenser. Last year, at Croydon, they started a new retort-house and a new condenser; and they had had from time to time to throw it entirely out of use, simply because it got choked—principally at the cooler end—with pitchy tar and naphthalene. He thought he would try to get out plans for putting into practice some such idea as Mr. Carpenter had described, as it seemed to be a step in the right direction. In connection with the remark by Mr. May, that it would be a good thing if someone would take up the question of investigating this naphthalene bother, he should like to refer to a matter that had been before the gas world for some little time. They had, he thought, lost an opportunity of starting a body of some kind by whom such investigations could be carried out. There was—he might say almost there is—a small gas-works on the market that could be bought for a mere song. He hoped they would not think he was speaking personally in this matter; but, if such works could be taken up by a few men not as a commercial venture, but for scientific purposes, he was convinced that a great deal of good would result. He heartily wished someone would take this matter in hand.

Mr. D. Irving (Bristol) remarked that the difficulty Mr. Helps had mentioned with regard to the removal of the ammonia after he had done away with his condensers, was the very trouble that one might anticipate. One suggestion that he would venture to make for dealing with the difficulty of the condensers stopping up at the cool end, and one which had been adopted at the works under his care, was to carry a 2-inch pipe to the top of the condensers, and from that pipe run ¾-inch pipes into the first three or four legs of the condenser, and periodically pass a quantity of liquor through. This he found was quite efficient in keeping a set of condensers (which were previously a great trouble) perfectly clean, and in working order. The condensers were large in proportion to the work they had to do; and they previously had the difficulty Mr. Helps had explained, which necessitated, every now and then, that the condensers should be put out of action to clean them, in order to get the gas through. It was two years since the arrangement he had described was

adopted; and there had not been the slightest difficulty, although the condensers had been in continuous work.

Mr. A. F. Browne said he supposed the point was that the naphthalene must come down out of the gas. Hitherto, or until a comparatively recent period, the tar, having been allowed to flow with the gas, had absorbed the naphthalene, and carried it away to the seals; and there had been no further trouble so far as the removal of naphthalene was concerned. They were all wishful of getting rid of the tar at the earliest spot, or at the highest temperature, because it not only absorbed the naphthalene, but carried down with it the other hydrocarbon vapours they were so desirous of retaining in the gas. He believed it would be possible to assist the retention of the naphthalene vapours by enriching the gas while it was hot; but he was not prepared to say whether it would pay to do it. Undoubtedly, if they added a hydrocarbon vapour that had a high vapour tension to coal gas, it would assist in retaining those hydrocarbon vapours which existed in coal gas at a lower vapour tension. But the naphthalene, under present conditions, must come down. The point he did not quite see in Mr. Carpenter's paper was, how, in this reversible condenser, in which the temperature at the outlet was such that naphthalene was deposited in large quantities, he could have a sufficiently hot gas to dissolve the naphthalene out.

Mr. Carpenter: The gas at the inlet has the temperature of the foul main—138° to 140°.

Mr. Browne: And it is close to the retort-house?

Mr. Carpenter: Yes.

Mr. Browne: And you find at the outlet of the condenser that a large proportion of the naphthalene is deposited?

Mr. Carpenter: Yes.

Mr. Browne: We are not troubled with naphthalene until the gas has passed through, roughly speaking, 200 yards of condensing-main.

Mr. Carpenter: That would form the outlet of your condenser—after the gas had passed through that 200 yards of condensing-main.

Mr. Browne: I have no current of hot gas to reverse with.

Mr. Carpenter: You would have a current of hot gas when you reversed it.

Mr. Browne: How is your gas hot enough to enable you to reverse the current with effect? That is my point.

Mr. W. E. Price (Hampton) asked what was the average temperature at the outlet of the condenser. He found he did not get any trouble at the outlet, providing he maintained the temperature sufficiently high. This was with a sort of working half-way between the suggestion of no condenser and the ordinary method of using a condenser—all of it—without taking any notice of what the temperature might be. By carefully watching the temperatures, and keeping them at from 60° to 75° Fahr.—which meant more often in the winter time not using a condenser at all—he had no trouble in the way of blocking. There was one difficulty he should like to mention; and he should be pleased to know if Mr. Helps's experience was the same—whether, when not using his condenser, he found that, in passing the hot gas on towards the scrubbing and washing plant, his stock of ammoniacal liquor was raised to a temperature whereby he lost ammonia. When he (Mr. Price) was not using his condensers, he found that his ammoniacal liquor was increased to such a temperature that they could notice all about the works that ammonia was being given off by the liquor.

Mr. Botley said it had been remarked that it would be a good thing if someone would undertake an investigation with regard to the naphthalene question. At Hastings, they had been forced to make an investigation for themselves through the trouble it caused. It was a great many years since he had been engaged in finding a preventative for naphthalene on the works; and so far the result had been that the prevention of naphthalene on the works had been accomplished. But they still had the difficulty of naphthalene in the district. Naphthalene on the works could be prevented by keeping a liquor seal, instead of tar; by drawing the tar off quickly; and by condensing-mains. They had none in the works or in the condensers now. They used to have; but now they had it in the district, in spite of every precaution. They had a spell of cold weather in October—there was a sudden fall in the temperature; and they had over 1000 cases in one week to deal with. The result of his investigation had been this: That the trouble on the works was nothing compared with what it was out-of-doors, with complaints from consumers, and threats to adopt another source of light. He was going to treat the gas as it left the works, with the view of eliminating the naphthalene. His experiments had been in progress for a good time now; and from the results obtained in the preliminary experiments, he hoped to be able to accomplish the desired end. He might also mention that they were putting up carburetted water gas plant at Hastings; and it was his intention to introduce the carburetted water gas into the foul main. They would have the means of taking it direct away; but he intended to try the experiment of placing it in the foul main with the coal gas, because he was inclined to believe that there was a gain in illuminating power in this way. If some of the tar was taken up by the vapours of the water gas, they would get an increased enrichment. If anything could be done in this way he should be very glad. He might also state that his was a water condenser—not a vertical one. It was erected about eight years ago; and he never had any trouble whatever with it. In his experience with exhausters, he had had the same difficulty of getting an oil that was constant. But recently they had had a great deal of trouble, and had had to abandon the use of tar oil, and to use a lubricant something similar to that Mr. Carpenter had suggested. He certainly agreed with the author that the mains should not be hidden. At his works, if he could not put them overhead, he laid them in channels underground, so that they could be readily examined.

Mr. C. Gandon (Lower Sydenham) said the naphthalene difficulty was, he supposed, one that bothered and interested them all. He agreed with Mr. Botley that, as a rule, the difficulty was not so much on the works as in the district; and, therefore, he did not know that any different arrangement in the condensing plant would get over that part of it. He should be pleased if some member could suggest how they could get rid of the trouble in the district. As to putting the exhauster before the condenser, that was a very old idea. He could remember that even Mr. Beale, in his time, recommended placing the exhauster before the condenser. He recollected that, in the works he (Mr. Gandon) was then connected with, it was in that position; and it gave them a great deal of trouble. It was constantly getting choked up with sticky tar. At the same time, he thought that probably in many cases, they carried condensation to too great an extent. He endeavoured with their condensers to maintain the gas at somewhere about the normal temperature of the atmosphere; and he thought that was about the best thing one could do. If they kept the temperature too high, it interfered with the action of the purifiers; and if it was too cold, it did the same. He experienced no particular difficulty with deposits of naphthalene in or about the condensers or the purifiers. Where they did get deposits of naphthalene occasionally was in the inlets or outlets of the gasholders; but he did not know that the position of the exhauster would have anything to do with that. He should be very pleased if someone could point out the way in which they could deal with the terrible nuisance of naphthalene stoppages in consumers' pipes and services. It had been talked about a good many times; but he did not know that anything effectual had been proposed for it yet. A circular reached him a day or two previously from some people who said they had a perfect cure for this trouble, and that it had been used with the utmost success by the Crystal Palace District Gas Company. (Laughter.) All he could say was he had a keg of the stuff in the laboratory; but they had never used it. They tested it, and found it was chloride of calcium. However, he intended to try it.

Mr. Robert Morton (London) said he rose for the purpose of making two suggestions. The first was that Mr. Botley (who was proposing to treat his gas, before he sent it out, for the elimination of naphthalene) should rather try to treat it so that he carried the naphthalene forward to the burners.

Mr. Botley: I intended to say retain the naphthalene in the gas or prevent its deposition.

Mr. Morton thought that Mr. Botley had made a mistake. In an investigation as to the cause of the deposition of naphthalene by a very eminent chemist, it was found that, if the gas was properly dried or desiccated, naphthalene would not become deposited. There must be moisture in the gas before the naphthalene could be deposited. There was the drawback that, to properly dry the gas, and so cause the naphthalene to go forward to the burners, they would require in big works very large apparatus. The other suggestion he had to make was that, if anyone had difficulty with his exhauster, or wished to carry more of the illuminating constituents of the gas forward to the gasholder, he should try the system which Mr. Carpenter had adopted at the Bankside Gas-Works of putting the exhauster on the hydraulic main; and he would advise anyone doing this to adopt a bye-pass arrangement. At one large works of which he (Mr. Morton) had charge some years ago, they had a make of from 4 to 5 million cubic feet per day; and the exhauster there was on the hydraulic main; and the condenser was a large vertical one, in two sections. They were so troubled with naphthalene that they were obliged to work only one-half of the condenser, and shut the other half off in order to clean it; and as soon as the latter was ready, it was time to turn the gas into it, and clean the other half. Condensing under pressure would throw down naphthalene; and Mr. Carpenter's arrangement of turning the hot gas into the outlet of the condenser was absolutely necessary if the work was to be carried on with anything like comfort.

The President observed that, like many others who used Newcastle coal, he certainly knew something about naphthalene. In regard to condensation, they had at Southampton foul mains in all the retort-houses; and during the recent "snap" of cold weather, they entirely condensed their gas in the retort-house, and completely shut off the outdoor horizontal plant. Their exhausters were all on the outlets of the condensers. The primary tar was taken off at the bottom of the hydraulic mains; and this system had been working for some years, and had been improved upon gradually. Notwithstanding the foul mains in the retort-houses, they still had their horizontal condensers out-of-doors choked with tarry naphthalene; and as he did not possess a reversing-valve to work the inlet and outlet, the condensers were sectionized. Thus he was able to use one or two or half a condenser, or shut one off altogether. They removed the plates

at the ends of the pipes, and, putting a disc in, they drew the stuff out by means of a chain or sometimes a crab; and then it would work again for a long time. They found the deposition was at the cool ends of the pipes, where it became thick. They had occasionally to attend to the inlets and outlets of the gas-holders, and clean them out by plunging or some other simple means. In certain districts, they were much more troubled with naphthalene outside the works than they were in others. His experience was on all-fours with that of previous speakers. During the recent cold weather, they had a great number of complaints not only of service-pipes being choked, but mains in different portions of the district; and in some parts, they knew pretty well where to go and look for stoppages at certain times of the year. But this season, he had had stoppages in mains where he never expected to find them. He was speaking to a professional colleague not long since, and asked him whether he found any naphthalene out-doors; and he replied "hardly any." He did not, however, know the reason, unless it was that his mains were laid almost entirely in chalk soil. In his (the President's) own district, the soil was gravel, clay, and at places sandy stuff; and according to the nature of the soil did he find the deposition of naphthalene. He supposed that pipes laid in chalky soil were much drier; and therefore any moisture there was in the gas would not have so much influence in causing the deposition of naphthalene.

Mr. Carpenter, in replying upon the discussion, said he should much rather have preferred reading a paper on how to prevent the formation of naphthalene in the retorts. But he was unable to do that; and the one they had been discussing was the next best thing he could manage. It was very evident that gas at the temperature of the hydraulic main must contain considerably more naphthalene (which was extremely volatile at ordinary temperatures) than it could carry at normal temperatures; and, as soon as the temperature fell, it was certain the naphthalene must come down somewhere. As long as they carbonized coal in the way they now did, naphthalene would be produced in the retorts. Whether it was possible to control the temperature at the latter part of the distillation, at which the greater part of the naphthalene was formed, he was not sure; but if anything was done, he believed it would be in this direction—that they would prevent the formation of naphthalene at the latter part of the charge. There was another point touched on by Mr. May. That was the question of naphthalene in the district. Well, he (Mr. Carpenter) would say they had better have naphthalene in the works than in the district. If they had it on the works, they only upset themselves. By maintaining the temperatures, they would have no deposition on the works; but they would have it in the district. Mr. Helps had related his experience of shutting off a condenser. There was a gain in the illuminating power of the gas; but the scrubbers became blocked up. This blocking up was due to the cause he had mentioned—that was, the temperature being reduced, the gas had more naphthalene than it could conveniently carry; and it was deposited in the scrubber instead of the condenser. It seemed to him (Mr. Carpenter) that the best place to part with it was in the condenser, because they could take it out better from there than from the scrubber. Mr. Irving had spoken of the loss of ammonia. That, of course, was a difficulty so long as pure water was used for taking up the final trace of ammonia. In those works where sulphate was made, there was a system of using diluted sulphuric acid to take up the last trace. Mr. Irving stated that he flushed out the condensers with liquor; and he (Mr. Carpenter) had to do the same thing. But his objection to flushing out condensers with liquor was this, that the liquor made streams in the naphthalene through which the gas passed, instead of getting the benefit of the whole area of the pipe. At any rate, that was his (the speaker's) experience. As to Mr. Browne's remarks about enriching hot gas, Mr. Foulis, of Glasgow, had found precisely the advantage in enriching with water gas—quite apart from the making of carburetted water gas—that Mr. Browne had suggested. Mr. Price had spoken of the temperature at the outlet of the condenser. If it was kept high, they would not have trouble with naphthalene; but if it was kept down to something like normal temperature—say, 60°, or perhaps below—they would get it. But they had better have it in the condenser than in the service-pipes. Mr. Botley had referred to the prevention of naphthalene on the works. He (Mr. Carpenter) should like to ask him how he had prevented it.

Mr. Botley: By drawing off the tar; and by arranging the condenser as you have described.

Mr. Carpenter: You have just as much in the district as ever?

Mr. Botley: Yes.

Mr. Carpenter (proceeding) said there was one other point which had not been touched upon, although he endeavoured to lay some stress on it in the paper—that was the question of drawing in air when they did not want it. He was visiting a large works some time ago where they found it absolutely impossible to purify from sulphur compounds, because they drew in so much air, simply through leaks in their washers and condensers. They drew in so much that all the sulphuretted hydrogen got burnt up in the first instance. This was the reason why plant of any kind under vacuum should be done away with. If air was wanted, let it be drawn in where, and in the quantity, required; but they ought not to do it in the indiscriminate manner which would often be the case with plant under vacuum. Mr. Gandon had spoken of the difficulty with naphthalene in the district. There, too, it seemed to him (Mr. Carpenter) it was a question of temperature as much as anything else; and if steps were taken to reduce the temperature at the works, he would get the naphthalene deposited there. But his paper was not exactly one upon naphthalene; it was on "Gas Exhausting and Condensing." As had happened in so many cases, however, it seemed to him they had gone off at a tangent. He was pleased to hear the remark Mr. Botley made in reference to burying mains. It would be a good thing if more of the mains were put where they could be seen, instead of burying them underground, where no one knew what happened to them.

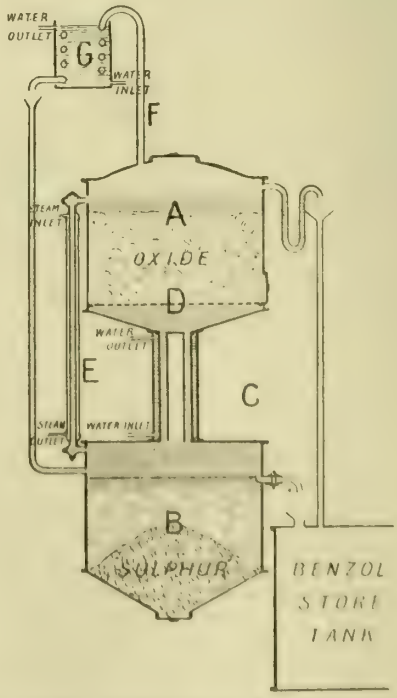
Mr. R. P. Thomas (Ware) asked to be allowed to add a little of his experience to the discussion. He was in charge of a small works, where, in his time, they had increased the consumption of gas from 5 millions to nearly 13 millions. He had had difficulty with naphthalene, principally in cold weather. He had 400 consumers; but during the last severe weather, he received only two complaints. He had 130 public lamps; and some of these had been stopped time after time. The remedy he had adopted was naphtha. He had had a tee introduced, with a simple ½-inch plug, in the rising pipe. Now when the difficulty arose, he had only to take out the plug, and pour in a ¼-pint of naphtha; and by the time they wished to light up, they found the lamp clear.

Mr. A. E. Broadberry (Tottenham) read the next paper upon

CLEANSING SPENT OXIDE.

It is with a considerable amount of diffidence that the author places before the Association the results of some small-scale experiments made at Tottenham, with a model apparatus which, though designed for use in another branch of commerce, is believed to be applicable to gas-works for the extraction of sulphur from spent oxide, leaving the material in good condition for re-use. The diffidence is real; and it arises from the slight practical value generally and properly attaching to experiments of this class. Indeed, this paper would not have appeared at all, had it not been understood that there would be no other paper forthcoming for this meeting. It had been hoped that the results of working with an apparatus dealing with a ton at a time would have been available; and on the strength of this, a promise of a paper had been made. But, unfortunately, the machine was not ready in time; so that it became a question of either breaking the promise made to our esteemed Secretary, or compelling you gentlemen to listen to an essay on possibilities instead of a record of accomplished facts. The former alternative could not be entertained.

The subject, however, is one of sufficient importance to the industry with which this Association is identified, to render it desirable that the opportunity should not be lost of making the members acquainted with the system; and it will perhaps be something in extenuation that the apparatus used (which was kindly lent by the inventors) is on a somewhat larger scale than is generally employed in the laboratory. As the oxide was in no way prepared, but was treated in its normal condition, it may be relied on that the results could be reproduced on any larger scale.



To facilitate the description of the apparatus, the accompanying sectional drawing has been prepared, showing its arrangement. Its simplicity is at once apparent. The upper, or oxide, vessel A is connected to the lower, or sulphur, vessel B by the water-jacketed pipe C, with the filter or strainer D above it to prevent particles of oxide from passing down. A further connection between the two vessels is made by the steam-jacketed

pipe E. The ventilating-pipe F is attached to a water-cooled condenser G; the condensation being returned to the apparatus. It will be noticed that, except for the stopcocks for steam, water, &c., and the doors for charging and discharging, there is an entire absence of cocks, valves, or working parts to be manipulated—in fact, the process of working is as simple as the apparatus itself.

The oxide to be treated is placed in the upper chamber—the lower one being about half filled with water; and then benzol, or other similar solvent, is put in up to about the overflow, entirely covering the oxide. To set the apparatus in operation, all that has to be done is to pass a small current of steam into the steam-jacket, and a flow of cold water through the water-jacket and through the condenser. The heat communicated to the solvent in the pipe E, induces an upward flow, and discharges it on to the top of the oxide in a heated condition—that is to say, at about 70° to 80° C. The return flow of the solvent is through the cooling-pipe C, which has its central portion occupied by a cylinder, the better to expose the solvent to the cooling surface; and this deprives it of its heat, returning it to the lower chamber at about (say) 25° C. The circulation thus produced continues automatically, so long as the steam and cold water are supplied to their respective places.

Benzol at its temperature of 70° to 80° C. in the upper chamber, will dissolve 2½ to 2¾ lbs. of sulphur per gallon; but when cooled to 25° C on its return to the lower one, it will only retain ¼ lb. per gallon. It therefore follows that for every gallon circulating, while there is plenty of sulphur in the oxide on which it can act, over 2 lbs. of sulphur are extracted from the oxide and deposited in the water at the bottom of the sulphur vessel. It will be seen that the principle of action is the different absorption of sulphur by the solvent at varying temperatures. Having filled the apparatus with spent oxide, water, and solvent, and turned on the steam and water, the apparatus may be left to itself until the extraction has ceased, when the benzol is drawn off and the oxide thoroughly steamed, to distil and recover the benzol with which it is saturated.

For the following calculations, the quantity of oxide treated was 20 lbs., and its percentage analysis before cleansing was—

Water	11·2
Sulphur	54·0
Purifying material	34·8

Or, calculated on the dry basis—

Sulphur	60·8
Purifying material	39·2

The total weight of sulphur in the 20 lbs. operated on is therefore calculated to have been 10·8 lbs., of which over 10 lbs. were extracted by the process.

The following is a test of the oxide after treatment:—

Water	40·8
Sulphur	5·6
Purifying material	53·6

Or, calculated on the dry basis—

Sulphur	9·5
Purifying materials	90·5

The water used in the water-jacket and condenser was run into a tank, and accurately measured. To ascertain the quantity of steam used, a condenser was placed on the steam-outlet; and the condensation gave the amount of steam employed. The time occupied was 7½ hours, during which, except for noting the statistics necessary for this paper, no attention was required. The solvent used was benzol, carefully measured before and after the experiment; the loss being just 1 per cent.

Having described the apparatus and the method of working, it has now to be seen what commercial figures can be deduced therefrom. The value of one ton of spent oxide, 54 per cent. sulphur, at 2d. per ton per unit, would be 9s., less 6d. for loading, or 8s. 6d. net. The cost and revenue of applying this method to one ton is estimated in the following statement. The figures based on the working of the small machine are believed to be excessive on the Dr. side for one of larger dimensions.

Dr.	£	s.	d.	*Cr.*	Cwt.	qrs.	lbs.		£	s.	d.
Spent oxide, 1 ton	0	8	6	10	0	16		sulphur at £2 15s.	1	7	11
Water, 2016 gallons	0	1	6	13	3	19	50	p. ct. purifying material at 30s.	1	0	10
Steam, 303 gallons water evaporated at 1d. per 10	0	2	6								
Benzol, 1 p. ct. on 400 gals.	0	4	0								
Labour (estimated)	0	6	0								
Profit	1	6	3								
Total	£2	8	9	Total					£2	8	9

The advantage to be gained may therefore be taken to be 26s. 3d. per ton of spent oxide.

It may possibly be urged that, with the limited quantity of oxide in use in most gas-works, the extra trouble makes "the game not worth the candle." In these days of sliding-scales, however, with the attendant desire to reduce the price and incidentally increase the dividend, not only must every item of expenditure be watched, but the merest possibility of improved working, however small, must receive its fair share of attention, if it will appreciably affect the cost per 1000 cubic feet. If then the calculation be made in this direction, it will be found that, estimating that one ton of oxide is used for every 2 million cubic feet of gas made, giving 28 cwt. of spent material, the saving would represent 0·22d. per 1000 cubic feet.

Attempts have previously been made for commercially extracting sulphur from spent oxide; the carbon bisulphide process being perhaps scientifically the most perfect. At the same time, practically it is highly dangerous; and probably no gas engineer would admit it on his works. The existence of carbon bisulphide in the gas is not sufficiently welcome to him to lead him to seek a further acquaintance. But with benzol and similar oils, he is already well acquainted in the enrichment of gas; and even should the vapours escape, they have a familiar odour, and do not cause that distress to the human system which carbon bisulphide does. On the other hand, should any be left in the oxide after the cleansing, it would merely tend to improve the candle powerof the gas. [Samples of the cleansed oxide, and also of the extracted sulphur, were placed on the table for inspection by the members.]

In concluding this paper, a few words of protest will not be out of place against a custom ruling in the oxide market. It is well known that quotations usually contain a clause providing that any percentage of water in excess of 50 per cent. will be deducted from the invoice—meaning, apparently, that one-half of the weight charged for is to be purifying material, or an allowance will be made accordingly. Let it be assumed, then, that a delivery comes in containing 60 per cent. of water. An allowance would be made of 10 per cent., which, at first glance, appears fair and satisfactory. But it is the solid matter, not the water, that it is desired to buy; and 60 per cent. water means 40 per cent. instead of 50 per cent. of oxide—four-fifths, or 80 per cent. The reduction should consequently be at the rate of 20 per cent.

It is obviously to the advantage of the sellers to make the moisture as high as possible; and it is rarely found that they fail to do so. When a reduction is claimed, and they allow it, they pocket an equal amount themselves; or, in other words, allow only one-half of what they should. Besides this, there are doubtless many cases in which the moisture is not tested, and no claim made; and then the sellers have all, instead of half, of what should belong entirely to the buyer.

Taking the extreme case shows the folly of it, so let us assume that 100 tons of oxide are ordered, and the seller pumps 100 tons of water, pure and simple, into a barge and delivers it. The invoice would be made out as follows:—

To oxide of iron	100 tons.
Less excess of water 50 per cent.	50 ,,
	50 tons at 30s., £75.

That is, £75 for 100 tons of water, and not a particle of oxide. It seems stupid; but it plainly illustrates the fact. One would naturally complain under such circumstances; but all the satisfaction one would get would be the reply: "We admit your point; but it is the custom of the trade, so we regret we can do nothing in the matter."

At Tottenham, for some years, attempts have been made, with varying success, to break the custom. Combined action by all the members of this Association would no doubt put an end to the iniquity.

Discussion.

Mr. C. C. Carpenter said the subject dealt with in the paper was one in which they were all interested; and, for himself, he cordially agreed with what Mr. Broadberry had said—that, in these days of cheap gas (that was what he meant when he spoke of the sliding-scale), they could not afford to neglect anything that would enable them to work more economically. With reference to this method of recovering sulphur from the spent oxide, it seemed to him that it was a novel one; and he could not conceive an apparatus better calculated to carry out the object Mr. Broadberry had in view. As he truly said, the method of using carbon bisulphide had long been known; but he gave a cogent reason why they should not have more carbon bisulphide on the works than they themselves produced. He (Mr. Carpenter) could not conceive a better material than the one suggested in the paper for recovering the sulphur; but at the present stage, it would be a little bit difficult to attach a definite commercial value to these operations. He noticed Mr. Broadberry said that, estimating that one ton of oxide was used for every 2 million cubic feet of gas made, giving 28 cwt. of spent oxide, the saving would represent 0·22d. per 1000 cubic feet. To use a ton of oxide for 2 million cubic feet of gas was rather large. He did not know whether Mr. Broadberry was estimating that the purification was done by oxide of iron only. He (Mr. Carpenter) thought that he must be, because otherwise he would not require a ton of oxide to purify 2 million cubic feet of gas. With reference to the last portion of the paper, the difficulty with the amount of water in his (what he supposed was) bog oxide was one they had all experienced. There was a simple way out of that, which was to use, not bog oxide, but pure oxide of iron. They could purchase this for 28s. or 30s. per ton; and they could put with it as much bog as they liked to suit their particular tastes and the pressure it was desired to work with in the boxes. They had used this material very largely in the South Metropolitan Gas-Works; and certainly he very much preferred it to bog oxide. He thought one reason was that the stuff was in an extreme state of fine division; and it had not the disadvantage that bog oxide had of being mixed with clay. It seemed to him they could get far more nearly the theoretical value out of this oxide than they could out of the bog oxide.

That was his experience. They could work it in their catch vessels; and the layers of these came out perfectly hard and caked. Then, when the material got fairly charged with sulphur, instead of rejecting the whole parcel, they could add (say) 5 or 10 per cent. of powdered oxide of iron again; and the material was as fresh as ever. This was a very important advantage in the use of finely powdered oxide of iron.

Mr. Botley said that to those who used oxide, and were far removed from any place of disposing of it, the system described would undoubtedly be an advantage if it was practicable. Fortunately there were other things to be considered in spent oxide besides sulphur. There were the cyanides. At Hastings, they had lately been able to dispose of a large parcel of spent oxide on account of the cyanides it contained; and they obtained for it double the price that Mr. Broadberry estimated the value of the sulphur at.

Mr. Gandon remarked that Mr. Carpenter had referred to pure oxide of iron.

Mr. Carpenter: I should have said precipitated oxide of iron.

Mr. Gandon said that Mr. Carpenter put the price at about 30s. per ton. He thought perhaps he was going to speak of Weldon mud or manganese. He should be glad to know where Mr. Carpenter obtained pure oxide at the price named; and how much moisture it contained.

Mr. Norton H. Humphrys (Salisbury) said he had just bought a consignment of natural oxide of iron from Gloucestershire. It contained 90 per cent. of pure oxide, 2 or 3 per cent. of water, and the rest earthy matter. It ran considerably over 90 per cent. of pure oxide—90 to 95 per cent.

Mr. May inquired if this invention was a patented one, and would there be any royalty to pay? In the estimate in the paper, there was nothing for royalty, or interest on the outlay, for the apparatus.

Mr. Broadberry, replying on the discussion, remarked that Mr. Carpenter had spoken of the figures deduced from the experimental apparatus as being of little value. That he admitted in the paper; and, as he had said, it was simply for the sake of placing the system before the members that he had prepared the paper. He also mentioned that he had been disappointed in not having had the results of experience of the working of the full-sized apparatus to include in the paper. As to the quantity of oxide used—a ton for 2 million cubic feet of gas—that, of course, referred to gas-works using oxide entirely for purification. Mr. Botley mentioned the cyanides as increasing the selling value of the spent oxide. Of course, everybody knew that oxide of iron contained a large proportion of cyanides, which increased the value of the spent oxide. The apparatus was patented; but he was unable to give any figures as to the price or royalties. He had no doubt the royalties would be included in the price of the apparatus. The inventors were now working out a scheme for extracting the cyanides from the spent oxide. At the same time, he believed it would leave a small portion of lime in it; but he was not acquainted with the system yet. Regarding the last portion of the paper, as to the custom of allowing only practically half the cost of the moisture that was generally in the oxide, he would add that no doubt this constituted a portion of the "living profit" of the sellers. He admitted they were entitled to a fair profit; but he did not think this was a just way of making it. It would be better to increase the price, and so obtain a fair profit. There was a slight connection between this point and the paper, as credit for the renewed oxide might then be taken at a higher figure.

Mr. Child moved, and Mr. Price seconded, a hearty vote of thanks to Messrs. Carpenter and Broadberry for the papers they had contributed.

The motion was passed, and suitably acknowledged.

The Proposed Amalgamation of the Southern and South-West Associations.

The President said the next business was to consider a letter received from the Hon. Secretary of the South-West District Association of Gas Managers (Mr. Norton H. Humphrys), respecting a proposal for amalgamation with their Association. He did not think he could say much upon this matter himself. There might, however, be both advantages and disadvantages in the amalgamation.

The Hon. Secretary said that some few months ago, he received a letter from Mr. Humphrys, enclosing a circular which he was sending out to the members of the South-West Association, calling a meeting to be held in September, and announcing that Mr. J. Lowe would propose that a Committee should be appointed to meet a Committee of the Southern Association to arrange terms of amalgamation. After the meeting of the South-West Association, Mr. Humphrys forwarded to him the resolution which was then passed. It was: "That this Association approves of the proposal for amalgamation with the Southern Association, and that the President, Mr. Irving, and the Hon. Secretary be appointed to meet a Committee of the Southern Association to confer on the matter, and, if desirable, arrange terms." He (Mr. Helps) brought the letters before their own Committee; and after the question had been carefully discussed, it was proposed by Mr. Carpenter, and seconded by Mr. May—"That the matter be laid before the members at the next meeting in November, with the recommendation that, if they thought it advisable, a Committee should be appointed to meet the South-West District Association to discuss the proposed scheme, and to report at the following general meeting." This was the recommendation of the Committee; and it was for the members to consider it, and to come to some conclusion as to whether or not it would be advisable to do anything in the matter. A good deal might be said on both sides. There was the question of papers; but if there was a difficulty in this respect in the two Associations, in his opinion that difficulty would not be decreased by amalgamation. Again, the South-West Association covered a great deal of ground; and the members of it were widely scattered. The Southern Association, however, could not entertain the idea of altering their rules as to the holding of their business meetings in London. Most of their members were situated in or round about London; and they always had a fair attendance at the meetings. Certainly, there were other little matters which would have to be smoothed over. For instance, the Southern Association only admitted gas managers and gas engineers, or men who were both managers and secretaries. On the other hand, the South-West Association admitted secretaries pure and simple.

Mr. F. G. Dexter (Winchester), the Ex-President of the South-West Association, said that that body had been placed in much the same difficulty as he knew, as a member, the Southern Association had been, in securing a thoroughly representative attendance and suitable papers on all occasions. Mr. Helps had expressed the opinion that, if the two Associations were amalgamated, it would not reduce the difficulty of providing suitable papers. He (the speaker) thought that Mr. Helps was mistaken, because there would be twice the number of members available to produce papers, and consequently half the difficulty. Looking through the lists of members, it would be found that the most active men in the South-West Association were already members of the Southern Association. Regarding the places of meeting, the Southern Association might perhaps consider it a hardship to be called upon to go from their particular district to works, for instance, in the neighbourhood of Winchester, or (say) farther afield than that in the south-west district; but quite recently they had taken themselves right away to Southampton, which was strictly south-west ground. Therefore, he did not know that they ought to advance that objection, having taken advantage of the ground of the other Association so recently. Works farther west than that—say, Exeter—would not be a much greater journey for members to take from London. The members of The Gas Institute went greater distances even than that; and so what might appear to be a difficulty now, would not really be so if regarded in the right spirit. He also spoke of the expense incurred in being a member of the two Associations, and pointed out that, under the present conditions of things, there were reasons for which he wished to be associated with the Southern Association, and others for which he desired to be a member of the South-West Association. He was not so well acquainted with the working of the Southern Association as he was with that of the South-West body; but he believed it had leaked out that, on more than one occasion, there had been a difficulty in arranging a suitable place for the meetings of this Association. It therefore stood to reason that, if the two Associations were amalgamated, there would only be half the number of meetings to arrange for; and consequently less difficulty.

The President pointed out that the two business meetings of the Southern Association were always held in London; and the holiday meetings wherever they might select.

Mr. Chapman said he had been connected with the Southern Association from the beginning; and he was the original Secretary. He felt that this question was a difficult one, and that it required a good deal of consideration before taking any definite step. There was one point which did not seem to strike some of the members, and that was that it was questionable whether, if an Association of this sort was made too large, it would be of so much benefit to members as two smaller Associations. If they made themselves into a kind of Gas Institute or Institution of Gas Engineers, would they not, he asked, be doing away with a great deal of the profit that they gained from the smaller meetings? He agreed with Mr. Dexter that it was an important point to get sufficient papers for the meetings; but it must be remembered that the Southern Association obtained a great deal of strength from the London contingent that belonged to them, in the way of papers. He was quite sure this Association must never drop one rule which was adopted when they started, and which had been the cause of their prosperity. Holding their business meetings in London would, he thought, be a difficulty for the members of the South-West Association; and it would cut off the connection of a great many of the members of that body from any Association. He felt that it was a *sine qua non* that the business meetings of the Southern Association should continue to be held in London; and therefore a great many of the men who had been in the habit of attending the south-western meetings would be excluded from taking part in all such gatherings. Regarding the point as to expense, it would, he said, be impossible for many of them to come to London on that account. Then it was a question whether the Hon. Secretary could carry on the work of a larger body, and whether it would not be necessary to have a paid Secretary. Mr. Dexter had alluded to their meeting at Southampton. But that was the town in which their President lived; and they

generally visited the President for the year on the occasion of their holiday meeting.

Mr. Irving (who is a member of both Associations) mentioned, as supplementing the remarks made by Mr. Dexter, that, in the south-west, they had found some difficulty in continuing the Association. He had not the least hesitation in making that confession, after the remarks they had heard as to the difficulties of carrying on the Southern Association.

The Hon. Secretary (intervening) said that was rather a wrong impression. There had been no difficulty—at all events since he had been Secretary; and, as to papers, this year had been the first in which he had had anything that could be called a difficulty in that respect.

Mr. Irving (continuing) said that as to papers, which were the real life of the Associations, he candidly admitted that they had had great trouble in the South-West Association; and it was such that it was incumbent upon those who had the best interests of the Association at heart to consider what should be done. He thought it would be well to appoint a Committee to discuss the question. The members of the South-West Association did not, so far as he knew, ask, or expect, anything unreasonable; and the members of the Southern Association, he was sure, would be courteous and reasonable with their arrangements. By conferring together, they could go into details more than they could hope to do that day; and they might then be able to arrive at an agreement which would be acceptable to both Associations.

Mr. Price observed that Mr. Helps had made a remark as to some of the South-West members not being eligible for the Southern Association.

Mr. Irving said he did not think Mr. Helps had made any reference to members not being eligible, but he mentioned a difference in the rules. He did not think there was any particular member who was not fully qualified for the Southern Association.

Mr. Price (proceeding) said the point he had in his mind was the rule of the South-West Association that gentlemen who were only secretaries were eligible for membership; but they would not be so for the Southern Association. Of course, if there was one member who was a secretary pure and simple, that would be a serious difficulty in accepting the South-West Association *en bloc;* and therefore, in his opinion, it would be better to accept them singly.

Mr. W. H. H. Broadberry (Tottenham), as one of the original members of the Southern Association, said it had been very successful up to the present; and he did not see what they were to gain by an amalgamation with the South-West Association. But if it was the wish of the majority of the members, he would not oppose it. If there were secretaries in the South-West Association, he did not see that there would be much difficulty in accepting those who were at present members, with the understanding that they took no others. He did not think they should make any hard and fast line on that point. He suggested that perhaps it would be better for any members of the South-West Association who wished to join the Southern Association to do so, and allow their own Association to die a natural death. He would propose that the matter be left to a Committee to investigate, and report at the next meeting.

Mr. Botley, who stated that he believed he was the first member to join the Southern Association, said he should not like to see any abrogation of the rules that had been laid down for the conduct of the Association. There were many estimable members of the South-West Association that he liked to see at all times; but indiscriminate admission of members should not be allowed. He would second Mr. Broadberry's proposition.

The motion having been agreed to, the President, the Hon. Secretary, and Mr. Chapman were appointed the Committee to deal with the subject.

The Incandescent Gas Lighting of Winchester.

The Hon. Secretary said that Mr. Dexter would make a short statement as to the adoption of incandescent gas-burners for lighting the streets of Winchester.

Mr. Dexter said that, as the members of the Association were all no doubt aware, they were now actively engaged in changing the lighting of the streets at Winchester. They commenced making the alteration from oil to incandescent gas lighting on the 1st of November, when about one-third of the entire number of lights were changed in one evening; and they produced an excellent impression. On Nov. 5, they had about half of the lights in the city on the incandescent system; and if any of the members were passing in his direction during the next two or three weeks, it would be a good time to see the transition from oil to incandescent gas lighting. Even the powerful Bray lights in the refuge lamps looked quite dismal among the rows of incandescent lamps stretching down the streets at different angles. The public and the press all approved of the change. As to the behaviour of the lights in windy weather, he was glad to say that his undertaking to the Corporation, when the alterations were first made, that they would have no difficulty in maintaining the lights without failure—without being blown out, or made to duck in any way—had been fully fulfilled. On Nov. 5, they had extremely severe weather in Winchester. House roofs were stripped in many places; and a great deal of damage was done by wind and rain. A similar night also occurred on the previous Saturday (the 9th). But, on each of these occasions, not one of the incandescent burners was blown out by wind, and they all remained perfectly steady; whereas there were a great number of the oil-lamps out. This contrast had done more than anything else in showing that the city would be well repaid in making the change.

This concluded the business proceedings; and tea was then served to the members.

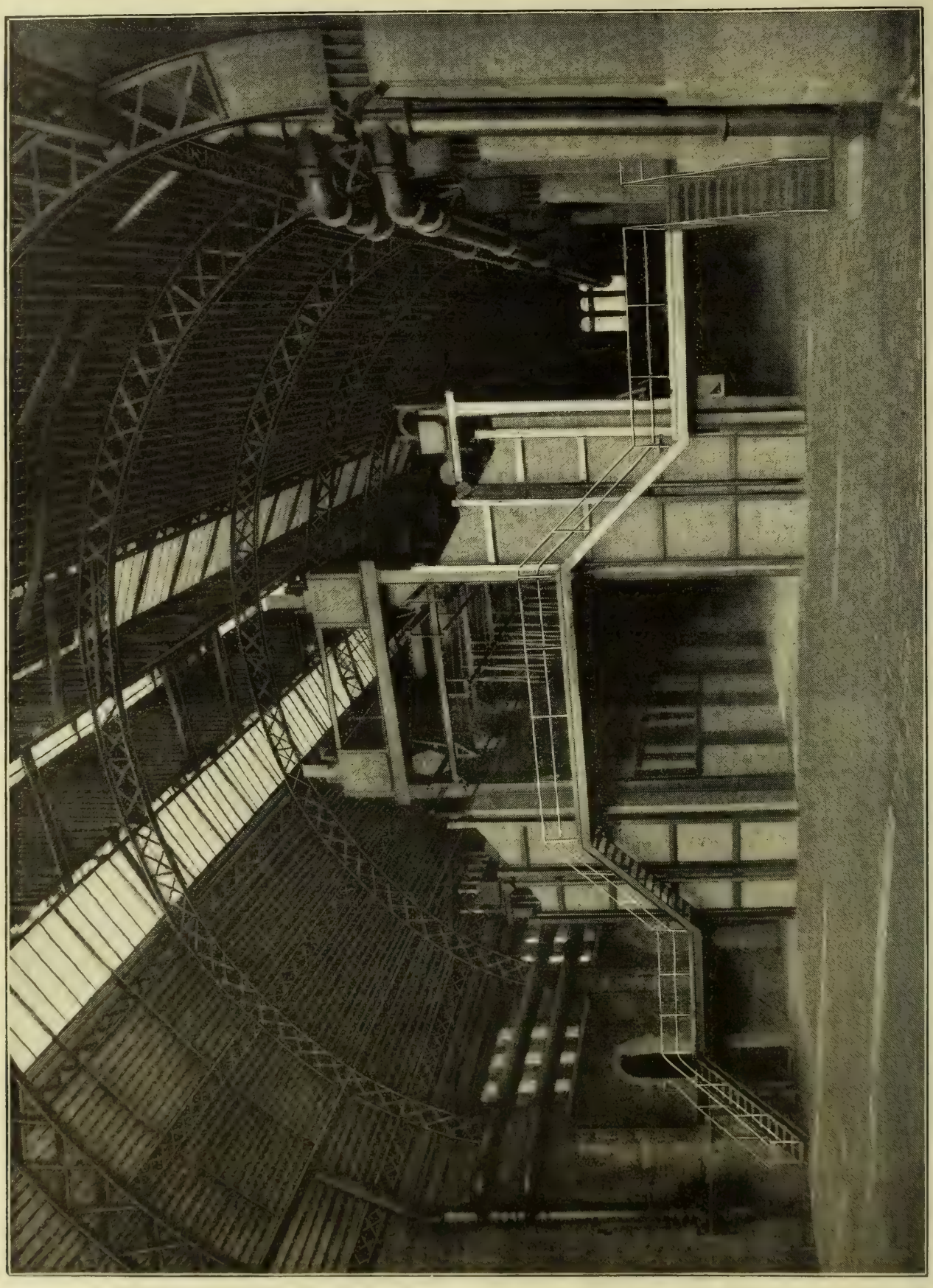
AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting in Philadelphia.

The Twenty-third Annual Meeting of the above Association was held on the 16th, 17th, and 18th ult., under the presidency of Mr. Walton Clark.

After some routine business had been disposed of, the President delivered his Inaugural Address. With a brief introduction, he directed attention to their Association. A voluntary association, he said, was what the members made it; and if it fell short of the standard set by its founders and desired by its friends, they need not look beyond the rules, or the energy with which they were carried out, for the cause. He felt that the present efficiency of the Association fell far short of the standard set out for it; and he proceeded to discuss its conditions, and to offer some suggestions for its improvement. While the Association was to be congratulated on the papers presented at the meetings, the discussions were feeble. With a membership of about 400, he noticed that the last three years' proceedings included only 81 speakers; and of these only 34 had taken as many as three subjects. Only 8 per cent. of the members spoke as often as once a year. He believed there were two causes for this. The first was the lack of opportunity for a previous study of the paper read; and the second was hurry. Some attempt had been made in the way of issuing papers in advance; but he believed great difficulty was experienced in getting writers to send in their communications in time. He suggested that the present *Quarterly* should be abolished; and that the Secretary should print and issue every paper as soon as it had been received and approved—discussion being confined to papers that had been issued at least two weeks previously to the date of meeting. In place of the *Quarterly*, he would publish an annual report of the proceedings, as soon as possible after each meeting. The present rule seemed to be that all the papers must be read, whether discussed or not; but one paper well discussed was of more value than many without discussion. There should also be a systematic investigation of processes and apparatus; but the Association was not ready for this till it had a larger revenue, and could retain the exclusive services of its Secretary. The Association was doing nothing to help those who were struggling to qualify themselves for positions of responsibility, while at present filling subordinate situations in gas-works. The work of the London Guild was admirable, though scarcely sufficient to meet the case; but the Association could easily, and at a small cost, do something in this way. He recommended a Standing Committee on Education, to prepare a list of questions, which might be published with the proceedings, and prizes of books offered for the best answers. The Association should include all elements of strength in its membership, and exclude all others. The present rule was not a sufficient protection, as any man holding one of several described positions was eligible, even if unfit otherwise; and no man, however competent, could be admitted unless he held the position. Her ecommended an amendment making membership dependent upon ability and record, and not on present official position. Speaking upon federation, he offered no arguments for or against it; but he thought that the Association might secure all the benefits obtainable by federation, without the uncertainty that must follow any radical change in organization. At present, it commanded the experience and ability of the whole country; and all that was wanted was to devise and operate the necessary system. He proposed the appointment of Special Committees on Standards and on Research. The latter should be a standing one, and might have power to offer bi-annually the prize of a life membership and a decoration for the most valuable contribution based on original research. It was said that the Association was stagnating; and there was already some talk about founding another on broader lines. But while it could not be disrupted from without, it could not afford to ignore the fact that many of the strongest members were dissatisfied, and held aloof. The proper course would be to make the membership so valuable that no ambitious American gas man would be content without it.

The first paper taken was by Mr. W. H. Rogers, of Paterson (N.J.), entitled "The Creation of a Healthy Public Sentiment towards the Gas Company in the District in which it Operates." He defined a healthy sentiment as a belief that the company were honest, impartial, fair and square in their dealings, mindful of the rights of others, not wanting the big end of everything all the time, and not unreasonable or tyrannical. The public should be convinced that the gas company were as worthy of faith and confidence as any other honest dealer. Assuming that the working was in the condition usual in any modern gas-works, he enlarged on the importance of courtesy to all customers. He



RETORT-HOUSE AT THE HUDDERSFIELD GAS-WORKS.

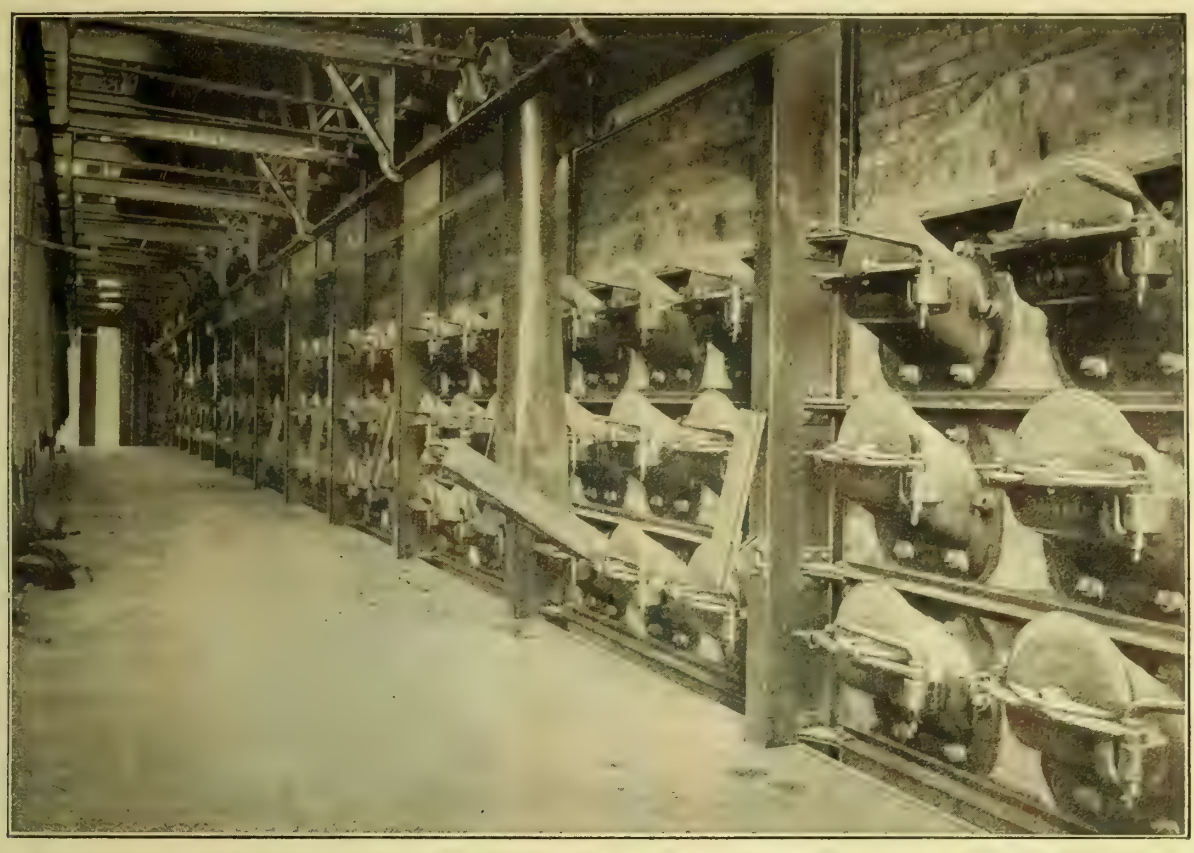
(*For Description, see p.* 1019.)

advocated getting business by fair means only, and the avoidance of adverse criticism on other competing forms of lighting. If electric meters were doubtful, and oil-lamps dangerous, the public would find it out without help. A mistake, if made, should be promptly acknowledged, corrected, and avoided in future. Discontented consumers, and the best ways of meeting their complaints, were next considered at some length; and the whole matter was summed up in the conclusion that, although gas companies have neither souls nor bodies, they are dependent for permanent success upon the same rules that govern the conduct of creatures possessing those attributes.

Discussion having been invited, Mr. M'Millin quoted some incidents from his experience, illustrating the necessity of maintaining cordial relations with the consumers. Gas companies should make just rules, and adhere rigidly to them. Mr. Greenhough supported the author in insisting on every effort to promote healthy public sentiment. In the larger cities, the official meter inspector was useful for deciding registration disputes. Some plan of municipal profit-sharing would prove the best antidote to the now common movement towards municipal ownership. Mr. Searle believed kind and considerate treatment would prove more conducive to the best interests of the concern than any system of profit-sharing. Mr. Somerville always thought it the best policy to do all he could to promote the interest and secure the satisfaction of his customers; and he believed that the steady growth of their business, in face of competition, was due to the fact that gas companies generally treated their customers with consideration and politeness. Mr. M'Millin agreed that it was often an advantage to give the city a bonus, or some share of the profits, as a consideration for granting the franchise; and he also advocated profit-sharing for the workmen. At Columbus, a dividend was paid to the employees on their wages, at the same percentage as that declared on the capital. It was not paid in cash, but in

SETTINGS OF INCLINED RETORTS AT THE HUDDERSFIELD GAS-WORKS.

(*For Description, see p.* 1019.)



stock, until the employee had acquired £60 worth of stock. Mr. Greenhough said that at Cleveland it had been suggested that there should be a payment of a percentage on the gas receipts to the city, and not a fixed sum. Mr. Norris saw no reason why the municipality had a right to gas profits any more than they had to those of any other trades. If the profits exceeded a fair percentage, the consumer and not the city should get the benefit; and there should be a reduction in price. Mr. Forstall remarked that the gas company were different from other manufacturers, because they received a franchise, for which some return might be claimed. Mr. Harbison preferred to give dividends to workmen in the form of increase of wages. He did not favour any scheme for sharing profits with the municipality, because gas consumers and taxpayers were not necessarily one and the same. The large proportion of local taxes paid by the gas company was a sufficient consideration for the grant of the franchise.

Mr. A. E. Forstall, of Newark (N.J.), read a paper on "Retort-House Design and Practice." He advocated making the retort-house large enough to admit of the use of machinery, and the provision of movable shutters, which could be opened or closed according to the direction of the wind. Openings in the roof near the eaves were objected to as likely to drive the smoke downwards. The possibility of extension at a future time should not be overlooked; and the arches should be wide—say, 10 ft. 6 in. clear for beds of nine, or 8 feet clear for beds of six. Wide furnaces prevented the fire from burning too low; and roomy combustion chambers were a *sine quâ non* for well-distributed high heats. The retorts should be of a size to enable the charge giving the desired yield to fill the retort as full

as was consistent with convenient drawing and charging. Large retorts run at low heats often gave more trouble with soot and naphthalene than the same retorts at higher heats with heavier charges; and, of course, regenerator firing would be employed. Stand-pipes should be at least 7 inches in diameter, and carefully laid out, so that the curves, where necessary, should be as easy as possible. The hydraulic mains should be large, and so arranged that the heavy tar could be easily removed while in operation, with adjustable overflow and a bottom outlet to each bench, and cross partitions so as to give each bench its own water-level. The furnaces should be air-tight, with the exception of the proper inlets—all cracks, &c., being carefully filled; and while any quantity of hot coke could be put in at one time, small charges of cold coke were the rule, leaving sufficient hot surface exposed to ensure the ignition of the carbonic oxide as soon as the air came in contact with it. If this was neglected, it was possible that the setting might be charged with an explosive mixture when the heats were low—as at first starting. The proper conditions for regular working could be tested by throwing a handful of coal dust in at the open door. If the damper was properly adjusted, the flame would waver lazily; neither being drawn steadily by the draught, nor flaming out vigorously from excess of pressure. A slight pressure in the furnace was best for economy of fuel; but, as a rule, good heats could not be maintained unless the pressure was cut down to zero. There should not be a decided pull on the furnace, except when getting up the heat without regard to consumption of fuel; and the heat should be adjusted by regulation of the primary air supply —the secondary air supply being proportioned to the production of carbonic oxide. The blue flame which indicates the presence of unconsumed carbonic oxide, should be quite absent at the outlet to the flue; and the secondary air-slides should be adjusted to secure this result. As the production of carbonic oxide varied according to the conditions of the fuel-bed, &c., from time to time, an exact adjustment for every hour in the day could not be maintained. Given a sufficient recuperative surface, the appearance of any heat above a dark red in the recuperators, below the point of entrance of the secondary air, was an almost certain indication of an insufficient secondary air supply, even though no flame could be seen. Arrangements should be made for properly clamping the air-slides, so that they could not be moved by accident; and their proper adjustment was a matter which should not be left to the average stoker or foreman. Not only must the fuel-bed be a good depth, but this depth must be uniform; and this could not be obtained without careful stoking back when the coke was drawn in, and by pushing to the back immediately before the draw. The better plan was to get the coke well banked up at the back before the draw, as the fireman was not then hampered by the presence of the shute or the falling coke. The work of clinkering the furnace, cleaning flues, &c., was next described in detail; and also the arrangements for drawing and charging the retorts, and cleaning stopped pipes, as adopted by the author at his own works. A specimen ruled sheet, to be filled up by the retort-house foreman, giving every detail of the work done during 24 hours, was exhibited. Every charge should be weighed, if possible; but frequently this was inconvenient; and it was necessary to be satisfied with recording the number of barrow-loads of coal used. A gang of three men was expected to work 27 retorts—three beds of nines—including attention to the furnaces, cleaning stopped pipes, &c. The average weight of coal per charge was 3 cwt.; so each man handled nearly four tons of coal per day. The retorts were cleaned by the natural draught through the stand-pipe; carbon tiles being laid to carry the air to the back of the retort, and the front being blocked up. The tar was run off from the hydraulics twice a day, and replaced with liquor; and this was attended to by a "topman," who also undertook scurfing retorts and other odd jobs. Every man was allowed a regular day off per week. There was a lengthy appendix to the paper, giving full working details of the construction of the various retort-house tools referred to.

Mr. G. T. Thompson commenced the discussion by describing the retort-house at the Shoreham Harbour works, near Brighton (England), as an example of good ventilation. He proceeded to speak in favour of shallow seals, and hydraulics well away from the top of the retort-stack. He suggested that 100 lbs. of coal to the scoop was rather light weight. Some discussion followed as to the policy of giving the men one day's rest in seven; and Mr. Forstall then briefly replied.

The Committee on the President's Address here presented their report, which was of a more important nature than usual, and embodied several innovations. They recommended that the *Quarterly* be abolished; that papers should be published to the members as soon as received and approved by the President and Secretary; that only papers so published at least two weeks previous to reading should be discussed; that an annual volume of Proceedings should be published; and "that the Council be authorized to include in the volume the proceedings of other Associations, if they deem proper, and can obtain from such Associations compensation therefor." They also advised the appointment of a Standing Committee on Education and a Committee on Standards, and the amendment of members' qualification, as suggested in the address. A supplemental report recommended that the Committee on Education should also be empowered to deal with research, and the offer of a prize for papers on research or invention. The Committee should not have power to deal with the funds of the Association for prizes; but would be open to receive special donations. These reports were adopted without discussion; and the President announced that a Past-President had offered the following sums for the prize fund: £20 for 1896; £40 for 1897; and £60 for 1898.

Mr. A. C. Humphreys, of New York, then read his paper on "The Commercial Value of Photometry."

(To be continued.)

THE COMMERCIAL VALUE OF PHOTOMETRY.

(Continued from p. 977.)

Let us see how this action of the eye comes in, when comparing the effect from two (hypothetical) arc lamps, one naked and the other enclosed in a translucent globe. Referring to fig. 1 [reproduced], let us suppose the small unlettered circle to

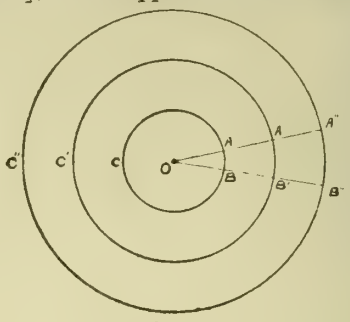


Fig. 1.

represent a light-source 1 inch in diameter and of 1000-candle power. This light-source will, at its surface, give an illuminating intensity equal to that of 576,000 candles at 1 foot distance, or 576,000 foot-candles. Now suppose the light enclosed in the globe A B C, 2 feet in diameter, and suppose the luminous intensity to be just sufficiently increased to compensate for the absorption by the globe. Now we shall have at the surface of the globe an intensity of illumination of 1000 foot-candles. Therefore the candle power and the illuminating intensity at any point are not altered. But how different must be the illuminating effect if the eye is permitted to receive the direct rays, as must almost necessarily be the case in general illumination? In one case, the eye receives direct rays from a light-source producing an illuminating intensity at its surface of 576,000 foot-candles; while in the second case, with equal illumination, the eye is only subjected to the direct rays from a light-source producing an illuminating intensity of 1000 foot-candles at its surface, for we may now consider the globe as the light-source. Or, expressing it differently, with equal intensities of illumination, with the naked light the eye must receive the direct rays from a source which has only 1-576th of the projected area of the shaded light.

Suppose that, when putting on the globe, we do not increase the luminous intensity, and say the globe absorbs 40 per cent. of the light; then the light will be 600-candle power, and only give 600 foot-candles at its surface. This will present to the eye a still greater contrast as to the direct rays; and we may readily believe that for general illumination, with the eye taking in all the surroundings, and therefore necessarily exposed to the direct rays, the shaded light of even reduced candle power will produce the pleasanter, and therefore the better, effect. If, however, it becomes necessary to examine any object closely and continuously, we shall find that, by shielding our eyes from the direct rays, and waiting until the eye has recovered from excess of excitation, that the naked light of 1000-candle power serves us better than the shaded light of 600-candle power.

Of course, in addition to the direct effect upon the eye, the larger light-source has the positive advantage of sending its converging rays in behind objects making shadows—producing a softer effect, and also again relieving the eye from sharp contrasts of intensity of illumination.

Even supposing we can correctly imitate the colour of sunlight, any source of artificial illumination, subdivide and distribute it as we may, must of necessity give imperfect results, if only on account of its lack of uniformity of intensity, through the operation of the law of the inverse squares. To take an extreme and hypothetical case to better impress this point, let us suppose we have two light-sources, an inch in diameter, and placed 400 feet apart, the intensity of illumination to be measured along the horizontal upon a vertical screen. We will compare the combined illuminating effect with that of 25-candle power light-sources of the same size, set 100 feet apart. A few selected combined intensities of illumination, expressed in foot-candles are given in the following table.

Cohn, an authority on hygiene, states that the illumination produced by daylight on a well-exposed table is equal to 4·6 foot-candles; and that the minimum required for reading and writing without undue fatigue is about 1 foot-candle. Wybauw gives as the minimum required for reading about 1 foot-candle; but for fluent reading, he says 1·4 to 2·3 foot-candles is required. And he gives as the minimum for street lighting 0·09 foot-candle. Professor Morton gives as the intensity of illumination at the back of a room, 20 feet from the

	1000 C. P. Lights, 400 Feet Apart.	25 C. P. Lights, 100 Feet Apart.
At the surface of the lamp	576,000·0060 ..	14,400·00250
1 foot from centre of lights	1000·0060+..	25·00255
10 feet " " "	10·0065 ..	0·25300
20 " " " "	2·5069 ..	0·06640
50 " " " " (midway between 25-candle power lights) . .	0·4081 ..	0·02000
100 feet from centre (surface of second 25-candle power lamp)	0·1110 ..	14,400·00250
200 feet from centre (midway for 1000-candle power lights)	0·0500 ..	14,400·00250
Carried over from one lamp to the next	0·0060 ..	0·00250
Mean intensity	256·0000 ..	186·00000
Mean intensity, omitting from the calculation the intensity within sphere 1 foot radius—say, "reduced mean intensity"	10·7500 ..	1·00+

window, with buildings opposite, from 1·75 to 2·25 foot-candles. The range for daylight, he states, will be very great; but the figures given are sufficient for easy reading.

By reference to the preceding table, we see that, if we could obtain from artificial light-sources a uniform intensity of illumination equal to the reduced mean intensity even of the 25-candle power lights 100 feet apart, we could have our streets illuminated sufficiently for reading. With the true mean, we should be flooded with light. Of course, in practice, the lights would be placed above the plane of the surface to be illuminated; and this would tend to make the intensity of illumination more uniform. But I purposely selected this case as showing the full effect of the law of distances.

In this connection, reference may be made to Professor Anthony's paper, "The Sub-division and Distribution of Artificial Sources of Illumination." Referring to the lighting of villages and suburban places by arc lights, he says: "A little spot 50 or 100 feet in diameter under each lamp is brilliantly lighted, while the more distant points are in darkness all the more profound from the loss of sensitiveness of the eye when in the strong light." Mr. Upton, in the course of the discussion upon the paper, said of the illumination of a building at the Louisville Exposition, it was possible "to illuminate a large exhibition building, so that it looked brilliantly lighted, with a very low grade of absolute illumination, because there was *no one spot which your eye looked at which made the rest look dark.*"

In all this we are reminded that a weaker light-source, more efficiently distributed, and reflected with a view to uniform distribution over the plane of the surface to be illuminated, and in connection with more efficient diffusing surfaces, may give a final result much superior to that obtained from a stronger light-source improperly applied. This difference in favour of the weaker light is sometimes found as the result of accident. This should not be noted as an argument that the photometrically weaker light-source is in practice the stronger, but rather we should take the lesson that the stronger light might be made to give proportionately better results.

In our crude observations, we often deceive ourselves by crediting one of the light-sources compared with too great a candle power. With many, the tendency seems to be to at once doubt the accuracy of the photometer and everything connected with it. The photometer and its governing laws are not to blame if it is used improperly, and partial statements accepted as if they were complete.

See how this applies to the arc light, with its so-called 1000 and 2000 candle power. Professor Anthony says there is no 450-watt lamp in use which will give 2000 candles *in the direction of greatest intensity*, or which will give 500 candles when surrounded by a plain globe, and measured for general illumination. On good 450-watt long arc lamps, he never obtained but one measurement out of thousands made as high as 2000 candles. Mr. Pike, in the discussion of Professor Anthony's paper, stated that 1200-candle power lamps in every case ran below 450-candle power when measured spherically. Apart from the error introduced into our estimates by crediting too high a candle power to the arc, the variation in intensity with the direction is a most disturbing element in our rough calculations, for the reasons already referred to.

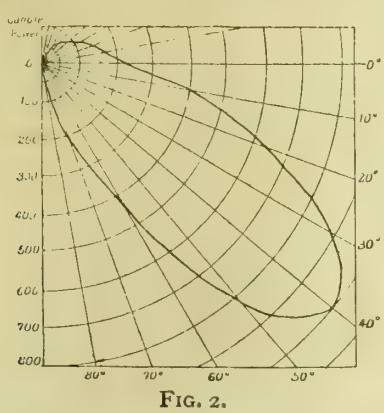


FIG. 2.

Fig. 2 shows the variation in the intensity of illumination from an arc lamp with the inclination, and is taken from the work of Professor Palaz. The diagram gives the result of all the photometric measurements made on continuous-current lamps at the Antwerp Exposition.

But the intensity of illumination also varies with the azimuth—that is, in any given plane, as we move around the lamp with it as a centre, its illuminating intensity will vary. Hence, to correctly state the value of an arc lamp, we must state it in mean spherical intensity. If we do not desire to illuminate above the lamp-plane, the efficiency can be increased by a proper system of reflectors. But the light, as a source, should be considered with regard to its mean spherical intensity.

The actual spherical distribution can be made to more uniformly conform to the mean spherical distribution by the simple addition of a translucent globe. Professor Palaz shows that while 15 to 60 per cent. of the total light may be so absorbed, the distribution is quite changed. He says: "The opalescent globe which surrounds the arc does not absorb the light uniformly. The luminous intensity of the parts of the globe which correspond to the maximum intensity is sensibly decreased, while that part which corresponds to the minimum is increased. The globe itself becomes luminous, and plays the part of a radiant."

Incandescent electric lights and flat-flame gas-burners also give considerable differences in spherical intensity; and Argand burners give different intensities for different angles of inclination. All these lights, when enclosed in translucent globes, also give a more uniform spherical distribution. Great stress is often laid upon the fact that a light, when enclosed in a translucent globe, furnishes a better result, and especially has "a greater diffusive power." Part of the explanation of this effect has already been attempted; and in this modification in the variations of intensity is found a further explanation.

In my paper of 1887, I detailed graphically and by tables the results of a long series of experiments on flat-flame burners; the candle power being taken horizontally for each degree between the edge of the flame and 90° (the flat of the flame), and for many different qualities of water gas; the variations being made by mixing carburetted and uncarburetted water gas in varying proportions. The most general practice at that time was to take the mean between the maximum (flat) reading and the minimum (edge) reading as the candle power. By the diagram showing my results was obtained the angle at which the burner would have to be placed to give a candle power equal to the mean of the maximum and minimum. This angle was found to vary, for the different gases, between 1·5° and 10·25°; and the mean of all the readings was 4·68°. A fairer method in each case would be to take the mean of all readings instead of the mean of the maximum and minimum.

In connection with these experiments, it is to be noted that the difference in readings between the flat and edge as a rule increased with the increase in the candle power of the gas; indicating a falling off in the transparency of the flames with the increase in density. Mineral-oil flames show still more strongly this absorption of light during its passage through its own flame; and this becomes very evident when testing large burners made up of a number of concentric rings.

Professor Mayer, in his paper "On the Illuminating Power of Flat Petroleum Flames in Various Azimuths," gives the results of his experiments with two types of petroleum burners—one the Hitchcock chimneyless air-blast lamp, and the other the ordinary lamp with chimney. With the Hitchcock lamp, the candle power from the edge of the flame was found to be 37 per cent. less than that from the flat; and with the ordinary lamp, the difference was found to be 38 per cent.

As bearing upon the question of the modification of spherical intensity by the use of globes, &c., Professor Mayer found that even a clear glass chimney had an effect. He says: "The flame of the Hitchcock lamp and the flame of the ordinary petroleum lamp with chimney increase in candle power with the azimuth in different rates. The reason for this is that the glass chimney acts as a reflector, and tends to equalize the illumination in different azimuths." Mr. Dibdin, in his "Practical Photometry," goes fully into the difference between the candle power of burners determined horizontally and spherically; and he shows his results by a number of diagrams.

Another source of error in our "practical" comparisons is in failing to keep in mind the (perhaps necessarily) arbitrary conditions imposed as to the standard burners to be employed in determining "candle power." If the standard burner gives a result not in accordance with the burners under observation, then to that extent are we astray in our premisses. This difference is sometimes in favour of, and sometimes against, the gas as ordinarily consumed.

Sheard's and Hinman's experiments show that a certain percentage of carbon dioxide will reduce the illuminating power of gas consumed in a flat-flame burner to a greater extent than if burned in an Argand burner. Here, then, two gases of equal candle power would give unequal illuminating effects if burned commercially in flat flames.

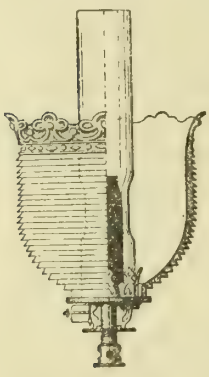
This lack of agreement is not due to any fault in the photometer, but to our arbitrary selection of a standard burner. The effect of carbon dioxide is less depreciating in the case of higher-power gas; and this difference between the candle power and the practical result would be eliminated, as the higher candle-power gases (in America, at least) are tested by the same burner most generally used by the consumer—viz., the flat flame.

(*To be continued.*)

THE FREDUREAU SYSTEM OF LIGHT-DIFFUSING GLOBES.

A desirable appanage for incandescent gas-burners is being introduced into the English and Colonial markets by Messrs. A. & E. Cohen, of Bury Street, St. Mary Axe, who are agents for the proprietors, the Société Anonyme des Globes Diffuseurs, Paris. These are a patented make of light-diffusing lamp-globes, or glasses, known in France by the name of the *système Frédureau*, These globes are manufactured of moulded glass, with a smooth inner surface, with the outside formed into concentric rings of prismatic section; the idea being to reproduce, in a cheap and suitable form for use with incandescent lights, the essential features of the dioptric lighthouse lenses of Fresnel. The angles of the prisms have to be carefully worked out with a view to the attainment of the object aimed at, which is to divert as many as possible of the upward and outward radiating rays of light from the source, and throw them downwards. If a transverse section of one of these moulded rings is examined, it will be seen that the upper side forms a segment of a paraboloid, the lower side being a plane. All these paraboloids are concentric with the globe; this centre being the focus of light. The effect of the addition of a glass so moulded to an incandescent gas-light is unmistakable. There is a notable increase of lighting effect in the region underneath the light, while much of the glare of an unscreened burner of the kind is removed. By a modification of the system, the globes can be adapted to act as projectors of light in a particular direction, for special purposes.

It will occur to our readers that this Frédureau system of globe moulding is somewhat similar to the holophane system already described in the JOURNAL (see Vol. LXV., p. 793). There is, however, this difference between the systems, that whereas the holophane globes are moulded with prismatic rings inside and out, the Frédureau globes are prismatic only on the outside. They are thus like a half of a holophane globe; and, of course, those who are interested in them aver that in this instance the half is better than the whole, inasmuch as the Frédureau system has the effect of bringing more light to bear in the desired direction. It does not, however, have the unique effect of the holophane system in so perfectly breaking up the rays of the light-source as to render direct vision of the latter impossible, and so exhibiting the phenomenon of a globe filled with light.



So far as the actual useful effect of the Frédureau system is in question, a report by Professor Silvanus P. Thompson ought to be regarded as satisfactorily establishing the point. He has made a series of photometrical tests of a 16-candle power incandescent electric lamp fitted with an upper hemispherical metallic reflector and a Frédureau diffusing globe. His report contains the following passage:—

The lamp used was nominally of 16 candles; but, as is well known, incandescent lamps rated at 16 candles emit very various amounts of light in different directions, owing to the shape of the filament, and, when hung in the usual manner, usually emit much less light in the downward direction from the end of the lamp than they do in sideway directions. In the following table, the direction downward was taken as zero:—

Angle at which Light was Measured.	Amount of Light with Naked Lamp.	Amount of Light with Reflector only.	Amount of Light with Reflector and Diffusing Globe.
Deg.	Candles.	Candles.	Candles.
0	8·00	17·50	34·00
10	8·50	17·50	24·00
20	9·25	18·75	22·00
25	10·25	15·20	16·25
30	11·50	15·00	12·00

From this table it will be seen that the lamp, nominally of 16 candle power, was giving only 8 candles in the downward direction until provided with the diffusing globe and reflector; but when so provided, it gave a light downwards of 34 candles—being an increase of more than fourfold in the desired direction. This increase was, of course, obtained by utilizing rays that would otherwise be wasted by being emitted upwards, or in directions where they would produce little result.

It could have been wished that Professor Thompson had left out the upper metallic reflector altogether, and measured the useful effect of the diffusing globe without this appliance, which, it is hardly necessary to observe, has no proper place in the system, and is never employed where a general pleasing lighting is desired. It is impossible to accept without this qualification the statement that the downward lighting effect was increased "more than fourfold." All the same, the diffusing globes alone, as we have witnessed, do increase the lighting effect in the downward direction, and are therefore calculated to be useful in cases where this is desired. The system is applied in several shapes to incandescent gas-burners; the foregoing illustration showing one of the most ornamental patterns.

MODIFIED FORMS OF APPARATUS FOR GAS ANALYSIS.

Translated from the "Berichte" by G. E. Brown, A.I.C.

In a paper communicated to the German Chemical Society, Herr O. Bleier describes some original modifications of existing gas analysis apparatus, by means of which automatic measurement of easily and difficultly soluble gases can be effected. If the measuring-tube of a gas burette holds exactly 100 c.c., the simple passage of a gas through it is sufficient to measure off 100 c.c., as is done in Winkler's burette. By the use of this form of apparatus in preference to that, the measuring-tube of which holds more than 100 c.c., not only are much time and trouble saved, but a small error of observation is avoided in measuring the gas. Such gas burettes, with automatic measurement of the gas, can also be employed with water as the trapping liquid, even in the case of easily soluble gases. Following out this idea, the author has adapted Orsat's apparatus and Bunte's gas burette, and has also constructed a gas burette allowing the use of absorption pipettes after the well-known Hempel pattern.

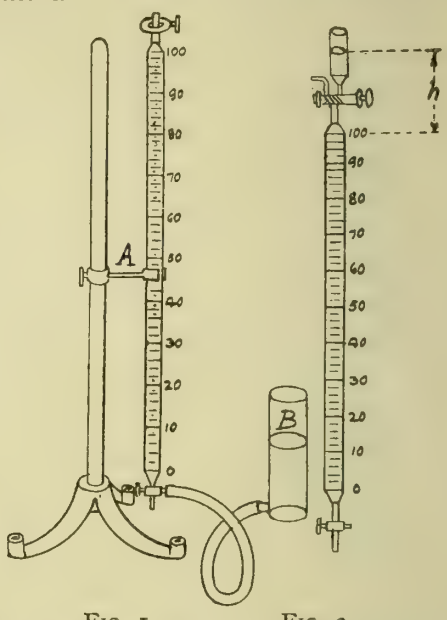


FIG. 1. FIG. 2.

The latter (fig. 1) consists of a measuring-tube A, which is affixed to an iron stand and a levelling-vessel B, connected to the measuring-tube by means of an india-rubber tube 110 cm. in length. The upper end of the measuring-tube terminates in a capillary tube (as in the Hempel burette), over which a piece of tubing is slipped, which can be closed by a pinch-cock. The lower extremity is provided with a three-way tap, through which communication can be made either with the capillary nozzle of the tap or with the levelling-vessel. The measuring-tube holds, from the plug of the glass tap to the end of the capillary tube, exactly 100 c.c., and is divided into $\frac{1}{5}$ c.c. The zero point of the graduation is at the lower end of the tube. The nozzle of the tap is made capillary in order that the water with which the tube is filled may take from two to three minutes to run out. Such a slowly sinking level of water carries with it most of the liquid adhering to the sides of the tube, so that a subsequent accumulation of the latter cannot take place. The bores of the three-way tap are not made capillary. The levelling-vessel holds about 150 c.c. It is made in any convenient form.

Manipulation of the Burette.—First turn the three-way tap so as to connect the measuring-tube with the levelling-vessel, which is filled with water, and, by raising the latter, fill the measuring-tube with water. Now turn the cock so as to connect the measuring-tube with the outlet-tube, and connect the tube carrying the pinch-cock with the reservoir holding the gas to be analyzed. If the pinch-cock be now opened, the gas will enter the tube, while the displaced water escapes below from the outlet-tube into a beaker. When all the water has been thus expelled, close the pinch-cock, and then the three-way tap. The short time which elapses between the closing of the pinch-cock and the three-way tap is sufficient to relieve any excess of pressure in the tube. Easily soluble gases must be allowed to pass through the tube for a few seconds after the water has been expelled, until the water adhering to the sides of the latter is saturated with the gas. From three to four seconds should be allowed for gaseous mixtures containing carbon dioxide, chlorine, or sulphuretted hydrogen; from eight to ten seconds for those containing sulphur dioxide, or gases of similar solubility; and from twenty to thirty seconds for those containing hydrochloric acid or ammonia. Annoyance from escaping gases can be avoided by allowing the end of the outlet-tube to dip into the water in the beaker standing under it.

Herr Bleier has introduced a very neat modification of Bunte's burette, by means of which easily or difficultly soluble gases can be automatically measured. The apparatus resembles Bunte's instrument in the main, and consists of a measuring-tube to which a glass cup is attached. The measuring-tube is closed at its upper

end by the two-way tap, proposed by Greiner and Friedrichs, and at its lower end by a single tap provided with a nozzle for the escape of water. This nozzle is made of fine capillary tube, so that the water takes from two to three minutes to run out. The space between the two taps measures from 100·7 to 101·0 c.c., and is divided into cubic centimetres and $\frac{1}{5}$ c.c. The 100 c.c. graduation is placed at the upper end of the tube; and above it the tube is contracted to a capillary. If the measuring-tube is filled with a gas under atmospheric pressure, and if, by turning the two-way cock, communication is made with the glass cup containing water up to a certain mark, then the gas in the measuring-tube will be compressed by the pressure of the column of water, the height of which is so arranged that a volume of exactly 100 c.c. shall result. The necessary quantity of water enters the measuring-tube, and runs down below the zero point of the graduation; so that for the tube to hold above its zero point exactly 100 c.c. of gas, which stands at the pressure under which all measurements are taken in the apparatus now under discussion—viz., under the pressure of the atmosphere *plus* that of the column *h* (fig. 2) of water—*h* must be so arranged that the pressure due to it exactly reduces the volume of the gas from 100·7 or 101 to 100 c.c. The exact value of *h* is determined empirically by the maker of each burette as follows: The water in the measuring-tube is allowed to escape, so that the latter is filled with air at atmospheric pressure. The lower tap is then closed, while the two-way tap is opened so as to connect the measuring-tube with the glass cup. Water is then poured into this cup until the level of the water which enters the measuring-tube coincides with the zero graduation. The level of the water in it is then scratched upon the glass cup; and in all subsequent measurements the water in the cup must stand at this level.

Manipulation of the Burette.—The gaseous mixture to be examined is allowed to displace the water from the measuring-tube, and then stream through the latter as explained when describing the first burette. The upper, and afterwards the lower, tap is then closed while the gas is passing through; and the glass cup is filled with the first absorption reagent to be employed. The two-way cock is turned so that the reagent slowly enters the measuring-tube. The liquid enters, first by reason of its pressure, and then in consequence of the reduction of pressure produced in the tube through absorption. The tube is well shaken until absorption is complete; the gas washed with a little water; and the volume read off. In order to absorb the next constituent of the gaseous mixture, place its absorption reagent in the cup, and, by opening first the lower and then the upper tap, allow the first reagent to escape from below while the second enters from above. Shake again; read off the volume; and so on. The first reagent may be sucked out before the second is allowed to enter, if the operator is satisfied that both taps close absolutely air-tight.

By this modification of Bunte's burette, analyses may be executed with great ease and speed, and with corresponding accuracy. Numerous analyses have been made by the author in both the burettes described. Since analyses of difficultly soluble gases are made commonly enough in such burettes some results obtained with easily soluble gases will, no doubt, be of interest. Analyses of an artificial mixture of air and hydrochloric acid gas are therefore subjoined (water being used as the absorption reagent):—

Experiment.

(1)	Analysis	25·8 per cent. HCl.		(4)	Analysis	25·6 per cent. HCl.	
(2)	,,	25·6	,, ,,	(5)	,,	25·6	,, ,,
(3)	,,	25·7	,, ,,	(6)	,,	25·5	,, ,,

The gaseous mixture was allowed to pass through the tube for 20 to 30 seconds after all the water had drained away. Similar results were obtained with sulphur dioxide and ammonia.

For storing easily soluble gases, a glass laboratory gasholder was fitted up, and, at the suggestion of Herr H. Kolb, a layer of paraffin about 4 cm. thick was allowed to float on the surface of the water. The paraffin was saturated by long shaking with the gases concerned, and was kept permanently in the gasholder. It rises and falls with the incoming or outgoing water, so that the same surface is always in contact with the gas. As shown clearly by the analysis of the gas given above, which was stored in such a holder, it is quite possible to keep a gaseous mixture of this description for some time fairly constant in composition.

MOVING WATER-MAINS WHILE IN USE.

At the Meeting of the American Society of Civil Engineers on the 2nd ult., a paper was read by Mr. E. C. Moore, in which he described the method adopted for moving two 36-inch water-mains without shutting off the service. The following is an abstract of the paper, the text of which appeared in the Society's "Bulletin":—

During the construction of the Lexington Avenue cable railway in New York City, it became necessary for the engineers of the Metropolitan Street Railway Company to move two 36-inch cast-iron water-mains without shutting off the water. These mains were laid in 1889, and were in 9-feet lengths. They had to be dropped for about 2 feet, and moved sideways about 1 foot for a distance of 100 feet; and for the same distance on either end of this section there was some shifting of position, so that the change in direction in passing from the old to the new location might be as gradual as possible.

The first work was to erect a yoke over each joint, from which the pipes could be hung by a chain and turnbuckles. The yokes were of 8 in. by 12 in. yellow pine, the posts being 8½ feet long, set on a wooden foot-block of 5 in. by 12 in. yellow pine 2 feet long, and the cap piece was about 11 feet long, being 9 feet between the posts. The cap was laid on top of the posts without framing, and fastened to them by 2 in. by 9 in. spruce cleats about 2 feet long; one being nailed at each post, and on opposite sides of the bent. Then a diagonal brace of 2 in. by 9 in. spruce about 3 feet long was nailed diagonally from the cap to each post on the opposite side to the cleat.

As soon as the first bent was set up and braced from the ground, the next was set up, and the two were fastened together by nailing two pieces of 2 in. by 9 in. spruce on the top, reaching from one bent to the other at the ends, and so on until twenty bents were in place. Then the chains, which were of ⅞-inch round iron, with links 7 inches long on the inside, were put in place. The part of the chain which went over the yoke was 5 feet long, and the part which went under the pipe was 11 feet long. There were two turnbuckles at each bent; so that the chain would not have to slip round the pipe or cap in lowering. Each turnbuckle was of 1½-inch iron, with hooks on each end, and could lower 12 inches without changing hooks, which were made to just fit in the links of the chain. When the pipe was dropped as far as the turnbuckle would go, the latter was taken off in its turn, and the hooks placed in links nearer the end of the chain, when the lowering proceeded as before. Everything was made of sufficient strength to allow of every other turnbuckle being taken entirely off without in any way blocking the pipe.

The lateral movement of the pipes was accomplished by hanging the chains over the cap-piece, a few inches to one side of a perpendicular through the centre of the pipe, and putting a 4 in. by 6 in. spruce brace from the end of the cap to the bank, to prevent the bent from moving towards the pipe instead of the pipe towards the bent. At the same time, a 2 in. by 9 in. spruce brace was added at either end of each bent, running diagonally from the top of one to the bottom of the next, and in opposite directions at the two ends of the bents. This was done to take care of the torsional strain caused by the cap being at right angles to the pipe.

By beginning at one end, it was possible to lower the first 100 feet of the pipe into position, and to take down and move ahead the first eleven bents. Then, as the pipe came into position, each bent was taken down and moved ahead again. The two pipes lay parallel to each other and 5 feet apart, centre to centre. One pipe was lowered at a time. There was one hydrant connection in each pipe, which had to be cut in moving. Occasional small leaks occurred while the pipes were being moved; but they generally stopped as the pipe was lowered, and the joint had a chance to come back into its place. When the pipes were in position, all the joints were gone over and put in good condition. The work was carried on day and night, and cost about £1100.

The Latent Heat of Evaporation of Benzene.—This subject was dealt with in a paper, by Mr. E. H. Griffiths and Miss D. Marshall, read at a recent meeting of the Physical Society. The results arrived at by the authors were summed up in the formula: $L = 107{\cdot}05 - 0{\cdot}1581\ \theta$, where θ is the temperature, and the thermal unit at 15° C. is used.

The Examinations in "Gas Manufacture."—According to the report on the work of the Technological Examinations Department of the City and Guilds of London Institute for the year 1894-5, which has lately been issued, the number of entries for the examinations in technology in April and May last was 12,864; the papers actually marked being 10,293, as compared with 9907 in 1893-4. The number of passes was 5824—an increase of 343 on the previous year. In "Gas Manufacture," there were 96 candidates, of whom 60 passed. Their names will be found in the Journal for July 2 (p. 44). In the Honours Grade, 3 passed in the first class, 19 in the second class, and 18 failed; while in the Ordinary Grade, 12 passed in the first class, 26 in the second class, and 18 failed. Of the 96 candidates, 39 studied in class, and 57 were external; and the percentages of failures were 38·4 and 36·8 respectively. This was a rise, in the latter case, of 13·4 per cent. as compared with 1893-4. The Examiner (Mr. Alfred Colson, M.Inst.C.E., of Leicester) reports that, "while the work of the candidates was, on the whole, fairly satisfactory, it generally indicated an absence of an all-round training, or general knowledge of the subject." The drawings of apparatus called for were weak; and Mr. Colson advises students to learn to readily make clear and graphic sketches to illustrate their ideas, and to describe processes and apparatus concisely and lucidly. The following are the names of the prize-winners: Ordinary Grade—First prize (£1 and silver medal), A. E. Brooks; second prize (£1 and bronze medal), F. P. Tarratt; third prize (bronze medal), J. P. Hallaway.

REGISTER OF PATENTS.

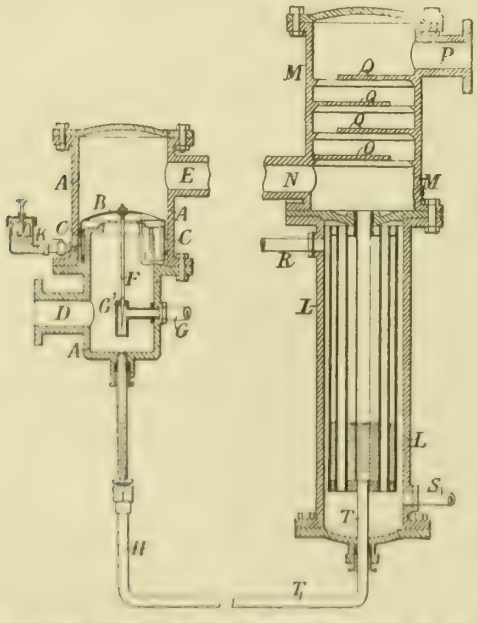
Increasing the Efficiency of Gas in Lighthouse Burners.—Wigham, J. R., of Dublin. No. 19,812; Oct. 18, 1894.

The object of this invention is to provide a method of rotating lighthouse lenses at such a rate that "the impression of the flash from one lens will not have left the eye of the observer till that from the succeeding lens reaches him; and thus the light is rendered continuous, never leaving the eye, while presenting a characteristic fluctuating appearance."

The method employed for the rapid rotation of the lenses is to fix them over a vertical spindle, with a case-hardened point working in a case-hardened socket, and the point surrounded by oil, for the purpose of lessening the friction. In some cases, where the weight of the lenses is very great, a chamber of mercury is used, for the purpose of diminishing the friction. The motion is communicated to the revolving apparatus either by the ordinary clockwork employed in lighthouses, or by a gas or petroleum engine. When gas is the illuminant used, there is combined with this arrangement a method by which the gaslight is intermitted so rapidly as to present its light continuously to the observer without sensible intervals of darkness; while at the same time the consumption of gas is diminished in proportion to the time during which the illuminant is not consumed. This is effected by valves, by which the gas is admitted to the burners for each lens or reflector, and shut off therefrom at the required intervals by means of a cam connected with the machinery by which the lenses or reflectors are rotated. The cam lifts a straight rod attached to the valve; and, in so doing, opens it for the passage of the gas. As it revolves, it closes the valve by the lowering of the rod; and thus shuts off the main supply of gas. A small bye-pass, however, maintains a very small, almost invisible light, fixed in the focus of each lens or reflector, so as to provide for its instantaneous re-ignition when the valve is again opened by the revolution of the cam. In the case of biform, triform, or quadriform lights, where two, three, or four vertically superposed lenses are used, this rod extends to all the burners, and opens and closes all the valves simultaneously, so that the flashes from the lenses form one unbroken beam (just as if they were emitted from one lens only), as at Galley Head, Mew Island, and Tory Island lighthouses. The valve is cylindric in form, divided in the centre by a diaphragm, on the under side of which is the entrance for the gas, and on the upper side the exit. In the diaphragm is formed a taper opening, which receives a disc of the same taper; both being ground in so as to be gas-tight. The disc is raised and lowered by means of the rod and cam already described; the rod passing through a stuffing-box at the top and bottom of the cylinder. The intermission may, however, be effected by simply rotating, by means of a belt or cog-wheel, the barrel of a ground-in gas-cock, having in the barrel the necessary number of slots for the emission of gas, and solid spaces for its retention.

Carburetting or Enriching Gas.—Tennant, P. C., and Hall, J. E., of the Gas Lighting Improvement Company, Bishopsgate, E.C. No. 20,253; Oct. 23, 1894.

This invention relates to means "for regulating or controlling the supply of various kinds of fluids, according to variations in the flow of gas which is to be carburetted thereby, or manufactured therefrom, or treated therewith"—the object being "to ensure that the quantity of liquid hydrocarbon admitted to the carburettor shall always be proportional to the amount of gas flowing through the same, and consequently the gas will always be uniformly carburetted or enriched, notwithstanding great variations in the quantity of carburetted gas being consumed."



The illustrations show a vertical central section of the regulating apparatus, and a form of carburettor to be employed in conjunction therewith.

A is a chamber, divided into two parts by a hollow float or bell B, partially immersed and floating in a mercury seal C. The chamber is provided with inlet and outlet pipes D E for the gas; the inlet being below, and the outlet above, the float or bell. The bell is provided with slots or with groups of perforations, so arranged that, when no gas is flowing through the apparatus, the openings in the bell will all be below the level of, and closed by, the mercury; and, when gas is flowing through the apparatus, the collective area of the openings above the level of the mercury will gradually increase or diminish as the bell B rises or falls in accordance with differences in the pressure of the gas. The gas to be enriched passes into the regulator A through the inlet D; and, by its pressure, raises the bell until the collective area of the openings above the level of the mercury is sufficient to allow the required amount of gas to pass without further raising the bell, and, after passing through such openings, the gas leaves the regulator by the outlet E.

The movement of the bell is utilized to open and close a valve for regulating or controlling, for example, the supply of liquid hydrocarbon to the vaporizer, according to the rate of flow of the gas through the carburettor and through the regulating apparatus.

The regulating-valve consists of a taper pin or rod F, depending from the hollow float or bell B, and extending through the mouth or aperture G^1 of a supply-pipe G, through which the liquid hydrocarbon flows from the store-tank, so that, when the valve is raised or lowered, it will regulate the flow of the liquid into the lower part of the chamber A. The chamber is provided with an outlet-pipe H for the liquid hydrocarbon, connected with the vaporizer.

To permit of adjusting the taper pin or rod F relatively to the aperture G^1, the patentees provide for raising or lowering the level of the mercury in the seal C, by means of a displacer or piston J, moveable in a small cylinder K, which can, when desired, be put in communication through a cock with the main body of mercury in the seal. Or this adjustment may be effected by raising or lowering the taper pin or rod relatively to the float or bell, by means of lock-nuts, adjusting screws, or other convenient devices.

The liquid hydrocarbon, as it passes through the aperture G^1, overflows into the lower part of the chamber A, whence it flows through the outlet-pipe to the vaporizer, passing on its way through a glass tube or other device, whereby the flow and level of the liquid may be observed.

The carburettor consists of a vaporizer L and a mixing chamber M above, connected by a pipe N with the gas-outlet E of the regulator, and itself provided with a gas-outlet P. The mixing chamber is, moreover, provided with baffle-plates Q, secured alternately to opposite sides of the chamber, so as to ensure the more effective mixing of the hydrocarbon vapour with the gas, and to arrest and return to the vaporizer any liquid that may be carried in suspension by the vapour from the vaporizer. The vaporizer L comprises a hollow cylinder, closed at its ends by tube-plates, and having tubes extending longitudinally through it; the cylinder being enclosed in a jacket or casing provided with inlet and outlet apertures R S, for the circulation of steam or any other heating medium. The cylinder is in direct communication at its upper end with the mixing chamber M; while its lower end is connected by a pipe T with the delivery-pipe H of the regulator.

The liquid hydrocarbon from the regulator flows through the pipes H and T into the cylinder of the vaporizer; and, rising in the same, it is heated by means of steam, hot water, or the like circulating around the cylinder and through the tubes. The liquid hydrocarbon is thus volatilized, and rises in the form of vapour into the mixing chamber M, in which the baffle-plates ensure its proper admixture with the gas.

In applying the regulator to apparatus for making oil gas, the patentees would intercalate the regulating chamber A in the pipe which conducts the permanent gas from the hydraulic main, or in the ascension-pipe which conducts the permanent gas and vapour from the retort to the hydraulic main; and then connect the pipe G with the oil-supply tank, and the pipe H with the ascension-pipe a short distance above the retort. With this arrangement, the flow of liquid hydrocarbon into the retort would be regulated according to the flow of the gas therefrom.

Tube Joints or Couplings.—John Brotherton, Limited, and Love, E., of Wolverhampton. No. 23,807; Dec. 7, 1894.

This invention relates to tube joints or couplings made without screwing the ends of the tubes, and in which loose collars placed round the tubes, and drawn towards one another at a joint by bolts, are made to bear against flanges on the tube ends, and thus tighten the flanges against suitable packing material. These joints or couplings require each only a single joint-ring of packing material, whatever pressure the joint may be intended to securely resist. The object is effected by placing a single packing-ring between the two opposing flanges of the tube ends, and surrounding the ring with a metal hoop or ring to prevent the packing ring being forced out from between the opposing flanges.

Gas-Engines.—Withers, S., of Holloway. No. 24,239; Dec. 13, 1894.

This is a vertical type of engine, having the cylinder inverted and supported on two standards fastened to, or cast with, the base or bed-plate which carries the crank-shaft. The gaseous mixture is admitted to the cylinder through an automatically acting valve in the top or inner end of the piston. The air is drawn in through a longitudinal recess in the side of the piston, communicating with the valve just mentioned; the gas being admitted to this recess (in order to mix with the air to form a gaseous mixture) through a passage in the side of the cylinder. The piston, with the recess in the side of it, is of sufficient length to always slide in register with the gas-passage during the whole or any part of the stroke of the piston. The valve for controlling the supply of gas is situated near the passage through the side of the cylinder; and an exhaust-valve near the end of the cylinder is used for discharging the products of combustion. For the operation of these valves, there is a rod situated in the same vertical plane as the cylinder and at the side. It is carried in guides affixed to the standards and cylinder, as may be found most convenient; being free to move up or down, and having tappets or strikers for operating the valves. The required motion is imparted to the rod by a cam revolving on a pin or bearing attached to one of the brackets or standards, and operated from the crank-shaft by tooth-wheel or other suitable gear in the proportion of two to one; thus giving it; the "Beau Rochas" cycle of operations. The rod has a friction-roller attached to its lower end, which bears on the periphery of the cam, and is caused to follow the curves on the cam by means of a spring.

The cycle of operations is as follows. On the piston commencing to make its downward or upward stroke, for drawing in a charge of

gaseous mixture, the valve in the piston acts automatically and admits air. At the same time, the cam, by means of a suitable curve, allows the valve-rod to slide in the direction for opening the gas-valve; and the striker on the rod for operating the gas-valve engages with the spindle of the gas-valve and opens it, allowing gas to mix with the air which is being drawn into the cylinder. (The method of regulating the supply of gas according to the power required from the engine is described later on). At the end of the out-stroke, the cam so operates the rod that the gas-valve is closed, and remains so until the next charging stroke. The piston now returns on the in-stroke, and compresses the charge; the valve in the piston being closed and kept so by the pressure in the cylinder. At the highest point of compression, the charge is ignited—preferably by an ordinary ignition-tube. The next out-stroke is the power or explosion stroke. Near the end of this stroke, the cam moves the rod in the direction of the exhaust-valve; the striker on the rod provided for the purpose engaging with the spindle of the exhaust-valve, and holding it open during the return or exhaust stroke. The opening of the exhaust-valve at or near the end of the power stroke, and the consequent release of the pressure in the cylinder, causes an influx of fresh air through the automatic valve in the piston to act as a scavenging or scouring charge (or stratum) to expel the products of combustion which would otherwise be retained in the compression space in the end of the cylinder. At the end of the exhaust stroke, the cam so operates the rod that the exhaust-valve is closed; while a further purging of the cylinder can be effected by holding open the exhaust-valve at the commencement of the compression stroke, by means of the cam and valve-rod, during which the piston travels inwards through a space approximating to the capacity of the compression space.

For the purpose of regulating the supply of gas to the cylinder, the striker for operating the gas-valve is pivoted from an arm which projects from the side of the valve-rod, in a manner and position suitable for suspending the gas-valve striker in vertical line with the gas-valve spindle, which is vertical or parallel with the valve-rod. Thus when the valve-rod moves in the direction for opening the valve, the striker presses endways on the spindle of the valve, and opens it. The end of the striker opposite to that which engages with the gas-valve spindle is extended for a short length beyond the pin upon which it is pivoted; and to this end is attached (preferably at a right angle) a vane or blade of thin sheet metal, which acts as follows: When the engine is running without a load, the impact of air on the side of the vane towards the direction in which the striker moves to open the gas-valve causes it to deviate from the vertical line with the gas-valve spindle, so that it does not engage with the spindle to open the valve. It passes by the side of it so long as an excess of speed is maintained by the engine; but when the normal speed of the engine is reached (either by a decrease of momentum, or by a load being put on it), the striker does not deviate enough from the vertical plane to disengage with the valve-spindle, and gas is admitted at each charging stroke, until sufficient impulses have been delivered to again raise the speed to the point at which the striker disengages with the gas-valve spindle.

Mixing the Gas and Air Supplying Incandescent Gas-Burners.—Denayrouze, L., of Neuilly, France. No. 14,053; July 23, 1895.

In his former patents—No. 7722 of 1895 and others—the inventor has described means for mixing the gas and air supplying burners of the Bunsen kind for incandescence gas lighting; and the present invention relates "to means of working the mixer in the form of a fan rapidly revolving in a chamber to which gas and air are admitted, and from which they pass intimately mixed to the burner."

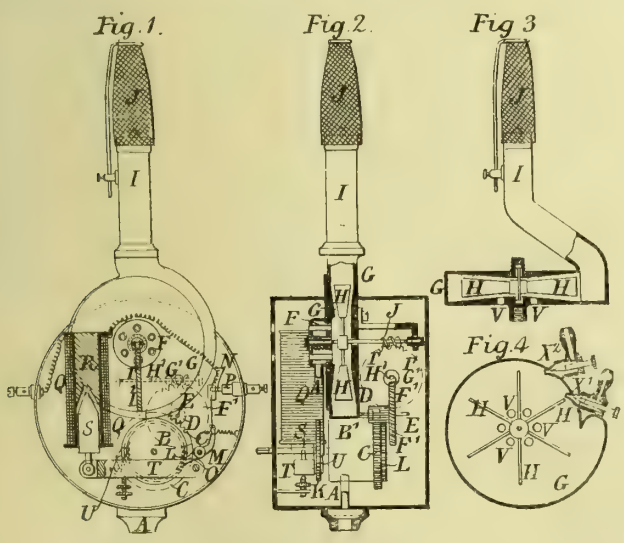


Fig. 1 is a front view (partly sectional), and fig. 2 is a vertical section, showing such apparatus driven by clockwork. Fig. 3 is a vertical section, and fig. 4 a sectional plan, of the mixing apparatus driven by the current of gas supplied.

In figs. 1 and 2, the gas passes by the conduit A to a chamber F, whence it passes by openings formed in the partition around the air inlet-tubes to the mixing chamber G, in which revolves the mixing-fan H, drawing in air while the gas enters with it. The fan is driven from a spring barrel B, a wheel C on which drives a pinion D on an axis E, which carries a worm-wheel F. This drives a worm G^1, on an axis H^1 carrying another worm-wheel I^1, which drives the worm J^1 on the axis of the fan H. This axis revolves on spring points; and the fan, revolving with great velocity, thoroughly mixes the gas and air, and drives the mixture into the burner-tube I, over which is the mantle J.

As the barrel B^1 revolves, the spring tends to become weaker, and would therefore drive the fan H more slowly; but this is provided against by winding up the spring as it unwinds, in the following manner: On the barrel to which the one end of the spring is attached, there is a ratchet-wheel L, with which engages a spring pawl lever M, terminating in a piece N, which, when the pawl enters a space between the teeth, makes a contact with P, by which an electrical current is transmitted to a solenoid or electromagnet coil Q. When the pawl is raised by a tooth of L, the contact of N and P is broken. On the axis of the barrel to which the other end of the spring is attached, there is fixed another ratchet-wheel K similar to L; and a lever T is provided, connected to an armature S, and carrying a pawl U. Whenever the magnet R is excited, it attracts S, raising the pawl U, and thus moving K a tooth to compensate for the wheel L turning a tooth. Thus, as the spring unwinds (turning L), the wheel K winds it up.

For starting the apparatus, the burner is provided with a gas-cock, by opening which a brake (not shown) is released, and an electric current is switched on. When the cock is closed, the brake is put on—stopping the mechanism, and switching off the current.

When the gas has sufficient pressure, it may be applied to drive the mixer, as shown in figs. 3 and 4. The fan H is fitted to turn freely in the casing G; its axis being preferably pivoted on jewels. Holes V near the centre of the casing admit air; while the gas enters through adjustable nozzles X^1 X^2 in jets, which act on the vanes of H, causing it to revolve, drawing in air, mixing it with the gas, and propelling the mixture up the burner-tube I. When air somewhat compressed is available, it may be sent through the nozzles X^1 X^2; the gas entering by central apertures.

As the pressure of the mixture issuing from the burner should be as low as possible, the utilization of the gas pressure in driving the mixer has (says the patentee) the advantage of producing the necessary reduction of pressure at the burner. In cases where the service gas has not sufficient pressure, an exhauster may be employed to raise the pressure; or air somewhat compressed (as mentioned above) may be applied to drive the mixer.

Gas-Fire Burners.—Sugg, W. T., of Westminster. No. 17,182 Sept. 14, 1895.

The object of this invention is to provide against the explosion and lighting back of gas-stove burners, by providing a bye-pass round the main cock to the burner, so that only a small quantity of gas will pass—sufficient to give a small flame at each jet, and by placing in the mouth of the jet a perforated steatite disc.

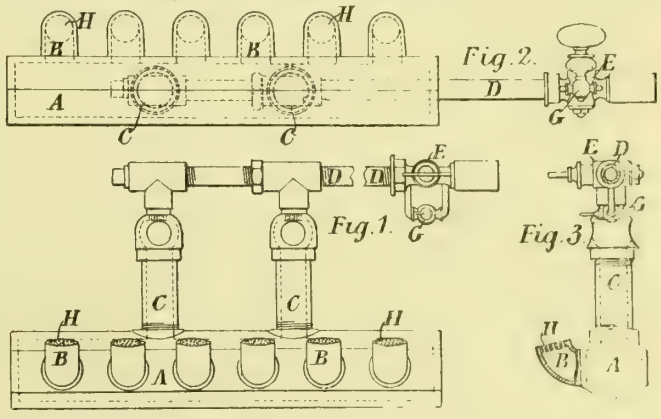


Fig. 1 is a plan of the burner; fig. 2, a back view; and fig. 3, an end view.

A is the burner, which consists of a long chamber, having elbows B, which form the jets or nozzles tapped into or cast with it. C are the mixing chambers for air and gas, of the Bunsen type; and D is the gas-supply pipe. In this pipe is the main cock E, round which is found the bye-pass G, also provided with a cock. In the mouth of each nozzle is a disc of steatite H, perforated with a number of small holes. The object of using the steatite is that, being a non-conducting material, it does not become red-hot by contact with the flame; and consequently there is nothing to light the mixture of air and gas, until it has passed through the disc, and comes in contact with the flame. The steatite also prevents the metal of the jets from becoming red-hot; and further, if the flame should try to pass through the steatite, it is cooled down at once and put out.

APPLICATIONS FOR LETTERS PATENT.

20,774.—Bryan, W. E., "Preventing waste of water and pipes freezing and bursting." Nov. 4.

20,801.—Morstein, O. Von, "Electrically lighting gas-jets from a distance." Nov. 4.

20,841.—Thomas, A. & P., "Automatic gas-pressure governor." Nov. 5.

20,889.—Harrison, E., "Asbestos fuel for gas-fires." Nov. 5.

20,964.—Marsh, T. G., Thorp, T., and Paterson, T. O., "Gas-condensers." Nov. 6.

21,060.—Schultze, W., "Air-heating apparatus for use in connection with gas cookers and for heating rooms." Nov. 7.

21,251.—Ives, E. W., "Sewage disposal works for towns, villages, and the like, draining into tidal waters." Nov. 9.

21,268.—Best, R. H., "Gas-lamps for photographic and other purposes." Nov. 9.

Gas Explosion at Primrose Hill.—About five o'clock last Saturday evening, an explosion of a somewhat serious character, followed by fire, occurred on premises of The Gaslight and Coke Company at Primrose Hill. It was afterwards discovered that a large gas-meter, of 500-light capacity, had been destroyed, and that a neighbouring brick and timber pit was in flames. The Marylebone and Paddington Fire Brigades were quickly on the scene of the conflagration; but, notwithstanding their exertions, the building and pit were destroyed.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Price v. South Metropolitan Gas Company.

SIR,—I think those of your readers who are interested in the case of the Southwark Bridge explosion would like to know the facts, which were not quite correctly stated in the judgment on appeal, as reported in your last issue.

The 3-inch main was laid by the late Phœnix Gas Company prior to the amalgamation in 1880. It is close to the side of the macadamised roadway of the bridge; and at this point it is only 10½ inches deep, owing to a part of the structure of the bridge on which it rests being in the way. About a month prior to the explosion, the sewer contractors for the City made a small transverse excavation beneath the main, of which the Company did not know, nor had they any means of knowing. After the explosion, an escape of gas was traced to this point, when it was found that the earth had been loosely filled in—leaving the main insufficiently supported, while on one side it had the rigid support of the part of the bridge above mentioned. The main was found broken in two, with the fracture perfectly clean and bright. The Lord Chief Justice is reported to have said that this was "a crack of some two or three days' standing at the time of the accident." Where he gets this, no one knows; for there is absolutely no evidence whatever that the main was broken until the explosion took place. The ground was frozen; and the gas could not escape direct into the air. But it had, through the loose ground underneath, ready access to the electric light conduits, through which it was free to travel a long way in a very short time. At the trial, my brother did not say (as stated by the Lord Chief Justice) that rewards were given to the Company's employees for reports of disturbances of the streets—for that is not the case; but that the lamplighters were rewarded for reporting escapes of gas, which is a different matter.

The Lord Chief Justice also said: "The Company ought to have known of the disturbance of the soil." But how any gas company is to know when the scores of public bodies and the hundreds (in our case many thousands) of owners of property who have the right to open the streets without giving any notice to gas companies—and who, as a matter of fact, do make hundreds of openings in our district every day without notice to us—do so, is a point his Lordship did not condescend to explain.

GEORGE LIVESEY.

South Metropolitan Gas Company,
Old Kent Road, Nov. 16, 1895.

Keeping Up the Gas Supply Without a Gasholder.

SIR,—If your correspondent "Storage" will communicate with me, I will give him particulars of an instance of supplying gas to a town without the use of a gasholder.

G. E. STEVENSON.

Rochdale Road Gas-Works, Manchester,
Nov. 13, 1895.

[Since writing the above, our correspondent has promised to send the particulars referred to for publication in the JOURNAL next week, as they may possibly be of interest to others of our readers.—ED. J.G.L.]

A Hint to Sulphate Makers.

SIR,—Some of the buyers are trying to raise the 24 per cent. to 24½ per cent., which to me appears the thin end of the wedge. No doubt, 25 per cent. will follow, if not checked. We shall not get a penny more for it, but less; and no margin to speak of for moisture, &c. My advice is to ignore altogether any correspondence that asks for 24½ per cent.; it is in the makers' hands.

"ANTI BULL, BEAR, AND CO."

Nov. 15, 1895.

The Alleged Defective Reservoir at Millbrook.—Further discussion took place at a meeting of the St. German's District Council on Thursday respecting the alleged leaking reservoir at Millbrook. Mr. H. Masterton had forwarded the final settlement with Mr. Weldon, the contractor, the retention amounting to £315. Mr. Brown, a member of the Council, said that sufficient trouble was not taken in the first place to see that the reservoir was properly constructed. He had heard that it was built on a bed of springs. Mr. Banbury said the money had been paid for something which they had not had; and he could not believe there was no redress. The Chairman (Mr. R. E. Paige) suggested that a deputation should wait on Mr. Masterton before he signed the final certificate for the work, and lay the case before him. As soon as the certificate was signed, the contractor would have to be paid. This suggestion was adopted.

The Sale of Gas and Electricity at Blackpool.—During the year ending March 25, 1895, the number of gas consumers in Blackpool was 6200; and they used 235¼ million cubic feet of gas. In the 1400 public lamps, 15¾ million cubic feet of gas were burnt. The quantity of gas sold consequently amounted to 250½ million cubic feet; being an increase of 21½ millions on the sale the preceding year. There were 1¼ million cubic feet of gas used at the works; and the leakage amounted to 3½ millions, or 1·33 per cent. of the make, which was 255¾ millions. Our readers are aware that, in addition to the gas-works, which are under the management of Mr. John Chew, the Corporation own the electric light undertaking, the supervision of which has been entrusted to Mr. W. Chew. There were 172 consumers of electricity in the above-named period, and they took units equivalent to 15½ million cubic feet of gas (reckoning 10 units as being equal to 1000 cubic feet). There were 94 arc lamps, which consumed the equivalent of 6¾ million cubic feet. The consumption of electricity for these two purposes showed an increase equal to 15¾ million cubic feet of gas as compared with the year ending March, 1894. On the works, there was used a quantity of electricity equal to half a million cubic feet of gas; and the loss of current in magnetizing, &c., was equivalent to 5½ millions, or 20 per cent. of the production. The total current was equal to 27¼ million cubic feet of gas.

LEGAL INTELLIGENCE.

CROYDON QUARTER SESSIONS.—Wednesday, Nov. 13.

(*Before Mr.* R. G. GLENN, LL.B., *Recorder.*)

Croydon Gas Company v. Assessment Committee of the Croydon Union.

The hearing of the appeal by the Croydon Gas Company against the assessment of their property by the Assessment Committee of the Croydon Board of Guardians, which was before the Court on July 26 and 27 (see *ante*, p. 293), and was adjourned over the Long Vacation, was resumed to-day.

Briefly put, the case for the appellants was whether their assessment should not be £11,717 instead of £18,343 per annum. The witnesses examined in July were Mr. Ryde, who fixed his valuation at £12,573 (this figure having been arrived at from the audited accounts); also Mr. H. E. Jones, M.Inst.C.E., who put his at £12,800; and Mr. Corbet Woodall, M.Inst.C.E., a Director of the Croydon Gas Company, but who gave evidence in his professional capacity, who worked out his valuation at £12,825. At the close of the appellants' case, Mr. Littler addressed the Court for the respondents; maintaining that, instead of 17½ per cent., with 15 per cent. to cover everything, any commercial man of means would willingly take up the Company and work the business to a profit.

Mr. BALFOUR BROWNE, Q.C., Mr. DANCKWERTS, and Mr. BARNES again appeared for the appellants; Mr. LITTLER, Q.C., and Mr. E. PAGE represented the respondents.

Mr. LITTLER opened the proceedings by calling the Secretary of the Company (Mr. W. J. Russell) to produce their cash and bank books to show the receipts month by month for the year 1894.

Mr. Russell having appeared in the witness-box with his books, it was agreed, after contention between Counsel, that he and Mr. Mason should examine them together, and extract therefrom the requisite data.

Mr. *C. F. Jones*, F.I.S., a rating surveyor and valuer of 24 years' standing, said he had had considerable experience in valuing gas-works all round London, in Essex, and in Kent. He had surveyed the works at Croydon, having made a re-valuation of the whole undertaking on the Company's accounts for the half year ended Dec. 31, 1894. He had also made the valuation in the separate parishes in which the Company traded. The gross receipts from the sale of gas in that half year amounted to £78,875, and from the disposal of the residual products to £29,347; making a total of £108,222. Allowing for bad debts, he put the total at £108,034. He had valued meters and stoves at £17,700, as against Mr. Corbet Woodall's £20,900 for the same things. There were 52,645 tons of coal carbonized; and for that item he put £1754, against Mr. Woodall's £1500. Then there was a locomotive, which was a tenant's chattel; and for this he had allowed £400. As this was not included in Mr. Woodall's estimate at all, it would bring that gentleman's figures up to £1900 for tenant's chattels. He had allowed for six weeks' stock of coal as ample for all requirements, which would give £4653; and he had put down £4700. In this he was borne out by the fact that, in the busiest month of the year for the manufacture of gas, the appellants were satisfied with a stock of only £4334 worth; while in the summer months their stock was allowed to fall to the value of £937. The tenant's working expenses, *minus* rates (because he dealt with these separately), were in the same period £60,182. Four-and-a-half months' working expenses would be amply sufficient. This would give three months' credit and 1½ months in which to collect the accounts. He therefore allowed 18-52nds of the total tenant's working expenses, which worked out to £20,132. But meanwhile the tenant would be receiving cash for residuals; so he allowed 18-52nds of these receipts as taken. This showed that they would only want £10,862. Then they received cash deposits £1935; showing that the tenant's necessary capital for meeting current expenses was only £8927. But even this figure was too high. It had been stated that the Company had £5000 in the bank; but, in his opinion, there was no necessity for them to have any such sum. He considered an allowance of 15 per cent. on tenant's receipts ample for working expenses and other contingencies; for 15 per cent. on a capital of £36,500 would be a very good remuneration for him. After going *seriatim* through a mass of figures, witness concluded by stating that £18,343 was well within the rateable value of the appellants' property.

Mr. BALFOUR BROWNE cross-examined witness at great length; pointing out a series of arithmetical inaccuracies in the statements produced. In the main, however, Mr. Jones's evidence-in-chief remained unshaken.

Mr. *W. R. Chester*, M.Inst.C.E., the Gas Engineer of the Nottingham Corporation, stated that he had valued many gas-works for rating purposes. He had inspected the works and district of the Croydon Company; and he agreed generally with Mr. Jones.

Witness was subjected to a long cross-examination, which was mainly directed to showing how he arrived at his numerical deductions. He said he agreed that 15 per cent. was ample for tenant's profits, as stated by Mr. Littler in his speech for the respondents.

Thursday, Nov. 14.

The further hearing of the case took place at the rooms of the Incorporated Law Society to-day in London.

Mr. *W. Eve* was the first witness. He said he had valued gas-works in 130 parishes, many of which he enumerated. After making a complete survey of the appellants' property, he had come to the conclusion that 15 per cent. was ample to allow for tenants' profits. He went through a long series of figures to bear out his calculation.

Mr. *W. A. Mason* corroborated the evidence of the previous witness, having on the previous day examined the appellants' cash-book.

Mr. LITTLER then summed up the case for the appellants at considerable length, contending that they were entitled to 17½ per cent. for tenants' allowances.

Mr. BALFOUR BROWNE followed on the other side; arguing that the respondents were only entitled to allow the appellants 15 per cent.

The Recorder reserved judgment.

THAMES POLICE COURT.—Thursday, Nov. 14.

(*Before Mr.* DICKINSON.)

The Quality of the Commercial Company's Gas—The "Candle" Question.

To-day an adjourned summons was heard against the Commercial Gas Company for supplying gas of less illuminating power than it should be under their Act of Parliament. There was also a new summons for a similar offence.

Mr. BERRY, who prosecuted on behalf of the London County Council, said the offence referred to in the first summons took place in April, 1894. Certain proceedings with regard to that case had since been taken in the High Court;* and as, he believed, it would not now be contested, he would leave the matter in the hands of his Worship.

Mr. CHANCE, who appeared for the Company, said his clients would plead guilty to both summonses, as there was a technical deficiency. But he should like to say a few words as to the candles used. Up to December, 1893, there had been in use a certain standard candle, which had been made in accordance with the Act of 1875. That kind of candle was used for many years; and it was found to be extremely unsatisfactory and variable. In the above-named month, the Metropolitan Gas Referees issued a "Notification," providing for the manufacturing of what it was hoped would turn out to be a more satisfactory candle. But the makers were unable to produce it. In March, 1894, another "Notification" was issued, increasing the maximum weight of the wick; and efforts were again made to meet the provision, but without success. The Referees afterwards abandoned the question of manufacturing a fresh candle; and at the beginning of the present year candles were made in accordance with the original "Notification." The Company now supplied the candles; and he believed it would be admitted that the one used in 1894 was one of the old candles tabooed by the Referees. He quoted statements showing that considerable confusion existed in the mind of the examiner as to which candle should be used. A new standard had now been agreed upon; and it was only awaiting the sanction of the Legislature. Under these circumstances, he asked for a reduced penalty.

Mr. DICKINSON said that, though on one point the penalty of 40s. was absurd, after what Mr. Chance had put forward in favour of the Company, he should only impose a penalty of 30s. and 2s. costs in one case, and 35s. and 2s. costs in the other.

The Alliance Gas Company and the Dublin Corporation.

In the Chancery Division of the High Court of Justice in Ireland last Tuesday, before the Master of the Rolls, the Solicitor-General applied, on behalf of the Alliance and Dublin Consumers' Gas Company, for an order that the Corporation of Dublin be attached for non-compliance with his Lordship's order of July 6 last (*ante*, p. 144), or, in the alternative, that a term might be limited for compliance with that judgment. His Lordship had directed that the defendants should remove all defective meters from the public lamps, and provide in lieu thereof proper meters within the meaning of the award, for the purpose of ascertaining the consumption and rate of gas supplied by the Company. Nothing had since been done; but, in the correspondence which had passed, the Corporation said they had placed the case before Mr. Serjeant Campion, to take his opinion as to whether they should appeal. The Company did not wish to appear harsh; and they were willing that the defendants should have a further three months to do what his Lordship had directed. Mr. C. O'Connor, Q.C., for the Corporation, said it was very difficult to ascertain within what time the change could be carried out, giving the Corporation credit for the utmost expedition. He would suggest that the motion should be allowed to stand over, with liberty to the plaintiffs to re-enter it if they were not satisfied with the steps the Corporation were taking in the meantime. This was agreed to.

The German Incandescent Gas-Light Company's Patents.

Our readers will doubtless be interested in the following particulars with regard to the proceedings which have lately taken place in the German Patent Office in reference to the Welsbach patents for incandescent gas lighting: The German Incandescent Gas-Light Company, who may be called for brevity the "German Company," brought an action against several firms, who may be shortly referred to as the "other Companies," for an injunction to restrain them from infringing the Welsbach patents. These Companies retaliated by bringing an action in the German Patent Office against the German Company for the purpose of nullifying those patents, on the grounds that they had been anticipated, were without novelty, &c. The case was heard on the 7th inst. The Court found in favour of the German Company; and the demands for nullity and revocation of the patent were rejected. The plaintiffs—viz., the other Companies—had to pay the costs and three-quarters of the extra-judicial charges; the defendants (the German Company) had to pay one-quarter of the extra-judicial charges for the following reason: The Court found that the original Welsbach patent of 1885 was to be upheld in its entirety. This patent covers the method of construction of the mantle and the materials employed; so that the whole basis of the patent has been declared good and valid, the anticipations brought by the other side against it have been rejected, and the soundness of its claims has been enforced by a decree of the Patent Office which is the Supreme Court on the validity of patents in Germany. There was, however, a second patent (No. 41,945), the third clause of the claim of which specifies the use of one of the ingredients alone. The Welsbach patents generally claim the materials used either alone or in combination. But the wording of the German patent No. 41,945 is somewhat obscure; and it was held by the Patent Office that these materials could only be used in combination. Hence the third clause of that patent was struck out, as the materials had never been used singly. It may be explained that mantles can be made with these materials, whether they are used in combination or singly; but the best results can only be obtained by using them in combination. The result of striking out of the German patent the use of the materials singly in no way prejudices the German Company, inasmuch as no mantles made of a single substance have any chance of competing with those made of combinations; and special combinations such as are adopted by the Incandescent Companies are those which give the highest results. The judgment went at some length into the alleged anticipations, and showed that none of them had any practical bearing on the question. After dealing with the third claim of patent No. 41,945, as above stated, the judgment runs as follows: "Otherwise the demands for nullity and revocation were rejected." The reasons for this are then given as regards nullity. As regards revocation, the judgment states that "under no point of view could there be found any reason for revoking the patents." Therefore, the finding in this case may be summarized as follows:—

(1) The original and principal patent of Dr. Carl Auer von Welsbach is upheld in its entirety; thus giving the Welsbach system the monopoly of the construction of the mantle with the materials mentioned.

(2) None of the anticipations brought against it were found to have any practical value or bearing upon the case.

(3) The Court held that clause 3 of the claim of the additional patent No. 41,945, where the materials employed were claimed singly, must be annulled. This decision was arrived at partly because the use of the materials singly had never been carried into effect, and would never be carried into effect, as the results are inferior to those obtained by using the materials in combination; and, further, the finding of the Court was arrived at upon this point because the wording of the German patent is peculiar in this respect.

The general result of this finding of the Judges of the Imperial Patent Court is of the highest value to the German Company, and also indirectly to the other Companies who are working the Welsbach patents. The decision, brought about after a most severe fight on the opponents' side, proves conclusively that the German Patent Office holds Dr. Auer von Welsbach as the inventor of the system called after his name.

Defective Water-Fittings.

At the Lambeth Police Court last Friday, the Secretary of the Southwark and Vauxhall Water Company was summoned by James Barrow for neglecting and refusing to furnish a supply of water to his premises, No. 86, Fenwick Road, Peckham, during a part of the time for which the rates for the supply had been tendered. Mr. Lynch appeared for the Company. The complainant, Mr. Barrow, is the owner of the premises in question, which are within the district supplied by the defendants. At the beginning of October, the Company complained that the pipe serving the house was leaking; and considerable correspondence ensued between the parties—the complainant asserting that the damage to the pipe was caused by the Company's men probing the ground for the purpose of ascertaining the depth of the main. The Company, on the other hand, suggested that the fracture was caused by the frost; and they threatened to cut off the supply unless the complainant had the pipe repaired. Mr. Barrow replied that, the Company's men having damaged the pipe, the Company must themselves repair it. The Company, however, cut off the supply on Nov. 4, and the complainant then took out a summons. On behalf of the Company, Mr. Lynch contended that it was immaterial how the damage to the pipe was caused. Mr. Barrow, as the owner, was the person liable for its repair. Mr. Denman did not think the complainant could succeed under the summons, for various reasons. The Company were only bound to supply water so long as the fittings were in such a condition that the water could reach the house without danger of waste. In this case, the pipe was admittedly faulty; and he thought the Company were justified in cutting off the supply, the owner having failed to repair it. The summons was dismissed.

The Sandwich Corporation and the Gas-Works.—The Sandwich Town Council have agreed to purchase the undertaking of the Sandwich Gas Company at a valuation; and the ratepayers have sanctioned the promotion of a Bill to enable the agreement to be carried out.

Slough Gas Company.—The expenditure incurred by this Company in the enlargement of their works and plant and extensions of mains during the past five years, has necessitated the raising of further money; and the shareholders have, in consequence, empowered the Directors to increase the capital to "the amount authorized by the Company's Act of Parliament."

Singapore Gas Company, Limited.—The Directors of this Company report that the revenue for the six months ending June 30 was greatly influenced by the exchange, which averaged 2s. 1½d. per dollar—a rate unprecedented during the existence of the Company. The accounts have been closely collected; and the works, under Mr. H. W. Smith's management, have been kept in good order and repair. At the meeting in May last, the Directors felt confident that they would be in a position this half year to recommend a dividend; but, in the face of a lower rate of exchange and a greatly increased cost of coals, they are again reluctantly compelled to advise that the balance of £1089 12s. 6d. be carried forward.

Torquay Water Supply.—An inquiry was held last Thursday at Torquay, by Colonel J. Ord Hastead, R.E., on behalf of the Local Government Board, respecting an application by the Town Council for power to borrow £4500 for works of water supply. It was explained by the Town Clerk (Mr. F. S. Hex) that the money was required for an extension of mains. An additional supply-main had been laid from Chapel Hill to the Warberry reservoir at a cost of £2644; the work having been done last winter to afford occupation for the unemployed in a period of exceptional distress. The other items were £304 for an additional supply-main from East Street to the service reservoir at Newton Abbot, £711 for the extension of the principal main at the intake at Tottiford to the storage reservoir, and the balance for additional mains at Cockington and in Torquay. Plans for the works were produced by Mr. T. S. Weeks, the Water Engineer.

* See JOURNAL, Vol. LXV., p. 755.

MISCELLANEOUS NEWS.

ELECTRIC LIGHTING NOTES.

The report by the Chief Clerk on the work of the Electricity and Public Lighting Department of the St. Pancras Vestry during the year ending May, 1895, was presented to the Vestry last Wednesday. The writer (Mr. A. E. Pycraft) sketches the progress of the work from the initial installation; and he remarks that the total number of consumers to May, 1895, was 373, representing 16,751 incandescent lamps of 16-candle power, 129 arc lamps, and 27 motors. The "large increase in the demand for supply, particularly that to private residences," he regards with satisfaction; and he confidently looks forward to the great impetus that will be given for a supply of current for cooking and heating purposes when the various electrical appliances are reduced in price. A table shows the increase in the sale of current at 3d. per unit to be 212 per cent. from January, 1894, to January, 1895; the cost of generating each unit sold, 2·060d.; the cost of distributing, 0·610d.; and the cost of management and general expenses, 0·565d. These charges, together with interest, repayment of loans, &c., make the total cost per unit 5·053d. Later, Mr. Pycraft recapitulates the report as to the electric lighting accounts furnished to the Vestry in March last, and epitomized in the JOURNAL at the time. The gas lighting section of the present report occupies only two pages out of the nineteen over which it extends; and the following particulars of the older illuminant are supplied. There are 4309 lamps in the parish, consuming an average of 4·64 cubic feet of gas per hour. In 1893, the average was 4·67 feet; and Mr. Pycraft says the present reduction in consumption "shows that the regulation of the governors has been attended to with greater care—thus producing the satisfactory results recorded." The reduction of the number of complaints from 44 to 14 is highly satisfactory—a more efficient result can, he says, scarcely be expected. The report also furnishes a proof that the electric light is not damaging the public gas lighting to such a degree as the friends of the former illuminant are apt to maintain, for reference is made to the "constant demand for more light," which has to be met. "Prior to 1874," the report continues, "the consumption was 5 cubic feet of gas per hour; by the meter system it has been reduced to an average of 4·6 cubic feet." The total amount paid to the Gas Company for the year ending Lady Day last was £8870 4s. 3d. On the same occasion, the Electricity Supply Committee reported that, pursuant to the Standing Orders, the Vestry had considered the communication from the Board of Trade, forwarding a copy of a letter received from a consumer respecting the supply of current at 220 volts. After being pressed for a reply, the Committee informed the Board "that no immediate change of pressure on the old mains will be made. It is proposed, however, to couple all new customers to the 220-volt distributors; and when it is found desirable to re-arrange the pressure on the mains, or to supply an old customer at higher voltage, the requirements of the St. Pancras (Middlesex) Electric Lighting Order will be fully complied with. If the Board deem it desirable that some form of notice or other action be observed, the Vestry will take any steps the Board may require in the matter." This letter was approved by the Vestry with but little discussion; but when the question of wages for the men working at the King's Road station was reached, a lively scene occurred. It appears that Mr. Baynes, the Chief Electrical Engineer, had written to the Resident Engineer ordering him to abolish double pay for overtime, and pay only the ordinary wage. Mr. Phillamore, the labour leader of the Vestry, was quite indignant at this; and he moved that the Vestry express regret at the action of the Chief Electrical Engineer without consulting his Committee. Mr. J. Dixon defended this official, who, he said, ought not to be continually interfered with. Mr. M'Gregor made his usual emphatic protest against the gross mismanagement of the Committee; and Mr. Gell complained of the low wages paid to the men. Eventually, Mr. Phillamore withdrew his motion. But the Vestry showed their disapproval of their Engineer's action by deciding that time-and-a-quarter should be paid up to 8 p.m.; time-and-a-half up to 10 p.m.; and after that double-time; while wages were practically raised all round. The ratepayers will note with interest that the Committee "are aware that the increase in wages and the other privileges will probably add to the cost of producing the current; but they believe they are acting in unison with the desire of the public and the Vestry in recommending them."

It will be remembered that the Hampstead Vestry recently asked the London County Council whether they would at an early date receive back the outstanding balances of loans advanced at rates of interest varying from £4 2s. 6d. to £3 10s. per cent., and amounting to £122,514, and re-lend this amount at 2¾ per cent. interest; and whether they would advance a further sum of £24,270 to enable the Vestry to repay the Prudential Assurance Company the outstanding balance of a loan. The reply received from the Comptroller of the London County Council was to the effect that the Committee could only recommend the Council to accede to the first part of the request upon the Vestry undertaking to pay to the Council the loss which would accrue to them by accepting such a reduction in interest as that proposed; that the loss in respect of one loan—viz., that of £20,000 advanced in 1889 for 50 years at 3½ per cent., and on which there are still to be paid 44 annual instalments of £400 each—had been calculated as an example, and that the present value of that loss amounted to £1696 4s. 7d. The Committee had no objection to recommend the Council to advance a sum for the purpose of repaying a loan, when it was to the advantage of the Vestry to do so, subject (1) to the term for the new loan not being longer than the remaining part of the term of the original loan; (2) to the satisfaction of the Solicitor upon legal points; and (3) to the Council having parliamentary power to advance the sum required. As to rate of interest, it would be that charged by the Council at the time of the sanction; the present rate for such a loan being 2¾ per cent. This practically means that the Vestry would be in no better position than heretofore, and the Finance Committee, to whom the matter was referred for consideration, will undoubtedly report to that effect. The Electric Light Committee will then have to find some other way out of their difficulties.

The Bangor City Council, like the Wimbledon District Council, seem determined to force the electric light upon the ratepayers in face of all opposition. We recorded last week (p. 984) how a meeting had been held, under the presidency of Dr. Emyr O. Price, to protest against the course adopted by the Council, and calling upon them to defer any action in the matter of electric lighting, beyond securing the necessary powers to proceed, and to take no further steps without consulting the ratepayers assembled in public meeting. This resolution was presented to the Council on the 9th inst. by Dr. Price; but the Deputy Town Clerk advised that it could not be read. Petitions against the action of the Council were laid before them by the representatives of several of the wards; but they were simply laughed at. At the same meeting, a proposition by Dr. Rowland Jones to rescind the resolution committing the Council to the electric lighting scheme was, after a discussion of nearly four hours, rejected by 13 votes to 8. In consequence of all these things, the opinion is freely expressed by the ratepayers that a majority of the Council have "taken the bit between their teeth," and are determined at all costs to impose upon the town a scheme which the ratepayers have condemned. With a view to impressing upon the recalcitrant majority in the Council the fact that that body does not exist to impose its own whims, or the fads of any section of it, upon the town, in opposition to the expressed wishes of the ratepayers, a requisition is to be presented to the new Mayor (Mr. J. E. Roberts), calling upon him to convene a public meeting of ratepayers to pronounce a further opinion on the subject. The dispute has now reached a stage at which it is not so much a question of whether the electric lighting scheme is good or bad, but whether the Council are to set at defiance the predominating wish and determination of the burgesses. We await the issue with much interest.

The Corporation of Harwich have lately been agitated on the subject of the public lighting of the town, for which at present oil is employed. The matter was referred to the Public Health Committee, who, at the last meeting, brought up a report containing the following statement: "With regard to the cost of lighting the public lamps with oil, the Borough Treasurer and the Borough Surveyor have gone into the figures, with the result that they are now able to fix the average amount expended for the last three years at £281 7s. 6d. per annum. As against this, the recent tender of the Harwich Gas and Coke Company for lighting, cleaning, and extinguishing such lamps is £502 7s. 6d. Since the last meeting of the Council, however, your Committee have received from the Town and Village Electric Light and Power Company, Limited, the following alternative proposals: (1) To provide for the Corporation a complete installation of electricity, for power as well as for light, and to take payment therefor by instalments extending over forty years; the sum from time to time remaining unpaid bearing interest at 3 per cent. (2) To take over the power of the Corporation, under the Harwich Electric Lighting Order, upon the following terms: (*a*) To provide the installation without any cost to the borough, and to enter into a contract for the supply of electricity for public lighting for the term of fourteen years, at the cost of 4½d. per unit—*i.e.*, the equivalent to 2s. 3d. per 1000 cubic feet of gas; (*b*) to pay the Corporation £300 by an allowance of a 10 per cent. discount off each quarter's account for public lighting until the whole of the £300 is absorbed. Having carefully considered the preceding proposals of the Company, your Committee recommend that the second one be agreed to, and that a contract upon the above terms be entered into." The retiring Mayor (Alderman Durrant, J.P.), in moving the adoption of the report, remarked that the Council had for a long time been considering various proposals for the proper and efficient lighting of the borough. When it was stated that oil had hitherto been used for the public lamps at Harwich, he had no doubt a good many people would have the impression that the borough was about a hundred years behind everywhere else. He did not admit this by any means. But he fully acknowledged that there was room for considerable improvement; and he believed the scheme now laid before the Council would meet with the approval of every resident in the borough. The Mayor-Elect (Mr. W. J. Nalborough) pointed out that the Council were placed in rather a peculiar position with regard to this question. The councillors elected on the 1st of November were all new members, who had not had an opportunity of considering the merits or demerits of the scheme. By supporting the recommendation of the Committee, therefore, they would be adopting a scheme into the details of which they had not gone; while, by rejecting it, they would be ignoring the decision of an old Committee who had given much time and attention to the subject. Under such circumstances, it seemed to him perfectly clear that he could not vote either way, but must maintain a position of strict neutrality. Mr. Whitmore seconded the motion. He said he was altogether opposed to a continuance of the present system, which had been a dead failure; and, if no other scheme had been laid before them, he should have voted for the adoption of gas lighting, notwithstanding the cost. After some discussion, an amendment was brought forward to refer the matter back to the Committee for further consideration. It was, however, rejected by the casting vote of the retiring Mayor. The original resolution was then submitted, in the form that a contract should be made with the Electric Light Company for lighting Harwich, "with such safeguards for the Corporation and the public generally as the Town Clerk may think desirable." Again the voting was equal; and the retiring Mayor—saying that he should most decidedly "stick to his guns"—gave a casting vote for the resolution, which was accordingly carried.

The Corporation of Torquay are still unable to decide whether it is advisable to erect electric lighting works. They obtained their Order so long ago as 1891; and two years ago they had a report from Mr. W. Trentham, M.Inst.M.E., on the means by which the town could be lighted with electricity. At a meeting of the Town Council last Tuesday, the Electric Lighting Committee recommended that a portion of Mr. Trentham's scheme should be carried out, including the establishment of a central generating station under the Bath Saloons, and that application be made to the Local Government Board for power to borrow £18,000 for the execution of the works. Mr. Kerswill, who moved the adoption of the report, dwelt upon the fact that the

time was approaching when the powers possessed by the Corporation would expire; and he said that Mr. Trentham had somewhat modified his estimate of the financial result of the undertaking. At 6d. per unit, the revenue would amount to £3300, or with arc lamps to £3600; while the working expenses would be £1160. Adding interest at 6 per cent., there would be left a net profit of £928, not allowing any revenue from meters, motors, or cooking apparatus. The sanguine estimate of Mr. Trentham that profit would be realized in the first year was challenged by Mr. Harrison, who seconded the adoption of the report; while Mr. Appleton, who followed, contended that the Bath Saloons were a most unsuitable site for a generating station. The Engineer had stated that there would be no nuisance from the boilers; but he said nothing of the nuisance that would arise from the noise of the dynamos. If the station was placed under the Bath Saloons, it would entirely destroy the use of those Assembly Rooms for concerts, meetings, and entertainments; and the value of the adjacent property would be depreciated. The proposed lighting area was very restricted; and he doubted whether they would get the anticipated revenue. The estimate was that £320 would be derived from public lighting. This sum was £95 more than they paid for gas; but it was only 10 per cent. of the anticipated revenue. Had the Committee ground for expecting that, on the line of the compulsory area, they would succeed in getting customers equivalent to 90 per cent. of the revenue? On the introduction of the light, a trader would have to spend about 30s. per lamp, and sacrifice what capital he had already expended in gas-fittings. The schemes of refuse destructor and electric light might be combined. Mr. Appleton concluded by moving, as an amendment, that the report be referred back to the Committee for further consideration and advice. Mr. Shrubb, who seconded the amendment, also advocated the combination of the electricity generating works with a refuse destructor; and he said that at Shoreditch they had a system which enabled them to store the heat from the destructor during the day, and use it at night for driving the dynamos. Other members opposed the scheme as it stood. The Mayor (Alderman Bovey) urged the Council to come to a decision, or at least to give the Electric Light Committee a definite instruction. They had already referred the question back to the Committee three times; and to do this again was practically to shelve it. It was finally decided that the subject should be considered by a Committee of the whole Council.

HUDDERSFIELD CORPORATION GAS AND WATER SUPPLY.

The Working of the Departments—The Illuminating Power of the Gas.

At the Statutory Meeting of the Huddersfield County Borough Council on the 9th inst., the retiring MAYOR (Alderman J. J. Brook) made the customary annual statement upon the work accomplished by the various departments of the Corporation.

His Worship's remarks upon the operations of the gas undertaking, showed that it continued in a steady and prosperous condition. During the year ending Sept. 30, 54,798 tons of coal were carbonized, yielding 558,371,000 cubic feet of gas, which had been enriched to a uniform illuminating power of 18½ candles. The reconstruction and renewal of the old portions of the works, which were commenced in 1893, had, he said, made rapid progress during the year; and it was anticipated that the whole scheme would be completed by the end of the current financial year. Referring to the public lighting, he remarked that the Gas Committee had, at the request of the District Committees, taken over the control of the burners and regulators in the lamps; and, during the past few months, the whole of the burners in the 2683 street-lamps had been renewed and re-adjusted, whereby the lighting of the public thoroughfares had been much improved and some economy achieved by the regulators preventing waste of gas. It was also satisfactory to note that the results of the working with the improved plant and apparatus, so far as it was completed to the end of March last, was very satisfactory, and fully justified the Council in the expenditure of the large sum of money which the renewal of the old plant had necessitated. Notwithstanding the fact that 3 per cent. more work was done, the expenditure during the whole year was £4391 less than in the corresponding period. The gross profit of the undertaking for the year ending in 1895 amounted to £19,603, the amount being apportioned as follows: Interest on loans, £11,615; redemption fund, £1533; reconstruction of works fund, £6455—total, £19,603. The receipts for the same period were £3135 less, chiefly attributable to a bad market affecting the receipts for the residual products. The Corporation having decided to apply to Parliament for extended powers, the Gas Committee were seeking additional borrowing powers to cover probable capital expenditure during the coming ten years; the chief item being the construction of a large gasholder and tank—the present storage capacity being less than twenty-four hours' maximum supply. In the year 1885, the capital of the undertaking was £222,118; and 36,062 tons of coal were carbonized. In the year ending March, 1895, the capital expenditure was £318,419; and 55,211 tons of coal were carbonized. Thus in ten years the capital had been increased by 43 per cent.; while the amount of work done had increased by 53 per cent., or an average of rather more than 5 per cent. per annum on the consumption of gas. Basing an estimate on the past decade, ten years hence—viz., in 1905—there would be a capital of £455,339, and 84,472 tons of coal carbonized; or an increase of £136,920 on the capital account, and 29,261 tons additional coal used. A sum of £100,000 was being applied for to meet the probable requirements for the term mentioned; the balance of capital now remaining unspent—£29,054—being sufficient to make up the difference between the anticipated expenditure and the amount to be applied for.

Turning to the Water Department, the Mayor stated that all the storage and service reservoirs had been kept in good order. The quantity of water in store in Blackmoorfoot reservoir was 304 million gallons, as compared with 542 million gallons at the corresponding time last year. The renewal of mains during the twelve months had been 1084 yards, as compared with 1791 yards last year. The extension of mains had been 2343 yards, as against 3794 yards last year. The total length of water-mains was about 236 miles. The number of gallons of water supplied through meter in the year was: Inside the borough, 414,919,000 gallons; outside the borough, 56,680,000 gallons—total, 471,599,000 gallons, as compared with 418,461,000 gallons last year, thus showing an increase for trade purposes of 53,138,000 gallons. The population supplied totalled to 146,330, as compared with 145,705 last year. The number of meters fixed was 605, as compared with 573. The net income for water for the year ending March 31 was £46,812; and the profit on the department was £890.

Later in the proceedings, the Gas Committee presented their minutes, which showed that the average illuminating power of the gas during September had been reported by the Manager (Mr. W. R. Herring) to be equal to 18·15 candles. Some conversation ensued as to the quality of the gas, in replying to which Alderman Stocks said the Gas Committee were doing their utmost to give the town the best gas they could make. They were about to apply to Parliament for power to raise £100,000—not for any hobby, but to extend the works to enable them to meet the demands, and to supply gas of high quality. He believed they had in their Engineer a very competent man; and he had no objection to any tests of the gas that might be made in the presence of members of the Council. The minutes were confirmed.

SOUTHAMPTON GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held on the 6th inst. —Mr. R. C. HANKINSON presiding.

The Directors' report for the six months ending June 30 stated that the profit and loss account showed that the amount available for dividend was £11,250. From this the Directors recommended the payment of maximum dividends, amounting to £8312, for the half year on all classes of shares, leaving a balance of £2938 to be carried forward. During the six months there had been an increase of 10,376,000 cubic feet of gas sold, as compared with the June half of 1894.

The CHAIRMAN, in moving the adoption of the report, stated that the quantity of coal carbonized during the half year amounted to 17,394 tons, as compared with 16,113 tons in the corresponding half of 1894; there being thus an increase of 1281 tons. The amount of gas sold, including the lighting of the public streets, was 178,148,000 cubic feet; and for the corresponding period of last year it was 167,772,000 cubic feet—the increase being 10,376,000 feet. This great advance was no doubt accounted for partly by the severe winter, which occasioned the Manager (Mr. S. W. Durkin) and officials a good deal of anxiety. It would be observed by the accounts that the renewals and repairs had come abnormally heavy during the half year. The proprietors must remember that the Directors were not allowed to raise a reserve fund for the purpose of writing off anything for depreciation of the works. It was, however, their bounden duty to keep them in the utmost state of efficiency; and this they had endeavoured to do. The receipts for residuals showed a small increase during the half year.

Colonel GRIMSTON seconded the motion.

The CHAIRMAN, in answer to a question, said it was true they had not earned the dividend in the half year by some £700 or £800; but there were several reasons for this. The first was the cost of the renewals, and, next, that a good deal of the new capital had been expended in new works which had not yet become remunerative; but it was pleasing to know that, if they took the figures for the whole year, they had not only earned the dividend, but a little over. Further, they had lately reduced the price of gas; and yet they carried £3000 of undivided profits forward. It was probable they would very soon require more capital.

The motion having been carried,

Resolutions declaring the maximum dividends and thanking the Directors and officials were passed.

Extension of the Sunderland and South Shields Water-Works.—The Sunderland and South Shields Water Company are about to construct a main from Seaton Bank Top to the Jarrow district. A reservoir capable of holding about 3 million gallons of water will be erected at West Boldon; and the total length of the new pipes proposed to be laid down is 13 miles.

Newport Water Supply.—Some time ago, the Newport Corporation sought the advice of Mr. C. Hawksley, M Inst.C.E., Mr. G. H. Hill, M.Inst.C.E., and Mr. Gitteridge, in regard to their Wentwood water scheme. These gentlemen have sent in their report, which is understood to be of an unfavourable character; and it is expected that this may lead to a modification or probable abandonment of the undertaking. They have advised the abandonment of the works, on the ground that, if they were completed, the reservoir would, in their opinion, not hold water. They also think it was impossible to ascertain that the geological formation was unsuitable. The probable outlay which has been incurred up to the present time is between £30,000 and £35,000. The Water Committee of the Corporation met last Wednesday to consider the report; and, after spending two hours in discussing the situation, the resolution was come to to lay the matter before the whole Council in Committee, and to take their decision upon it.

Oriental Gas Company, Limited.—In the report to be submitted at the forthcoming meeting of this Company, the Directors state that the business in the year ending June 30 showed an increase as compared with the preceding twelve months. A greater quantity of gas was made and sold, and the revenue from all sources was higher by nearly £3000. On the other hand, the expenditure was but very slightly and disproportionately augmented. The Company's operations, therefore, so far as they are within the control of the Directors, present a satisfactory result. Unfortunately, however, the adverse rates of exchange have, to a considerable extent, neutralized this result, and have very largely diminished the net profits. Since the close of the financial year, however, the rate has slightly recovered. The balance of the general revenue account (after payment of the interim dividend of 3½ per cent. in June last, and carrying £1500 to the reserve account) is £31,951, out of which the Directors recommend the payment of a dividend of 4½ per cent., free of income-tax; making a total dividend of 8 per cent. for the year, and leaving a balance of £18,451.

METROPOLIS WATER SUPPLY.

The Proposed Alteration of the Metropolitan Water Supply Regulations.

(*Continued from p.* 991.)

At the close of the case for the County Council, evidence on behalf of the Water Companies was immediately taken.

Mr. *E. M. Eaton*, Assoc.M.Inst.C.E., said he had been for 26 years Engineer of the Sheffield Water-Works. Until 1887 the works were in the hands of a Company; but in that year the Corporation took them over. Under the bye-laws, the maximum flush allowed was two gallons, which was found to be eminently satisfactory. He did not know of a single case where a closet-trap or soil-pipe had been stopped merely by excrementitious matter or paper. There were only about 7000 closets in Sheffield, which was not a closeted town. He attached very great importance to the down pipe being 1¼ inches in diameter; and where the cistern was only a little above the closet, he should make the pipe a trifle larger. The cistern should be about 4½ feet above the closet. He attributed the whole success of the system in Sheffield to the insistence upon the regulation relating to the wide flushing-rim. [Witness produced two models. One, called the "Oxford," had merely a deflector-rim, which did not flush at all. Water discharged into it was distributed by the spreader at the back; and the whole operation was performed by the spreader—the rim merely acting to prevent the water flowing on the seat. In the other one, called the "Cambridge," the rim was rounded off, and curved in to the basin on the inside, so that the water was equally distributed, and everything was carried away—all the sides being washed.] There was no basin better than the old-fashioned short hopper cottage basin—the cheapest, and in many respects the simplest, on the market. It had been in use in Sheffield for 25 years, and was as effective as anything yet introduced. He objected to the drain being considered at all in connection with the flush. The function of the closet was to cleanse the basin, clear out the trap, and remove everything from the soil-pipe into the drain. It was more important to regulate the type of basin than the flush. The proposed alteration in the quantity of the flush would entail a greatly increased charge upon the Water Companies.

Cross-examined: Before a closet could be put up in Sheffield, it had to be passed by the Corporation officials; and unless it had the rim of which he had spoken, it was not fixed; or, if fixed, water was not laid on. He disagreed with that part of the model regulations of the Local Government Board which related to the pan having a large water surface to receive the excreta. He did not see any advantage in a larger flush than two gallons; and with a proper flush, no paper or light material was left. A model of the closet used at the Yabsley Street Buildings was produced; and witness stated that he thought it had a slotted rim, which was different from the kind he favoured.

Re-examined: He considered there would be imperfection in the flush from a pan with a slotted rim.

Mr. *E. Collins*, M.Inst.C.E., Engineer to the New River Company, said the Company supplied about 160,000 houses. Previously to 1872, the amount of water for each service-box varied from a gallon and a half to two gallons; but it was not fixed. In 1872, it was settled at two gallons. The syphon flushing-box was not then known or generally in use; the one that was common being the double-valve box. Continuing, witness said the two gallons were not always discharged from the waste-preventers; and there were some thousands in London that did not contain more than a gallon and a quarter. Some of these did not discharge even as much as that. With a proper pan, a flushing-rim, the flushing-box at proper height, and a down-pipe of 1¼ inches, two gallons were a sufficient flush. In many old closets still in use, the inlets to the basin, though the down pipe was of proper size, were not as large as the pipe. With a 1¼-inch down pipe, the height of the flush should be between 4 ft. 6 in. and 5 feet. The delivery, to which he attached much importance, should be given in four seconds. The two gallons were sufficient to clear the pan and the trap; but the matter of clearing the drain-pipe, he considered, did not come under the jurisdiction of the Water Companies. The flush depended somewhat on the one that followed it. In a drain at a gradient of 1 in 60, two gallons would carry an ordinary amount of soil and paper about 25 feet. The general question of the flushing of closets had been affected recently by the introduction of "combination" closets, which were causing much more water to be used. He did not see how the excreta remaining in the drain-pipe would affect health, because any gas arising therefrom would pass through the air-pipe, and thus not enter the house. He attached much importance to the effect of bath water upon the drains. The Company employed some sixty inspectors to detect waste; and a year ago they were instructed to note all cases of stoppage in drains where the closets were properly supplied with water. He had had complaints from the inspectors of a total absence of water in the winter, but not one where the closet complied with the regulations, and had a two-gallon waste-preventer. Where stoppages had occurred, they were due to the introduction of extraneous matter. In passing, witness alluded to a portion of the evidence of Mr. Doll, one of the witnesses on the other side, who had said that the Company in one case had consented to his having a three-gallon waste-preventer. He said that the Company did not give their consent, but that Mr. Doll had put up the appliance behind their backs. Continuing, he stated that he demonstrated to his own satisfaction to the Sanitary Institute that the two-gallon flush was sufficient to clear the pan and trap. The Committee, however, then shifted their ground, and said he could not clear the house drain. They conducted experiments of their own; but he did not think they were important, as the conditions were not fair. Witness went on to give figures showing that there were, as he estimated, 320,000 water-closets in the district supplied by the Company. He had found, from a form which was filled up by the occupants of 41 houses, that the average number of times a closet was used was ten daily. Taking off 25 per cent., so as to be on the right side, there would be an increase in the flushing of those closets, which would make a difference of 2,400,000 gallons a day over the district of the New River Company, and of 12,000,000 gallons over the whole of the Metropolitan district. He thought the Companies ought to be empowered to specify what fittings should be used, as this would make a great difference in their effectiveness. The New River Company had fitted up, for experimental purposes, apparatus which represented as nearly as possible what would be the position in a dwelling-house; and the Inspector could see the apparatus if he wished to do so.

Cross-examined: It very often occurred with present fittings that the two-gallon flush gave unsatisfactory results. There was no obligation on the Companies to insist that a flushing-box should contain two gallons. Very often he stamped boxes containing less. There were cases in which the down pipes were smaller than 1¼ inches in diameter, but few had occurred recently. The flush should clear the pan, the trap, and the soil-pipe—the pipe running from the closet to the house drain. Both water and rain would materially assist in doing this. There were instances where the New River Company allowed the three-gallon cistern to be used; but it was where the water was supplied by meter. In many cases, people, merely from habit, and not because of necessity, pulled the handle before as well as after using a closet, where there was a two-gallon flush. There would be no saving in having a three-gallon flush, as people would still act in the same way. There were very few automatic flushing-tanks. He condemned them strongly as being wasteful; and where the supply was not by meter, the Company refused to allow them to be used. He thought the best pan they had was capable of improvement. He should like, however, to see the short hopper pan employed in cottages and model dwellings; and he was not aware that this would be opposed to the model regulations of the Local Government Board. Apart from the experiments conducted at the New River Head for the Sanitary Institute, there was another set made with five or six artificial closets, for the special purpose of showing that a two-gallon flush would clear the pan. Asked to suggest a remedy in cases where this flush was insufficient, witness said he would alter the pan.

Mr. *W. B. Bryan*, M.Inst.C.E., the Engineer to the East London Water Company, said the Company's district contained a large number of small houses, the flushing-cisterns in which, in very many instances, he had examined. He found that, with fittings and apparatus proper in every respect, the two-gallon flush was perfectly effectual; and he had made experiments which proved this. If a three-gallon flush should become general, it would represent an increased consumption of from four to six gallons of water per head per day. This he thought would be caused chiefly by the closets being used as urinals. The remedy for cases where the two-gallon flush was insufficient was the provision of proper fittings.

Cross-examined: The two-gallon flush was defective only where the fittings were defective. The three-gallon flush was totally unnecessary. He had no statistics to show, as he believed, that the consumption of water had increased since the introduction of combination closets.

Re-examined: In the Beachcroft and Yabsley Street Buildings, the cisterns had a down pipe of 1¼ inches in diameter. There could be no fair comparison between the closets at the two places, as in one case the flush descended far better than it did in the other; and the construction of the pan and other conditions were not equal.

On the inquiry being resumed on Tuesday, the 5th inst.,

Mr. *Collins* was re-examined by Mr. Pember. He said the two-gallon flushing-cisterns only failed when the fittings were in an improper condition; and three, four, or even six gallon cisterns would also fail under these conditions. The effect of the proposal of the County Council would most decidedly be retrospective. If the Council made an order that nothing but three-gallon cisterns should be used, it would necessitate the alteration of the whole apparatus for flushing purposes in dwelling-houses, and would cause an immense outlay of money. At the very lowest estimate, the expense of altering the water-closets could not, under the most favourable circumstances, be less than £3 apiece. This meant £960,000 in the New River Company's district alone. In the whole Metropolitan area, it would entail an outlay of £4,800,000; and taking off 50 per cent., it would mean two millions of money.

Mr. *A. E. Farrant*, the Deputy-Chairman of the Artizans' and Labourers' Dwellings Company, the Chairman of the Middle Class Dwellings' Society, and the Deputy-Chairman and Managing-Director of the Rowton House Company, said that the Artizans' and Labourers' Dwellings Company owned and kept in repair 5048 cottages and shops; the number of their tenants being upwards of 7000, irrespective of the lodgers the tenants took. They had 7420 water-closets, in each of which the waste-preventer cistern was uniformly of two gallons capacity; and their experience was that these cisterns were perfectly satisfactory. The closet they used almost invariably was a short hopper one, which was an improvement on the old form, which was somewhat in the shape of a funnel. They had found a two-gallon flush amply sufficient to keep the closet clean, and to answer all purposes. They took special care in fitting the pans; this being done by their own workmen. At the Yabsley Dwellings, in Poplar, which were spoken about by Mr. Bury as having given a certain amount of trouble by getting stopped up, it struck him that the difficulty was owing to the new tenants not being accustomed to the conveniences. The closets might be used repeatedly without being flushed at all. His Company had flats at Buckingham Palace Mansions, at Ridgmount Gardens, and at Gordon Mansions. In some of these, the closets had three-gallon cisterns; but in those cases the basins and traps were the same as those in use with two-gallon cisterns. There had never been a case of stoppage with a two-gallon flush, except where a house flannel or a scrubbing-brush had accidentally found its way into the pan. In regard to the Rowton House property, they had there accommodation for 184 lodgers. There were 40 water-closets in the house, 16 of which were available only at night. There was approximately one closet to every 20 men; so that these conveniences were more used than those in private houses, or even in hotels. The flushing-cisterns were of two-gallon capacity. Though they were rather low down, and therefore not under the most favourable conditions, in three years there had been no complaint as to their efficiency; and there had never been any difficulty as to the drains. The pans were always perfectly clean, and as satisfactory as they could be. The Company kept the place in repair.

In cross-examination by Mr. Freeman, witness said that the water for Rowton House was paid for by meter. It was true that, in the case of some of their property, the Company had used cisterns with a three-gallon flush; but before the houses were completed, the style of closet was altered. The pans were changed, but the cisterns were

allowed to remain. He had never heard any objection raised by the Water Company.

Mr. *J. W. Gray*, M.Inst.C.E., said he had been for 29 years Engineer of the Birmingham Water-Works, having been connected with the undertaking when it was in the hands of a Company, till 1876, and then continuing in the service of the Corporation when they took it over. Though he had discontinued active employment in connection with the Birmingham Corporation, he was still their Consulting Engineer. He was a member of the Guild of Plumbers of Birmingham. In the course of his professional experience, he had made himself familiar with most modern sanitary appliances. The Birmingham Corporation had the following bye-law :—

A person who shall fix or fit on any premises any water-closet or urinal apparatus that may be intended to be used for receiving or delivering the water of the Corporation shall comply with the following regulations, that is to say: (1) Every water-closet cistern other than a double-valve cistern shall have an efficient waste-preventing apparatus so constructed as not to be capable of discharging more than two gallons of water at each flush; and every water-closet cistern being a double-valve cistern shall have an efficient waste-preventing apparatus so constructed as not to be capable of discharging more than *three* gallons of water at each flush. This regulation shall apply only to cisterns of every water-closet used in respect of a single or separate house or building. (2) Every urinal cistern, other than public urinal cistern or cisterns having attached to them a self-closing apparatus, shall have an efficient waste-preventing apparatus, so constructed as to be capable of discharging not more than one gallon of water at each flush. (3) No pipe by which water is supplied to any water-closet shall communicate with any part of such water-closet, or with any apparatus connected therewith, except the service cistern thereof.

In sending this bye-law for the purposes of the present inquiry, the Birmingham authorities had stated that a two-gallon cistern was invariably used in Birmingham; and that, when it was properly fixed and had a suitable basement, it was found to be perfectly satisfactory. He (witness) thoroughly endorsed this statement. He attached the greatest importance to the closet being properly constructed. He was acquainted with the short hopper closet referred to by the last witness; and he considered it a very good one. He had never heard any complaints about the flushing power of two-gallon cisterns. Complaint was made as to the length of time they took to fill; but this would be accentuated in the case of a three-gallon cistern, as the overflow was always slow.

In cross-examination, witness said that all the regulations, both as to waste of water and sanitation, were in the hands of the Corporation. The regulations bearing upon the water supply in Birmingham were made in the time of the Water Company; but now, under the Corporation, they were bye-laws. He agreed with the last witness that a three-gallon flush was no more cleansing than a two-gallon one. If a two-gallon flush was sufficient, a three-gallon flush was waste.

Mr. *J. W. Restler*, M.Inst.C.E., the Chief Engineer of the Southwark and Vauxhall Water Company, stated that his Company supplied 120,000 houses, or, roughly speaking, 900,000 persons, with water. His attention had frequently been called to Regulation No. 21 under the London County Council; and he had found the wording of it, since the intermittent service had been changed for a constant supply, very difficult to understand. In cases where there had been a defect in the flush with a two-gallon cistern, it was attributable to the insufficient size of the down pipe, or to a defect in the pan or in the cistern itself. Taking the poorer portion of the district, 50 per cent. of the flushing-pipes were less than 1¼ inches in diameter; but, under the present regulations, the Company were powerless, in the case of the existing fittings, to require that the pipes should be made of lead, and be 1¼ inches in diameter. An amendment of the regulation prescribing the kind of pipe would be useful. If the Water Companies had the power possessed by municipal bodies, it would be of advantage to them, and of benefit to the localities. Less than one-third of the local authorities in his district, after receiving the circular-letter of the London County Council, had assented to the proposal contained in it that the size of the cisterns should be enlarged. There had been no demand for an increased flush, and no public meeting or agitation for it, until the County Council had taken action in the matter. With regard to the flushing power of a cistern, so long as it removed everything from the closet-pan and the trap, it did all that was expected of it; and, in his opinion, a two-gallon waste-preventer, with a suitable down pipe and closet-pan, was all that was needed. Mr. Binnie had suggested that water would be saved by a three-gallon flush, for the reason that a two-gallon flush was insufficient at one pull of the chain, and that a second pull would have to be made. He (witness) did not agree with that. A two-gallon flush was ample; and therefore, when three gallons of water were discharged, one gallon was wasted. If a three-gallon flush were insisted upon, it would mean an increased supply from his Company of about 2 million gallons of water per day.

In cross-examination, witness said his estimate of the increased supply was founded on the assumption that each closet would be used four times a day by each person living in any house.

Mr. *E. J. White*, Assoc.M.Inst.C.E., Director of the Lambeth Brass and Iron Company, Limited, and a specialist in the manufacture of sanitary appliances, gave evidence in support of a two-gallon flush, the efficiency of which, he stated, depended on the construction of the basin of the closet, the down pipe, and the cistern. The short hopper closet which had been spoken of was the best form of pan with which he was acquainted. He had always found a two-gallon flush efficient and sufficient.

Mr. *M. W. Hervey*, M.Inst.C.E., the Engineer of the West Middlesex Water Company, considered a two-gallon flush sufficient for all requirements.

At this point, the Inspector was conducted over the building in which the inquiry was taking place, in order to examine the washout and non-washout closets there in use.

Mr. *Pullen*, a builder and contractor, having blocks of houses in Walworth, containing 500 water-closets, stated that the short hopper closets were the best for all practical purposes; and that these could be efficiently cleared and cleansed by a two-gallon flush, provided those who used them did not put into them house flannels, hearth-stones, scrubbing-brushes, halfpenny bundles of wood, and so forth.

In cross-examination, witness said that with a two-gallon flush he had never known a closet-pan to be dirty.

Mr. *T. F. Parkes*, Assoc.M.Inst.C.E., the Engineer to the Lambeth Water Company, stated that, with proper appliances, according to his experience, a two-gallon flush was ample. If three-gallon cisterns were substituted for those containing two gallons, it would cause a great increase in the water supply in the Lambeth district. The population supplied by his Company within the Metropolitan area was 497,000; and the proposed regulation would necessitate, to supply this, an extra 2 million gallons of water a day. The cost of fitting up the necessary appliances to give such a supply would be £250,000, or about £4 10s. a house for 70,000 houses.

Major *L. H. Isaacs*, ex-M.P. for Walworth, and the Surveyor to the Holborn District Board of Works, also gave evidence in support of a two-gallon flush, which he stated would be amply sufficient for all practical purposes, if the other appliances were of a proper kind.

Mr. *J. Phillips*, who, in 1846, was the Chief Surveyor to the Westminster Court of Sewers, said that, after fifty years' experience, he was prepared to say that a two-gallon flush was ample for all domestic purposes.

Mr. *A. A. Gill*, Assoc.M.Inst.C.E., the Engineer to the Chelsea Water Company, said a two-gallon flush was amply sufficient under ordinary conditions. If a three-gallon flush were made general, it would increase his Company's supply by 12 per cent., or 1½ million gallons.

Cross-examined: The whole of his evidence was founded on the fact that no complaints had reached him of the insufficiency of the two-gallon flush. The experiments made by the New River Company had confirmed his view.

Mr. *E. K. Burstal*, M.Inst.C.E., of the firm of Messrs. Stevenson and Burstal, stated that he had been called upon to advise many water authorities in the establishment of supplies, and had never recommended the use of other than two-gallon cisterns for flushing purposes. These were almost universally employed in the provinces; and no complaint of them had reached him from any sanitary authority. If a two-gallon cistern did not flush properly, the fault was with the closet or the fixtures, and not with the cistern.

Cross-examined: There was an exhaustive inquiry into this question some years ago at Sheffield. Later, in 1888, it had been investigated at Portsmouth; and a provision had been made in the award for the use of two-gallon cisterns. Until this inquiry, he had not heard that engineers were divided in opinion in regard to the two-gallon flush. He had never thought it would be seriously contended, save by gentlemen who had invented new appliances, that a two-gallon flush was insufficient.

The inquiry was again adjourned.

The inquiry was continued on the 6th inst., when

Mr. *A. Dickson*, the Secretary of the Kent Water Company, said the closets in his district were not always of a satisfactory type. Where the fittings were efficient, the two-gallon flush was adequate, as it would cleanse the pan, carry the contents through the trap and soil-pipe, and usually along the drain. Witness did not see the experiments made by the Sanitary Institute; but he saw the arrangements under which they were carried out. The mode of testing the effect of a flush was not fair, because it did not correctly represent the conditions existing in the houses in his district. No allowance was made for any aid that might be obtained from sinks, baths, &c. If the failures with a single flush of two gallons amounted to only 3 per cent., he should say the flush was satisfactory. A Committee of the Sanitary Institute, consisting of Mr. Rogers Field, Dr. Confield, Mr. Ernest Turner, Mr. F. W. Cutler, and Mr. White Wallis, attended some experiments carried out at the works of the Kent Water Company, at which a "Norwich" double-chamber flushing-cistern was used. It had been designed to hold two-and-a-half gallons; but its capacity was reduced to two gallons. The pan was of the short hopper type—a patent of Messrs. Guest and Chrimes—and had an open, not slotted, rim all round. Apples were placed in the pan, and a number of experiments with the two-gallon flush, under various conditions suggested by the Committee, were made, and acknowledged to be satisfactory. Other experiments were carried out with the old hopper wash round pan, to show the difficulties and restrictions in connection with them. The Committee were satisfied that, with proper fittings, two gallons would give an adequate flush.

Cross-examined: If the chain of a "Norwich" flushing-cistern were not held down till the end of the flush, the flush would be shortened. In practice, the warning-pipes were not generally such as to prevent the full two gallons flowing. In closets put up in recent years, there was generally a 1¼-inch down pipe, with an inlet of similar capacity to the pan. He attached great importance to the rim of a pan being open all the way round, and not slotted. He knew, however, that the model bye-laws of the Local Government Board referred to pans in which water should stand for excreta to fall into.

Mr. *E. Yates*, a builder, of Walworth, said he was connected with property in which there were between 3500 and 4000 water-closets. The two-gallon flush was universal among them, and was sufficient for practical purposes. He had lately used the "Improved Artizan" type of short hopper pan; and he was careful to have a 1¼-inch pipe, with an inlet of the same size.

Mr. *R. W. P. Birch*, M.Inst.C.E., a member of the Council and of the Examining Board of the Sanitary Institute, as well as one of the Exhibition Judges of that body, stated that the report of the Institute in respect to the experiments was written and adopted in great haste for the convenience of the County Council; and he protested against it at the time. He had the figures which represented the results of the experiments; but the conclusions he drew from them were different from those of the Committee. It appeared from the report that the two-gallon flushes were discharged in five seconds each; whereas the three-gallon flushes occupied seven seconds. This made it rather difficult to say how far the results were due to the larger quantity of water, and how far to the increased velocity of the discharge. The experiments went to show also that a long drain should be 4 inches in diameter at the upper, and six inches at the lower part. This would improve the action of a two-gallon flush. By increasing the fall of a 50 feet house drain from 1 ft. 3 in. to 1 ft. 8 in., its efficiency might

be increased by about 30 per cent. Witness thought it was impossible to provide that the excremental matter should always fall so as to drop into water in pans. With good and proper fittings, he did not think the increased flush was required.

Dr. *H. W. Roberts*, the Medical Officer of Health for Deptford, stated that, with a properly constituted closet, his experience was that two gallons constituted a sufficient flush. He had five inspectors under him; and they all agreed as to the adequacy of that flush.

Mr. *H. S. Barham*, a builder, of Blackheath, said he had erected forty houses on one estate at Blackheath, putting one closet in some, and two closets in others. During the last three years, he had used the short hopper pan, and had taken care that the other requirements were fulfilled. The two-gallon flush was always sufficient.

Mr. *W. Lewis*, for 32 years caretaker of the tenements of the Improved Industrial Dwellings Company in Crossfield Lane, Deptford, stated that the closets, 155 in number, were in his charge. They consisted of stoneware short hopper pans, with a single-valve flushing-cistern of two gallons capacity connected with the pan by a 1¼-inch down pipe. The two-gallon flush was always sufficient.

Mr. *J. Ward*, an Inspector of the Kent Water Company, said he visited, on the 1st inst., the East Greenwich Cottages, which were artizans' tenement dwellings of the London County Council. The water-closet basins there were of the short hopper pattern; and the flushing arrangement was Boulding's syphon—the discharge being two gallons. He selected twenty tenements at hazard, and interviewed the occupants; but in no case did he receive any complaint of stoppage.

Mr. FREEMAN said he had a list of stoppages which had occurred in blocks of tenements visited by Mr. Ward.

Witness denied having been to the particular tenements where the stoppages had happened, or that he had knowledge of them.

Mr. *J. Moore*, the Secretary to the Improved Industrial Dwellings Company, also spoke of the efficiency of the two-gallon flush in the tenements of the Company.

Cross-examined: The Company's buildings were from five to seven storeys high; and the closets, being under one another, were in an exceptionally favourable position as regarded flushing.

Professor *W. R. Smith*, the holder of a number of public positions, and the President of the British Institute of Public Health, stated that, with proper fittings, two gallons of water were sufficient to clear a closet pan, trap, and soil-pipe. Witness corrected a statement made by Dr. Parkes, one of the previous witnesses, by saying he (Dr. Parkes) was asked by the Council of the Metropolitan Branch of the Society of Medical Officers of Health, not by the branch itself, to attend and give evidence.

Mr. *F. Gollan*, the Chief Inspector of the Kent Water Company, also bore testimony to the efficiency of the two-gallon flush. He said it worked well in Sheffield; its success being due partly to the control which the Corporation had over the fittings used. London fittings were very inferior to those in use in Sheffield.

On the resumption of the inquiry on the following day,

Sir *F. Bramwell*, F.R.S., the first witness, stated that, in his judgment, the two-gallon flush, when good, and properly used, was sufficient. The introduction of the lift-up lid closet had caused a very large amount of male urination to be made down such closets; and where formerly a gallon flush was deemed sufficient to carry it away, two gallons were now used, and were ample for the purpose. Therefore, if the increased flush were adopted, only waste would follow; and the amount of the waste would be enormous. Between 1881 and 1893, the increase in the domestic consumption of water in the districts supplied by the Metropolitan Companies amounted to two gallons a head per day. With five people to a house, this meant an increase of 10 gallons a day per house, or in the aggregate of 10 million gallons daily, taking the population at 5 millions. The augmented flush would add a very serious responsibility to the purveyors of water, and involve an additional burden on the sewers. In the less costly class of houses, there was usually a portable bath, which was generally emptied into the closet, and afforded material assistance in washing out pan, trap, soil-pipe, and drain-pipe. As this water entered the basin *en bloc*, it was very effectual. Witness thought the most effectual flush of all, if practicable, would be the throwing of a pail of water down the closet. Before the passing of the regulations of 1872, there had been much discussion, notably in the Sheffield case, as to the quantity of water necessary for a flush. Witness went on to express approval of the proposition that slop-sinks—those down which excrement was passed—should be brought under the regulations relating to the flushing of closets; and he also agreed with Mr. Pember that the other regulation, to prevent cisterns communicating directly with a water-closet cistern from supplying water for domestic purposes or for the use of animals, was a proper one. It was, however, already attained, practically, by existing regulations. In regard to the remaining proposal—that, in all cases where premises had a constant water service, one or more taps should be connected with the rising main for drinking purposes—he should have thought the consumer was at liberty to do this at present. He did not think, however, that it appertained to the duty of the Water Companies. London being one of the most closeted towns in England, the matter of the increased flush was more important than elsewhere.

Cross-examined: If it were shown that, with the best appliances properly used and kept in good order, the two-gallon flush was insufficient, he should favour the increase. He did not know that the two-gallon flush did not keep the closets clean. There had been a considerable increase in the consumption of water since the introduction of the combination closets; and he thought he might connect the two. Much of this increase was due to baths, the use of which had largely increased of late. He knew that, since 1872, Bradford and Edinburgh had made regulations allowing a three-gallon flush. In his calculation as to the extent to which the larger flush would increase the consumption of water, he had considered that each person would use the closet for both purposes four or five times daily.

Re-examined: The syphon and combination closet together were fatal to economy in water supply.

Mr. *Berry*, recalled, and examined by Mr. PEMBER, said that, in some of the County Council's buildings with which he was connected, there were two closets, each of which was connected with a common soil-pipe. There was the bend of the trap itself; and he thought two others besides. The stoppages had occurred in the traps, and not in the soil-pipes.

Mr. PEMBER said he was informed that the stoppages had taken place in the soil-pipes.

Witness, in reply to Mr. FREEMAN, said stoppages had occurred in the soil-pipes; but he had not accounted for them in the lists he had previously given. The stoppages in the traps might lead to stoppages in the branch soil-pipe.

Mr. *Walker*, the Superintendent of the County Council's buildings at East Greenwich, where there are 78 closets used by about 400 persons, said that between November, 1894, and November, 1895, there were 21 stoppages, not counting those due to frost. Manholes were placed near the closets, and two of these had been stopped. Residents at first were somewhat careless in the matter of flushing; but they behaved better after awhile.

Cross-examined: In some cases, four flushes had occurred in connection with one block of tenements, but on different floors.

Mr. SATCHWELL, the Superintendent of the County Council's buildings at Hughes Fields, Deptford, stated that he had had to unstop closets there, in addition to inspection chambers on nine or ten occasions, in the past six months. These cases did not include stoppages caused by extraneous matter.

Cross-examined: The residents were very poor, and often did not flush the closets.

Mr. PEMBER then addressed the Inspector on behalf of the Water Companies. In regard to the proposal relating to the slop-sinks, the Companies did not oppose it, as these sinks were really water-closets. As to the last two proposals, which dealt with preventing cisterns connected directly with a closet from being used for domestic purposes, and with the placing of taps on the rising mains, he had come to the conclusion that they were totally unconnected with the Companies, and that, if added to the regulations, they would form merely the thin end of the wedge for introducing more foreign and irrelevant matters. In regard to the alteration of the size of the flush, over which the real fight was taking place, he thought sufficient had transpired to make it clear that the Companies were being called upon to make good the shortcomings either of the sanitary engineer, the plumber, the builder, or the architect, who were responsible for the equipment and maintenance of the sanitary appliances of a house. It was altogether a perversion of the Acts of 1852 and 1871, which provided against waste and the undue consumption of water—a commodity which was far too precious to be lightly wasted. If this demand were right for one town, it was right for another. It would follow, therefore, that, with the exception of Bradford and Edinburgh, and one or two other instances which had been quoted, there ought to be a revision of the regulations of the towns of the kingdom; and then the water consumption of the country would be seriously added to. There were, to his mind, three aspects of the case—namely, the waste of water, the waste of money in providing an unnecessary quantity of it (and this would be very considerable), and the question of the injustice to the purveyors. He contended that the change should only be made after all the local authorities of the kingdom had contributed evidence. Nowhere was there such scandalous waste of water in large quantities as in many districts of London; and nowhere were there such bad fittings, both as regarded construction and maintenance. The learned Counsel asserted that, in connection with some of the more important requirements—the size of the cisterns, dimensions of the down pipe, inlet to the pan, height of the flushing-cistern, or laying the drains—neglect and omission had occurred. There had been no supervision of these matters. Until such supervision was exercised, they were practically encouraging faulty construction and inefficient maintenance of the fittings, and saying they would overcome these defects by giving a superabundant supply. All he had said was based on the hypothesis that the two-gallon flush was efficient; because if it were not, there would have been an outcry all over the country years ago. As regarded the evidence for the case of the County Council, he said he might summarize it in the statement that, considering the great extent of the imperfection of the fittings, two gallons were running it rather fine; and then their chief desire seemed to be to clear the house drain, which was not the Water Companies' business at all. After reviewing the evidence at length, the learned Counsel concluded by asserting that the origin of the demand was sudden; that it was lightly and recklessly taken up; and that it was by no means universal.

The inquiry was resumed and concluded on the 8th inst.

The INSPECTOR, in opening the proceedings, said it had been stated that the short hopper closet of the "*e*" Doulton type was in contravention of the model bye-laws of the Local Government Board. Which bye-law did it contravene?

Mr. FREEMAN: Bye-law 69, and particularly paragraph 3.

The INSPECTOR pointed out that the style of closet he had alluded to did not seem to have been invented at the time the model bye-laws were written. There was, however, a drawing attached to bye-law 69 which appeared identical with that style of closet, except that it was not quite as straight at the back.

Mr. RICKARDS said he understood that the Local Government Board did not object to this closet.

The INSPECTOR did not think they did

Mr. RICKARDS said he was much obliged to the Inspector for mentioning the matter, because it was well to know that the closet was not disapproved of by the Local Government Board. He took it, too, that the Inspector's remark applied to short hopper closets generally.

The INSPECTOR expressed assent

Mr. FREEMAN then proceeded to address the Inspector in support of the case for the London County Council. He asserted that, if he established that the increased flush was a sanitary requirement, it should be made the subject of a regulation, even if it entailed more water being used, and some reduction of the dividends of the Water Companies. If places like Bradford, Edinburgh, Croydon, Gloucester, and other towns, had felt it necessary to make regulations causing the use of a greater flush than prevailed in London, surely such regulations would be good for London. In these towns, he pointed out, the Corporations, who were the sanitary authorities, also owned the water supply.

and consequently they had no dividends to consider. After dealing very briefly with the proposed alterations or amendments in the regulations, apart from the matter of the increased flush, Counsel proceeded to say that both sides were agreed as to the necessity of the flush clearing the pan, trap, and soil-pipe, by which was meant the drain communicating with the house drain. The Companies, however, contended that they were relieved by the Act of 1852 from any responsibility regarding the drains or sewers. He admitted that there was no obligation upon them, under the head of domestic supply, to turn on water for flushing drains and sewers; but he did not think it had been intended, or that the Act could cover the proposition, that so long as the contents of the pan were sent through the soil-pipe, the Companies had nothing further to do. He disagreed very much with this view, and asserted, moreover, that the two-gallon flush often did not clear the pan, trap, and soil-pipe—things which the Companies admitted they were bound to do. Dealing with the contention that the remedy, in cases where the two-gallon flush was inefficient, lay in the use of proper fittings, he stated that regulations to effect this object had already been made by the County Council under the Public Health Act, 1891. As the two-gallon flush, under the conditions laid down in those regulations, was not effective in clearing the closets, it was necessary to increase it to three. Moreover, the Companies, it should be noted, did not object to the larger flush where the supply was by meter. A considerable number of witnesses for the Companies had asserted that, where the fittings were "proper" in each and every particular, two gallons were sufficient; but these conditions were such as were not met with in every-day life. The same remark applied to the experiments that had been made. He did not suggest that the experiments of the Kent Company or the New River Company were not as honest and reliable as those of the Sanitary Institute; but neither one set nor the other could compare with the evidence of daily practice. Then the Companies alleged that the introduction of the combination closet had resulted in a great increase in the water used, owing to the closet being flushed whenever it was used for urination purposes—this being one of the causes of the great general increase in the consumption of water of late years. Baths had, however, come into use to a much greater extent than formerly; and they had contributed greatly to the increase. According to some of the evidence, the extra consumption arising from the use of the third gallon would mean an increase of 15 million gallons daily over the districts of only six of the Metropolitan Companies. This meant that every man, woman, and child in the Metropolis would make from two to six visits to the closet each day—the estimated number of visits varying with different witnesses. This, of course, was ridiculous, especially when they remembered that the father and children were absent nearly all day. Against the increase that would occur, they had to set the saving in the case of the man who used a two-gallon flush twice—consuming four gallons to effect what one three-gallon flush would suffice for. In conclusion, Counsel said this matter had been taken up by the County Council under a serious sense of responsibility, and was supported by a very strong body of opinion; and he asked the Inspector to say that the remedy he had suggested, simple in character and efficient in its result, should be applied to the present unsatisfactory state of affairs.

The Inspector then expressed a wish to be allowed to examine some of the closets at the various dwellings that had been referred to; and it was arranged that, accompanied by representatives of the Water Companies and the London County Council, he should visit a number of these buildings.

The proceedings then terminated.

BRADFORD CORPORATION WATER SUPPLY.

The Arbitration in Connection with the Nidd Water Scheme.

As already mentioned in the Journal, arbitration proceedings were commenced at the Surveyors' Institution on the 15th ult., before Mr. C. Oakley, in regard to a claim made by Mr. Thomas E. Yorke, of Pateley Bridge, upon the Bradford Corporation, for a sum of about £45,000, compensation for a certain easement and land required in connection with their Nidd Valley water scheme. The claim had been referred to Mr. T. Fenwick, M.Inst.C.E., for the Corporation, and to Mr. J. Waugh for Mr. Yorke; and as these gentlemen could not agree upon an Umpire, the Board of Trade appointed Mr. Oakley. The easement in question comprises a strip of land about eight miles long and six yards wide—in all, some 18 acres—reaching from Rainstang, in the township of Stone Beck, up through Appletreewick to Ashfold Sire, in the township of Stone Beck Down. Close upon three miles will be used for a tunnel at a depth of 400 feet below the surface of the ground; and nearly four miles will be in cut-and-cover, having an average depth of 12 feet. Smaller quantities of the land will be used as follows: 1249 yards for pipe-tracks to be laid at an average depth of 6 feet; and 2417 yards for branch pipes, at an average depth of 4 to 5 feet. The claimant, in his notice of claim, alleged a variety of grounds for compensation—viz., severance of lands, rights of ingress and egress for the Corporation, damage and injury to shooting and other sporting rights, damage through loss of water, the power to take which the Corporation have gained by Act of Parliament, injury to mines and minerals, and additional cost of getting and dealing with such mines and minerals. Among the objections raised by the Corporation are these: That, as to the alleged severance of lands, the greater portion of the works will be underground; and as to the parts above ground, they will consist of bridges and other works across streams, not causing any severance. The Corporation hold that, as to the right of ingress and egress, the income of the owner of the land will not be interfered with; as to shooting, the ground is not suited for birds, and the rent of such land would be nominal; as to water, that the only serious question of compensation is as to one corn-mill; and a general negative with regard to mines and minerals.

Mr. Balfour Browne, Q.C., and Mr. W. J. Waugh appeared for the claimant; Mr. Cripps, Q.C., M.P., and Mr. Freeman represented the Corporation.

Mr. Balfour Browne, in opening the case, said Mr. Yorke's claim was not for the value of the land *per se*, but for compensation for taking a strip eight miles long out of the very centre of his estate, and putting in a foreign owner whose rights would affect the property very seriously. The main element of compensation was that, at the present time, Mr. Yorke was the owner of this estate absolutely; while, in future, right through the centre of the land there would be a new and another owner. The Umpire would know what an enormous sum a landowner now and then had given, in order to get rid of some small proprietor with an insignificant farm in the centre of his estate. One of the witnesses he would call would say that, if it had been a case of merely laying this pipe down and never touching it again, or interfering in any way with Mr. Yorke's rights, there would have been practically no compensation. But he could show that, by having this foreign proprietor in the midst of the land, with large powers to prevent Mr. Yorke from doing all he had done before, the damage to the estate was very considerable indeed. As to the matter of ingress and egress, it appeared at first sight a small one; but there was a good deal behind it. If a section of the conduit broke down, and new pipes had to be inserted, the workmen could not be expected to go to the top of the valley and come down the eight-mile strip of land, nor would it be feasible to take the pipes by such an extraordinary route. The Corporation would have a right of way, by necessity, in such case over the claimant's land; and the pipes could be carried by the nearest available route. That right of way must be paid for. Then with regard to the shooting rights, after the construction of the works, there would be disturbance of the game—the shooting would not be the same. There was a lead mine which would be affected by the conduit, because the water would be drawn off by which the lead was washed. From that mine, Mr. Yorke drew a royalty producing an annual income of £1000. The washing of the lead polluted the water; and therefore it would not be legal any longer to wash it. If the Bradford Corporation, by Act of Parliament or in some other way, would make it as legal in the future as it had been in the past to wash this lead, Counsel would take £15,000 off the claim. If the washing were stopped, Mr. Yorke's income of £1000 a year in this direction would cease; and the Corporation must pay compensation.

Evidence was then called in support of the claim.

Mr. *F. Phillips*, of Pateley Bridge, Mr. Yorke's agent, said there was a smelting-mill and lead mine on the estate at Lolly Scar. Mr. Yorke's revenue from these works last year was £1100, which included a royalty of one pig out of twenty; but it comprised also the lead left in the smelting-flue. In consequence of the building of the tunnel through the estate (which work was in progress), the water supply at four farmhouses had already been diminished.

In cross-examination, witness said the nearest washing would be a mile from the Corporation's works.

Mr. *J. Newbold* and Mr. *J. Atkinson*, tenants of farms on Mr. Yorke's estate, testified that, since the construction of the Corporation conduit, their supplies of spring water had been injuriously affected.

Mr. Cripps said the Corporation were not responsible in the way suggested by claimant's Counsel until the works were completed. The remedy lay against the contractor.

Mr. Balfour Browne contended that the Corporation were responsible during the construction of the works; but the point was one which could not be settled then.

Mr. *W. B. Woodhead*, of Bradford, gave a history of the Nidderdale estates since their purchase by Sir John Yorke in the year 1546. He said the chief hardship upon Mr. Yorke was that these works were laid out in such a way that the whole of the water would be taken into the conduit, and conveyed to a gauge-point, where 17 million gallons would go forward to Bradford, and the rest would pass down to the compensation reservoir. Of the land now required, two acres were for permanent works, and consisted of 51 patches. The damage done to the estate in this way would be very serious. The easement was 14,454 yards, with a width of about 6 yards. It carried with it the rights of repair and alteration, and substitution of tunnels, pipes, &c., a perpetual right of way over the whole distance, day or night, and with or without horses and vehicles, and the power of preventing Mr. Yorke and his successors in title for ever from building on this land or planting trees thereon. These rights could not be exercised without detriment to the estate. In the course of the eight miles, the conduit crossed seven principal streams, of which the Corporation took six. The taking away of the 17 million gallons of water meant withdrawing practically the whole of the summer water from the area crossed by the easement. He put down £5000 as compensation for the easement and the incidental damage to the estate; and £1530 for 51 detached plots of freehold—together, £6530. Adding 10 per cent. for compulsory sale, brought the amount up to £7183. As to the shooting, fishing, and sporting rights, the fishing had gone entirely, and the shooting right was spoiled. He considered that the rent of the sporting rights would be reduced by £100 a year; and multiplying that by 25 years' purchase gave £2500. As to the ingress and egress, this was a more difficult question. But the land was in six or seven valleys; and for access to the workings of the Corporation, some seven miles of right of way along these valleys would be given over to the use of the Corporation for all time. Taking the compensation for this at £500 a mile, he made £3500 on this head. As to the sheep-washing, the landowner would have to provide an artificial supply of water, with tanks and other works; and calculating that six of these would have to be constructed, at a cost of £400 each, with £100 for somebody to look after them, gave £2500. It was also claimed, on behalf of Mr. Yorke, that his mineral industry, as to which figures had already been given, would be destroyed; and for this £15,000 was put down in the claim. The value of the two mills involved was not large. He had put them at the nominal rent of £30 each, which at 18 years' purchase came to £1080. He also considered that the water on the estate that was not in running streams was of value to Mr. Yorke. The Bradford Corporation were taking 17 million gallons, which sold for 9d. per 1000 gallons. If the Corporation had not needed the water, somebody else might have wanted it. Taking it that Mr. Yorke had one-tenth of this water, or about 1¾ million gallons, to deal with, and putting the value of the water at the lowest price he had ever heard of—viz., ¼d. per 1000 gallons—it would yield an annual value of £638, or capitalized at

20 years' purchase it meant £12,760. All these claims together brought up the total to about £44,500.

Mr. CRIPPS remarked that the original claim was for £35,000; and he asked why it had been raised to £45,000 within 24 hours.

Witness said he was told on the previous night, by Mr. Balfour Browne, that there was a proprietary right in the water; and he was asked to supply the figures as to its value. So he took 1-10th of the water Bradford was getting, and 1-36th of the price they were receiving for it.

Mr. *R. Horsfall*, a surveyor of Halifax, said Mr. Yorke's estate would seriously suffer through the interception of the streams and springs by the Corporation. He valued the proprietary rights of the claimant to the underground water on his estate at the same figure as Mr. Woodhead, with whom he had discussed the matter.

In cross-examination by Mr. FREEMAN, witness said the consequential damage in connection with the easement was the fact that mining below the conduit would be stopped, and that no buildings or trees could be put above it. This damage he estimated at about £6000. The value of the land taken would be only a small fraction of that amount.

Mr. *J. Waugh*, the Arbitrator appointed by Mr. Yorke, said on the question of dual ownership, if the pipe now existed, he would advise him to pay £5000 to get rid of it and its foreign owner. The abstraction of water from the streams was a very serious matter for Mr. Yorke. The Corporation had a right to take 97 streams. The land on the lower side of the conduit would be much depreciated through losing the streams. The Corporation, after taking their 17 million gallons, sent back the surplus, not into the streams, but to the Gowthwaite reservoir. The Corporation had certainly to provide water for domestic and agricultural purposes; but such provision was not an adequate substitute for the natural supply of streams and springs. As to the sheep-washing on Mr. Yorke's estate, there could be no washing above the conduit, because it would pollute the streams; and there could be no washing below it, because there would be no water. Mr. Yorke received £280 in rent for shooting. With what Mr. Yorke shot over himself, he estimated the total rental for the acreage involved at £700 a year; and he considered this total rental would be depreciated to the extent of £100 a year. With regard to the underground water on Mr. Yorke's estate, he believed it would be more than one-tenth of the total quantity taken, as estimated by Mr. Woodhead, because there were hundreds of valuable springs in the district; and he was also himself of opinion that the water was worth ½d. instead of ¼d. per 1000 gallons. In his judgment, the loss of water in connection with the farms justified a claim of £500.

Mr. CRIPPS, in opening the case for the Corporation, said the claim was one of the most hugely exaggerated ones with which he had had to deal; and he said this because his view was that the amount to which Mr. Yorke was entitled was only between £3000 and £4000. The demand for £15,000 in connection with minerals was altogether outside the arbitration, because the Corporation did not intend to stop the lead-washing, which they did not think would affect the Gowthwaite reservoir. With regard to the claim of £12,000 for the underground water on the estate, he contended that it was not worth a farthing; and the very suggestion of compensation for it was an absurdity. On the point of law, also, the claim was bad. As to the loss to the farms, Counsel submitted that the Umpire could not consider the matter, because the Corporation could not take any water until after the compensation reservoir had been built. They had no power to take the water from these farms; and therefore, if the water was being withdrawn from them, the tenants had good ground for an action against either the Corporation or the contractors. But their claim was altogether outside and beyond the present arbitration. The same argument applied to the sheep-washing claim. Coming to the claims which the Corporation considered were questions of amount, the Corporation were quite willing to allow between £400 and £500 for the corn-mill and the saw-mill, which was all anyone would give after seeing them. As to the consequential damage from the easement, there was really none, except in relation to the shooting, for this was merely moorland, and the pipe seldom came to the surface. The permanent injury to the shooting could be only very small. The works were chiefly tunnelling and cut-and-cover, with a few manholes; and did the fact that a Corporation official would pass over the line of easement two or three times a year mean that Mr. Yorke's shooting rental would be depreciated by £100 a year? Besides, if Mr. Yorke asked specially that the official should not come along the line of the easement while he was shooting, the matter could be easily arranged. As to the building and planting of trees, he did not suppose the inability to carry out these operations along the line of easement in a district like the one in question was ground for compensation. He did not like to commit himself to figures; but, looking at the matter all round, he could not but think that the utmost compensation Mr. Yorke was entitled to for the laying of this tunnel through his land, and of making permanent works over the two acres, was a sum of between £3000 and £4000.

Mr. *J. Watson*, M.Inst.C.E., the Water Engineer to the Bradford Corporation, said the water-works administration in Bradford had never paid; and the suggestion of the other side that it was a profitable undertaking was wrong. He produced the parliamentary map of the works, signed by Lord Belmont, showing that Burn Gill and the Lolly Scar lead mine were both in the compensation area. The pipe which was now being laid would carry 10 million gallons a day. This would convey as much water as the Corporation would want for 25 years to come. The cut-and-cover work would carry 22 million gallons a day. A slight deviation was being made in the direction taken by the conduit as compared with the original plan. But he had Mr. Yorke's verbal assent to it; and he also received a telegram to the same effect from his assistant, who had a formal interview with Mr. Yorke on the subject. Of the eight miles of easement now being sought, a length of 4[illegible]7 yards was in tunnel at a depth of 400 feet and upwards below the surface of the ground, and a length of 6085 yards was in cut and cover, having an average depth of 12 feet. Witness gave other statistics as to the easement works, showing that they were nearly all underground. He said the works, so far as opened out, at no part disclosed evidence of minerals of any value, the prevailing characteristics being sandy clay, shale, and millstone grit, which constituted almost entirely the formation of the strata throughout the whole length of the land in question. Such materials were not of any commercial value to Mr. Yorke. In reference to the £12,000 which the claimant asked for underground water, the Corporation did not touch that water. Of the 97 streams which the Corporation had the power to absorb, they only took seven on Mr. Yorke's estate. With the exception of these streams, the Corporation did not take any surface water from the estate. He could not conceive the possibility of collecting the underground water and selling it. It was one of the most absurd proposals he had heard.

In cross-examination by Mr. BALFOUR BROWNE, witness said he should not object to the lead-washing water going into the Nidd, and afterwards into the Gowthwaite reservoir. Those interested in the stream had never objected so far; and there was no reason for upsetting the present state of things. The Lolly Scar lead mine was a mile away from the Gowthwaite reservoir. The streams absorbed by the Corporation were by no means largely supplied by springs. Instead of a hundred, he could only find in the district six springs on the Ordnance Map. He admitted that the seven streams taken by the Corporation were fed by a few of the 97 streams which the Corporation had the power to take; but they were not on Mr. Yorke's estate.

Re-examined by Mr. FREEMAN: The deficiency on the water-works accounts for several years had been made up out of the gas profits.

Mr. *C. Gott*, M.Inst.C.E., formerly the Water Engineer of the Bradford Corporation, said his valuation came to £2862. This did not include anything for the shooting, because, from his experience on the subject in connection with other moorlands on which the Corporation collected water, the works did not in any way interfere with the game, nor did the workpeople; and, further, the Nidd conduit—the subject of the inquiry—was outside the grouse moor area. The sheep-washing would not be affected. It was only an occasional operation; and if at the time the stream happened to be dry, the Corporation would be bound by law to supply water. The lead-washing was a matter in which the Corporation were not interested, because the water went into the Nidd. As to the getting of minerals generally, the work of the Corporation would not affect the estate. The suggestion that Mr. Yorke could collect the underground water in the district and sell it, was altogether impracticable.

Cross-examined by Mr. BALFOUR BROWNE: Apart from the fact that the water went with it, this land would not be worth twopence; and therefore his valuation included compensation for the water. If it had not been for the water, the Corporation would not have wanted the land at all.

Mr. BALFOUR BROWNE: Do you mean to say that the 5 million gallons of water a day which you will take from this estate are not worth more than £2862?

Witness: Mr. Yorke cannot sell it, and does not sell it. We have made bargains more favourable to the Corporation than this with regard to other areas in connection with these same works.

Mr. *F. Fowler*, a surveyor, of Sheffield, said his estimate of the amount which should be paid to Mr. Yorke was as follows: For the tunnel easement, £434; for the conduit, 284 chains at £3 and 160 chains at £4, which made £1492, or a total of £1926. He had estimated the value of the freehold taken at £150 per acre, and there being two acres, this would make a sum of £300. The damage to the saw-mill and corn-mill he put at £450; the damage to the sporting rights, at £300; and to trees, at £30. This made a grand total of £3006. In his opinion, there would be no interference with lead-washing or the getting of minerals.

Mr. *J. Smith*, a surveyor and valuer of 45 years' standing, said he had made a joint valuation with Mr. Fowler, and practically agreed with him in his estimate of the amount to be paid to Mr. Yorke in respect to the easement and the damage to his estate.

This concluded the evidence; and the proceedings were adjourned.

On the resumption of the inquiry on the 12th inst., the Umpire was addressed by Counsel for both parties; and he stated that he would carefully consider his decision—the case being a complicated one—and give it before Christmas.

The Opposition to the Welsh Water Scheme for London.—At the monthly meeting of the Newport Harbour Commissioners last Wednesday, letters were read from the Monmouthshire Conservators relative to the London County Council's water scheme, and opposition suggested. A letter was also read from Mr. T. Canning, stating that the scheme would kill the Usk. The Chairman said the project would destroy the Usk as a fishery river; and he did not see why a matter of something like 10,000 or 12,000 salmon should be done away with. With regard to manufactories, the scheme would materially affect them. Newport would be much injured, too, with regard to the water for the docks. A Royal Commission had pronounced against the scheme. It was decided that the Commissioners should take measures to arm themselves] with information with the view of opposing the project, if necessary.

Water-Works Extension at Tonbridge.—The Tonbridge Water Company have just completed a most important extension of their undertaking. During the last twelve months, they have constructed three new wells, each 10 feet diameter, with the result that a bountiful supply of excellent water is now obtainable; and on Friday last the Chairman of the Company (Mr. J. Fagg) started the new horizontal duplex compound condensing pumping-engine, erected by Messrs. J. H. Carruthers and Co., of Glasgow, to replace the machinery no longer suitable for the requirements of the rapidly increasing district. Mr. Fagg said it was a pleasant duty for him to take part in the proceedings, the event being an important one in the history of the Company. Engineering was making great strides; and he claimed that the Company were in possession of the most improved and up-to-date appliances for pumping and distribution. The Directors were certainly to be congratulated on having obtained an ample and unlimited supply of good water, and much credit was due to the able management of their Engineer (Mr. J. Lees), who had rendered such excellent service since his appointment in the spring of last year. We may add that the engines and wells are highly satisfactory, the engine-room has been remodelled and greatly improved, and considerable additions to the mains are being carried out.

SHEFFIELD AND THE LITTLE DON WATER SCHEME.

The Water Committee of the Sheffield Corporation recently had before them correspondence between the Corporations of Sheffield, Rotherham, and Doncaster on the question of an extended agreement respecting the water supply of the Little Don Valley, already referred to in the JOURNAL. This having been read, and the Chairman having reported as to the interviews that had taken place, it was resolved as follows:—

(1) That a further agreement be entered into between the three Corporations of Sheffield, Rotherham, and Doncaster, so as to provide that the terms of the agreement of June 12, 1895, shall apply to a scheme for the utilization of the whole watershed of the Little Don, and with regard to the cost of filtration works and maintenance of the same, and of other works in connection therewith; and that the seal of the Corporation be affixed to such further agreement.

(2) That the Sheffield Corporation in the session of Parliament of 1896 do promote a Bill asking for power to construct reservoirs and do other works in the valley of the Little Don or Porter River, and thereby to intercept and impound the waters of that river and its tributaries, for the supply of Sheffield, Rotherham, and Doncaster, in accordance with the agreement already existing between these Corporations, and dated June 12, 1895, and the last-mentioned supplemental agreement; to lay such mains as are mentioned in the said agreements; and to do all necessary works to enable the Sheffield Corporation to carry out their engagements under such agreements.

(3) That such Bill be so drawn as to include the right out of the water proposed to be impounded by the Sheffield Corporation from the Little Don Valley to supply the Corporation of Barnsley with water, in accordance with the offer contained in the letter addressed by the Town Clerk of Sheffield to the Town Clerk of Barnsley, dated the 24th day of October, 1895.

The Town Clerk (Mr. H. Bramley) laid before the Committee the draft parliamentary notice for the promotion of the above-mentioned Bill, and, with certain alterations then proposed, it was agreed to.

PROPOSED NEW WATER-WORKS FOR BASINGSTOKE.

Local Government Board Inquiry.

Last Friday, Mr. F. Tulloch, C.E., continued an inquiry, on behalf of the Local Government Board, in connection with an application of the Basingstoke Town Council for power to borrow a further sum of £16,000 for the construction of water-works. Considerable interest was aroused in the proceedings, on account of the very strong opposition which has been raised against the scheme; this feeling having been accentuated by the defeat of Mr. A. Dowling, the Chairman of the Water Committee, at the municipal elections held since the inquiry was opened.

The TOWN CLERK (Mr. W. H. Bayley) informed the Inspector that in 1883 the Corporation purchased the present undertaking from the Water Company; but though some of the plant went with the purchase, neither the well nor engines did so, as it was the intention of the then Town Council to erect proper works of their own. They consulted Mr. T. Hawksley on the matter in 1885; and a scheme was prepared, but it was considered too expensive to proceed with. The present works consisted of a well with headings in what was known as the Dell The engines and boilers used for pumping the water were leased by the Corporation; and the water was pumped to a reservoir on the northern side of the town—a stand-pipe being kept, over which the water was pumped in order to supply, as far as possible, the high levels of the town. There was a consensus of opinion that there should be an extended service in the hands of the Corporation; and in February, 1894, Mr. Rofe was instructed to prepare a scheme, which was the one now under consideration.

Mr. *Henry Rofe*, M.Inst.C.E., said he acted for the Basingstoke Corporation when they purchased the existing works in 1883; it being then admitted that new ones were absolutely necessary, at an expense put by Mr. Quick, the Engineer engaged in the arbitration, at £6447, of which £1000 was estimated as the cost of a high-service tank to supersede the objectionable mode of supplying the high levels by means of a stand-pipe. In February, 1894, the Corporation consulted witness, who then found that, though a new reservoir had been constructed, the high-service tower had not been carried out; the stand-pipe being still in use. In 1881, the average daily supply of water for all purposes was 263,194 gallons; in 1891, the quantity was 290,000 gallons; in 1892, it was 322,000 gallons; and in 1894, 400,000 gallons. To meet this increase, he should advise the erection of a pumping-station capable of supplying 750,000 gallons a day (by the putting down of two engines), in the proportion of two-thirds to the low-level and one-third to the high-level reservoir.

The INSPECTOR asked if the old works would be abandoned in the event of the new ones being carried out.

The TOWN CLERK replied in the affirmative.

Witness (continuing) said the new reservoir would hold 250,000 gallons, or one day's supply to the high levels. The new well had been sunk into the chalk at Sherborne; and he would say that 400,000 gallons at least had been pumped out of it per day, and if he wanted 2 million gallons he would be content to go into the same area. He estimated the cost of pumping a million gallons at the new works at £2 17s. 6d., or 0·69d. per 1000 gallons. The cost of pumping and distributing a million gallons at the old works was £7 16s.; whereas at the new works it would be £5 14s. 6d., including wear and tear of machinery, and all other incidentals.

Mr. *J. Whitaker*, F.G.S., of Southampton, said he considered the proposed new works would be a vast improvement on the existing ones, which, being in an inhabited area, with the ground-level not a great way above the water-level, might easily lead to an absorption of impurities from the surface or from cesspools around.

Mr. *J. Edney*, the President, and Mr. *A. H. Barton*, the ex-Captain of the Fire Brigade, testified to the inadequate supply of water available under the existing arrangements in case of an outbreak of fire.

Mr. *A. Dowling*, the ex-Chairman of the Water Committee of the Corporation, said he considered the old system of pumping was bad, dangerous, and totally unequal to the present requirements. Many complaints had been made about the inadequate supply to the higher parts of the town; no water being available except when they were pumping over the stand-pipe. Mr. Rofe's first estimate for the proposed extension was £6000; but when the scheme was more thoroughly gone into, it was altered to the present figure.

Mr. *S. Bird* contended that the changes were made without the sanction of the Town Council, who merely considered a scheme limited to the provision of a new pumping-station which was to cost about £6000. When Mr. Rofe's latest proposal was received, it was a complete surprise to everybody. A scheme of such magnitude was never dreamt of, and would not have received a second thought if Mr. Rofe had not emphatically declared that the Local Government Board would not sanction a loan for a scheme which did not provide for a constant supply of water to the high-level districts, and that he personally could not undertake one which did not furnish it.

Mr. *H. Smith* said a public meeting had unanimously declared against the scheme, as unnecessarily elaborate and expensive under the circumstances. It would cost nearly £20,000; whereas if his (Mr. Smith's) scheme were adopted, it would not exceed £6000. His figures worked out as follows: New well and adits at Sherborne Bottom, £1800; engines and pumps, £2900 (engines to be in duplicate, and capable of pumping 30,000 gallons per hour); cost of inquiry and professional charges, £150; annual cost of pumping over the stand-pipe, £937; and there would be the cost of the land, &c. He did not hesitate to say the existing plant at the old works would last another twenty years; and at a previous inquiry, evidence was adduced to show that the water-works were then substantial in every way.

The inquiry then closed.

THE OLDHAM CORPORATION WATER-WORKS.

On the occasion of a recent visit of the members of the Oldham Corporation to their water reservoirs, a description of the various works was distributed among them; and from it we take the following: At Strinesdale, there are two reservoirs, which were constructed under powers obtained in 1825 and 1838. The drainage area of 660 acres has been lately rejected, owing to the many farms, &c., on the gathering-ground rendering the water flowing therefrom objectionable for domestic use. The dilapidated and unsafe condition of the old watercourse has made it compulsory on the Water Committee to renew it without delay. The work is in hand, and is estimated to cost £3500. At Castleshaw, the ceremony of cutting the first sod was performed on May 25, 1887; and the works were opened on Sept. 30, 1891. The water is conveyed to Strinesdale in cast-iron pipes, 30 inches in diameter, and about 4½ miles in length; 1½ miles being laid in the tunnel passing under High Moor. The drainage area is 950 acres; and the aggregate storage capacity, 389 million gallons. The cost of the works, inclusive of land, has been £226,100. At Denshaw, the first sod was cut on July 26, 1876; and the works were opened on July 26, 1883. Recently Dowry Castle and Rag Stone Estates have been purchased at a cost of £8760. The drainage area is 1350 acres; and the aggregate storage capacity is 381 million gallons. The total amount expended, inclusive of land, has been £253,552. At Rooden, the first sod was cut on July 30 last year. Owing to the physical features of the ground, two embankments are required to form the reservoir, which was estimated to hold 225 million gallons. The peat and other excavations removed from the bed of the reservoir will increase the capacity by 20 millions. The reservoir has no drainage of its own, with the exception of 25 acres; but a projected tunnel from Ready Con Dean Brook, and an intended watercourse to intercept the two main streams in Piethorn Valley, will deliver into the reservoir the rainfall from 778 acres of moorland. In wet seasons this water has formerly run to waste. Puddling in the northerly trench is now proceeding. A depth of 83 ft. 6 in. had to be excavated before reaching solid strata; and excavations are proceeding in the southerly trench. The construction of this reservoir completes the series for which statutory powers were obtained by the Corporation in 1886. The estimated cost is £89,256. The Act of Parliament for the construction of the Piethorn works was obtained in 1855. The watercourse on the north-westerly side of the valley is being reconstructed at an estimated cost of £1750. The embankment of the Ogden reservoir was recently raised 10 feet; thus providing an additional storage of 64 million gallons, at a cost of £21,662. This sum includes the purchase of the property at Spring Mill. The aggregate storage capacity of the reservoirs in Piethorn Valley is 696 million gallons; and the drainage area is 1820 acres. The Brushes Clough and Besom Hill reservoirs and conduit were constructed under powers obtained in 1855. The area of the gathering-ground is 700 acres; but, on account of land cultivation, the water from one-half this area is not collected. The total amount expended on the water-works at March 25 last was £1,064,487.

The Water Supply and Sewerage of Linslade.—The Linslade Parish Council, at a meeting on Friday, the 8th inst., awarded the first premium for the competitive designs for the sewerage and water supply of the district to Messrs. R. F. Grantham and Son, Northumberland Avenue, London, and the second premium to Mr. H. B. Nichols, of Birmingham. The rateable value of the district is about £20,000; and the estimates of cost varied from £3200 to £9900.

The Okehampton Town Council and the Gas-Works.—Some time ago the Okehampton Town Council opened negotiations with the Gas Company with a view to the purchase of their works and rights; and at a meeting of the Council yesterday week, the reply of the Company was read. They said that, after consideration, they were willing to sell the works to the Corporation for £3000, exclusive of the gas cooking-stoves. Alderman Passmore moved that the letter be referred to the Lighting Committee, and said the Company had asked about 100 per cent. more than their works were worth. The motion was agreed to.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Few headlines in a newspaper are more effective in the matter of arresting the attention of the ordinary reader than "An Explosion of Gas," more particularly if the word "Alarming" can be inserted in it, which it nearly always is; and consequently the ordinary reporter, catering for, if not creating, the tastes of his readers, is not slow to serve up very highly magnified accounts of such occurrences. The close of the last sentence, I am sorry to say, is not by any means confined to accidents which have a connection with gas, but may be applied to the whole range of journalism. A local newspaper may generally be relied upon to give a fair account of any occurrence, so far as the capacity of the writer will carry him; but there are in the ranks of that class of journalists who are known as correspondents, many unscrupulous gentlemen who spice up their paragraphs to such an extent that they are altogether useless for their only purpose, which is to give information. There are two reasons for this state of matters—first, the introduction of the new journalism, which aims at telling a good story, irrespective of the facts, in order to make a sensation, of which you have several examples in London; and, second, in the case of correspondents who are paid by the line, the scramble to get their communications accepted. The latter works out in this way: Suppose a fall of snow—say, of one inch—takes place, every correspondent will be sending in an account of it. There is not space for them all, and the man who tells honestly that it was only one inch will have his manuscript relegated to the waste-paper basket; while the one who can make it four or five inches will have his accepted. If a gale of wind blows, the man who can make it the most terrific gets the pennies for his lines. There is thus a great temptation to exaggerate; but more's the pity that it should be taken advantage of, because the result is to shake the confidence of the public in accounts which they see in newspapers.

Of gas explosions, I have three on my list this week—one at Forfar, one at Aberdeen, and one at Hamilton. So far, the Aberdeen one was the most serious—not perhaps the most violent—in respect that the cause which led to it also led to the loss of a man's life. The man was a labourer, who lived alone in a one-roomed house. He had not been seen since Sunday; and on Wednesday afternoon a lad was sent by his relatives to see why. The door was not fastened; and the lad, on entering, found the house in darkness. Noticing a strong smell of gas, he, without thought, struck a match; and an explosion occurred, which could not have been very violent, as it only blew out several panes of glass in the windows, disturbed some furniture in an adjoining house, which was separated from this one by a partition, and singed the lad's hair. The occupant of the room was found lying dead on his bed. He had been dead for some time; his death having been due to suffocation by gas. Some of the neighbours perceived a smell of gas from Monday onwards, but called no attention to it; and their carelessness probably lost the man's life. As in so many other cases where fatalities from gas occur, no gas was used in the house; but it had been at one time. When the gas-meter was taken away, the end of the service-pipe was soldered up, for which care the Gas Manager (Mr. Smith) deserves to be commended; because it is not uncommon to have the end simply battered flat. In this case, the service-pipe ended in a cupboard; and the occupant of the house having used the cupboard as a receptacle for coal, it is concluded, I think with safety, that the end of the gas-pipe had been fractured either by the tumbling of the coal in or by the shovelling of it out—most probably the latter. This story, as taken from a local paper, is moderately told, and bears on the face of it that it is accurate.

The explosion at Forfar was the most interesting to your readers, as it took place within the gas-works; and the young Manager of the works (Mr. Forbes Waddell) was at first reported to have narrowly escaped with his life. This, however, according to the latest information, turns out not to be the case; but it is by no means the only exaggeration which was published regarding the affair, in the manner of which I have written above. The occurrence took place shortly after ten o'clock on Monday night; and my attention was first called to it by a Glasgow newspaper on Tuesday morning. The account was very alarming; the expression occurring that "the loud report and the crashing of masonry and glass alarmed the town." But a Dundee newspaper, apparently served by the same man, improved upon this by adding that, "so loud, indeed, was the report that it shook the houses in the locality, and was heard a considerable distance from the town. Following the report, an escape of gas took place, which caught fire, and brilliantly lighted up the surrounding district." It was added that "the retort-bench was entirely wrecked, while the retorts adjoining were also considerably damaged;" that "the pipes of the retort-bench, which measured 12 feet by 9 inches, and weighed about half a ton, were completely destroyed;" and so on. The inference was that the gas-works were almost in ruins. It is considerable relief, therefore, to learn, through more moderate sources, that the damage which was caused by the explosion may be covered by from £25 to £30. So far as I can discover, what took place was this: Last summer Mr. Waddell had a new retort-bench erected on a regenerative system which was to a large extent his own. The settings were in fives; but there was one setting of four retorts, which had been in use during the autumn, when the consumption of gas was not so large as it is now. When the larger settings were put in operation, the small one was let down. Mr. Waddell had resolved to bring it into use again; and on Monday, after seeing to the night pressure, he went to look after the lighting up of the small oven. It is said that when he opened the door of a retort (by which I presume is meant the furnace door), gas which had accumulated inside exploded. Mr. Waddell's account has not been issued yet; and as only he and one of the workmen, named Stark, were in the retort-house at the time, it is not very clear what took place. There was, however, an explosion which was something more than the "blaff" which is frequently heard when a retort is opened, and there could be a considerable outburst of flame. Part of the front of the oven was blown out; and two ascension-pipes were brought down. That seems to have been the full extent of the damage to property. Unfortunately, Mr. Waddell, who was working at the oven, was hurt by the falling bricks and pipes, and was rather seriously burned. The other man was injured, but much less seriously. Mr. Waddell was found lying on the floor of the retort-house in an unconscious condition; and was carried into his residence, which adjoins. He shortly recovered consciousness; and the latest report about him is that he is progressing favourably, which everyone will be glad to hear. It is a most unfortunate accident, if for no other reason than that it will give a handle to those members of the Corporation who are not too friendly to Mr. Waddell. The cause of the explosion is said to have probably been the wheeling of a barrow of coke past at the time the door was opened. That is not a satisfactory explanation, as, if it had been the case, the barrow would have been there to show that it was so. I have a belief that it happened in another, and quite a natural way; but until Mr. Waddell gives his version, I think it better not to put forward my view. Mr. Waddell's brother, Mr. A. Waddell, who is Manager of the Broughty Ferry Corporation Gas-Works, was sent for the same night; and he saw to the work being continued. Thereafter Mr. Peter Thorn, the clerk at the works, under the direction of the Gas Committee, took charge of the works. Arrangements are already being made for the restoration of the damaged portion of the oven, and of the glass in the roof which was broken.

The third explosion, at Hamilton, took place on Thursday afternoon, and was of a very trifling nature.

On Wednesday morning fire broke out in the Barrhead Gas Company's works. The stokers were cleaning a choked pipe from an oil-gas retort, when the escaping gas ignited the roof of the retort and boiler house. That part of the roof, despite prompt exertions on the part of the Manager (Mr. J. W. Carmichael) and his staff, was destroyed. The damage done is estimated at about £100.

Bailie M'Hale has been appointed Convener of the Gas Commission at Hamilton, in room of Mr. Brown, who has left the Council. The new Commissioner will probably give me more to do than the old one did.

Tenders were lately received by the Glasgow Corporation Sub-Committee on Gas-Works for the timber framing, &c., required in connection with the large gasholder which is about to be erected at the Tradeston Gas-Works, and for which the tank is now in course of construction. The three lowest offers were sent to the measurers to be checked; and the Secretary was authorized thereafter to accept the lowest tender. Messrs. Lamb and Stewart, of Glasgow, have been successful in securing the contract. Eleven tenders were sent in for the supply of the timber required for the supporting framing, and for the execution of the work in connection therewith.

Some weeks ago, a man named Robert Dunn, labourer in the pipe-store at Howard Street, Bridgeton, belonging to the Glasgow Corporation Gas Commissioners, met his death by accident, when helping the foreman (his own brother-in-law) to move some large pipes. Application was made by his widow to the Gas-Works Sub-Committee for compensation; and an inquiry into the circumstances was made by the Convener of the Committee, along with Mr. Fife and the Law Agent. In their report on the matter, they recommended that (without admitting legal liability) the Corporation should pay the funeral expenses of the deceased, and also a sum of £150 to his widow for herself and her children. The recommendation has been approved of and acted upon.

The Portobello Gas Company have replied to the Town Clerk of Portobello, who had written asking a reduction in the price of gas supplied to public lamps, that in consequence of the cost of the upkeep of the lamps, and the exceptionally heavy outlay upon street improvements recently, the Directors do not see their way to make any reduction upon the existing terms.

Parliamentary notices are appearing this week. There is to be nothing very large, either in connection with gas or water, from Scotland this year. The largest is the scheme for the extension of the boundaries of Edinburgh, so as to include the towns of Leith and Portobello, as well as a large slice of the county of Mid-Lothian. Were the measure to pass—which I suppose not even the most sanguine of its promoters expect will happen in the next session of Parliament—the area of gas and water supply would then be practically coterminous with the city boundaries. It is therefore proposed to take power to compulsorily acquire the undertaking of the Portobello Gas Company; and also to merge the Gas Commission and the Water Trust in the Town Council—the officials and employees of those bodies becoming Corporation servants. The measure will most probably be opposed by the Leith Corporation, and, formally at least, if not more forcibly, by the Portobello Gas Company. The Corporation of Portobello seem, as yet, to be favourable to the proposal, if they obtain the terms they wish.

The Falkirk and Larbert Water Trust have given notice of a Bill to empower them to augment their water supply, which is to be effected chiefly by raising the levels of the existing reservoirs. The scheme is likely to be opposed, unless along with it there is an extension of the area of compulsory supply.

The Bill which the Dundee Corporation were proposing to introduce, the principal provision of which was to have been the taking of power to borrow money in connection with the gas undertaking, has been abandoned for this year. When the Committee came to consider the Bill, they found a number of things cropping up, which certain members were pressing for inclusion in the measure; and as there was not time to consider them all, it was resolved to drop the Bill.

The Arbroath Gas Corporation have accepted the offer of Messrs. Pettigrew and Co., of Middlesbrough, to erect the sulphate plant in their works, at a cost of £357. They have also resolved to abolish meter-rents.

With reference to the Arbroath water supply, the Police Commissioners on Monday night unanimously resolved to rescind the resolution of the last Commission to proceed with the introduction of a gravitation supply, and remitted to a Committee to consider the augmentation of the supply from the pumping-stations in the Nolt Loan.

It is not often that complaint is heard that the price of gas has been unduly reduced; yet this took place at a meeting—a rather hole-and-corner meeting, I should call it—in Arbroath on Wednesday. The persons who met are holders of bonds to the amount of £5000, which were granted them in respect of loans for harbour purposes. Part of the security under these bonds was gas profits to an extent not

exceeding £250 a year. The complaint now made is that the Corporation, in reducing the price of gas from the figure it stood at when the bonds were granted—namely, 5s. 8d.—to 4s. 2d. per 1000 cubic feet, have prevented a surplus being earned on the gas supply. The Chairman of this meeting, which, all told, numbered eight gentlemen, indulged in some heated fulminations against the accounts of the Gas Corporation; and was understood to mean that the accounts might have been prepared so as to bring out surpluses from which harbour interest might have been paid. A Committee was appointed to lay the matter before the Town Council. I hope they will get snubbed. It would be worse to take gas profits to pay interest on harbour loans than it would be to take harbour profits to assist the gas undertaking, did it require help. If the bondholders accepted a nebulous security like that they hold, that is their look-out; but gas consumers ought not to be made to suffer in order that they might get their interest. Let that be paid out of the rates; in which case it will fall equally upon all.

Sulphate of ammonia is reported to be selling in Scotland this week at £8 15s. per ton for spot delivery, which is a shade firmer.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 16.

Sulphate of Ammonia.—Early in the week, the market was very quiet at a slight decline; but within the past few days, there has been more inquiry; and it looks as though the operators were being obliged to come in to cover their November sales. So far, they are moving very cautiously; but everything offering at the lowest points has been picked up, and in some quarters an advance has been realized. The closing value is about £8 15s. f.o.b. at the ports. For forward delivery, the situation is practically unchanged; for, although buyers seem more disposed to operate, sellers remain firm, and not much business has therefore been done.

Nitrate of Soda is quiet at 7s. 9d. per cwt. on spot. The forward position is unchanged.

LONDON, *Nov.* 16.

Tar Products.—A sharp advance has taken place in the benzol series. There is no doubt now that the benzol going into consumption for enriching gas has relieved the market of any surplus existing before. There are pressing inquiries in every direction; and it would appear that benzols will yet see higher prices. Pitch is somewhat languid at former rates. But most makers are fully sold; and heavy shipments are being made. Price tends towards easier rates for next year's delivery. Carbolic acid is in fair request; and old stocks having been cleared out, it is reported that makers are shorter of this article, in any of its forms, than has been the case for many years. Anthracene is reported firmer on the Continent; and for good brands there is a distinctly improved inquiry. Solvent naphtha has participated in the improvement in benzols; and the market for naphthalene salts is steady. The values obtainable during the week are: Tar, 19s. to 23s. 6d. Pitch, 35s., west coast; 38s., east coast. Benzols, 90's and 50's, 1s. 6d. Solvent naphtha, 1s. 3¼d. Toluol, 1s. 6½d. Crude, 30 per cent., naphtha, 5½d. Naphthalene salts, pressed, 50s.; drained, 27s. Cresylic acid, distilled, 1s. 2d.; crude, 9d. Carbolic acid, 60's, 1s. 8d.; 75's, 2s. 0½d. Anthracene, "A," 1s.; "B," 9½d.

Sulphate of Ammonia appears hopelessly to be in the hands of operators and dealers; and, although considerable shipments are taking place, and stocks are largely reduced, there seems to be no recuperative life in the article, although important business has been done at London, £9; Hull, £8 15s.; Newcastle, £8 15s.; Leith, £8 13s. 9d.; Liverpool, £8 17s. 6d.; Glasgow, £9—all less 3½ per cent., delivered f.o.b., bags included. For forward delivery, an advance of 5s. to 10s. is asked. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—In the coal trade here business has again quieted down. Very few pits are working full time; while in most cases where advances were attempted on list rates with the commencement of the month, these have had to be abandoned. The only real upward move is where prices which were previously exceptionally low have been pulled up to list rates. For house coals the demand, which recently briskened up owing to the colder weather, has now fallen to only moderate dimensions. Prices still average about 10s. 6d. per ton at the pit for best Wigan Arley; 9s. to 9s. 6d., for Pemberton four-feet and seconds Arley; and 7s. to 7s. 6d., for common house-fire qualities. The inferior descriptions of round coal, which did not appreciably participate in the spurt of activity with the commencement of the month, are in very slow demand; and with a continued excess of supplies over requirements, prices necessarily are kept at a very low point. Good descriptions of steam and forge coals do not average more than 6s. to 6s. 6d. per ton at the pit mouth; whilst in the shipping trade, which continues very depressed, ordinary descriptions of steam coal are obtainable at 7s. to 7s. 6d. per ton delivered at Mersey ports, or 7s. 3d. to 7s. 9d. delivered at the Partington tips on the Manchester Ship Canal. With regard to engine classes of fuel, medium qualities still move off fairly well at about late rates; but inferior descriptions hang on the market, with concessions on quoted rates offered to effect clearance sales. Average quoted rates remain at about 3s. to 3s. 6d. per ton at the pit mouth for common, to 4s. 6d. and 5s. for best sorts.

Northern Coal Trade.—There has been some interruption to the working of most of the collieries, owing both to the lack of orders for steam coal, and also to the delay of steamers through the stormy weather; so that the work has for the last week been very scanty at many of the Northumbrian collieries. At the Durham pits, there has been an occasional stoppage through the non-arrival of steamers; but most of the gas-coal pits have now full work, and there may be even pressure to obtain full supplies before a month is over. Best Northumbrian steam coals are still quoted at 8s. per ton f.o.b.; but sales at lower prices have taken place, and the want of work at some pits weakens the rate. Second-class steam coals are 7s. 6d. per ton f.o.b. generally; and steam smalls are about 4s. per ton. Tenders have been taken this week for the large contracts for the locomotive coal for the North-Eastern Railway; but it is probable that they will not be decided on for a fortnight, and in the end the price to be paid will be much lower than that under the contracts that are now running. The extreme dulness in the steam coal trade will make locomotive coal cheap. In household coal the demand is increasing; but there is an abundant supply. For shipment, the quotation for this class of coal varies from 10s. to 11s. per ton f.o.b. Gas coals are now in very strong demand; and for about three weeks there will be very strong pressure to obtain adequate supplies for the winter season. The quotation for best Durham gas coals for odd cargoes is now from 6s. 9d. to 5s. 3d. per ton f.o.b.; but most of the pits have very little coal to spare after meeting the large deliveries on contracts of long standing. Manufacturing coal is steady; and contracts that are being renewed for another year are generally at the prices that have ruled this year, so that this branch of the trade seems better than the steam coal trade in prospect. Coke is steady at from 14s. 6d. to 15s. per ton f.o.b.; but the exports are rather lower than they were, though the home consumption is still very heavy, and likely so to continue. Gas coke is rather fuller in production, but is well taken up both for export and locally; and there is no alteration of moment in the price this week.

Scotch Coal Trade.—Trade in Scotland is neither better nor worse. The shipbuilding dispute on the Clyde is doubtless interfering a good deal with it; but there is, notwithstanding, a good volume of trade, though rates do not improve. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 3d. to 6s. 6d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 161,766 tons—a decrease as compared with the preceding week of 2368 tons, but an increase over the corresponding week of last year of 10,969 tons. For the year to date, the total shipments have amounted to 6,428,798 tons—an increase on the corresponding period of last year of 2,070,819 tons, but a decrease as compared with 1893 of 38,365 tons.

Sales of Shares.—A few fully-paid 6 per cent. preference shares (£12 10s. each) in the *Salisbury Gas Company* have recently been sold by auction at £18 7s. 6d. and £18 10s.——At the Mart, Tokenhouse Yard, last Wednesday, £50 of 6 per cent. second mortgage debentures of the *Cape Town and District Gas Company* were sold for £53 10s.——At the Sun Hotel, Shipley, last Thursday, Mr. W. Booth sold by auction £4000 of new ordinary 7 per cent. stock of the *Shipley Gas Company*, at prices ranging between £168 and £171 per £100 of stock.——About 100 shares in the *Bournemouth Gas and Water Company* have recently changed hands at £29 10s. per share for £10 original shares, £17 15s. each for "B" shares, and £18 15s. each for 6 per cent. preference shares.

The Explosion in the Strand.—The inquiry into the circumstances attending the death of Fireman Sprague through injuries caused by the fall of buildings in New Church Court, Strand, on the 29th ult., subsequent to an explosion, was resumed yesterday. Evidence was given on behalf of the New River Company and The Gaslight and Coke Company; among the principal witnesses for the latter being Sir Frederick Bramwell and Mr. G. F. L. Foulger. At the close of the evidence, the Coroner, (Mr. John Troutbeck), in directing the jury, exonerated from culpable negligence all parties interested; and the jury simply returned a verdict of "Accidental death." A report of the evidence touching upon the cause of the explosion will be published next week.

The West Kent Boards and the London Water Bills.—The presentation of the proportionate costs incurred by the various local authorities in West Kent in opposing the Water Bills of the London County Council is causing some friction; several of the Boards objecting to pay anything. At the meeting of the Bexley Urban District Council last Thursday, application was made for the payment of £52 16s. 6d., the sum apportioned to that district. Mr. Cottell proposed that, as the Council had not by resolution agreed to incur any liability, payment be declined. Mr. Pitt seconded the proposition. Mr. Lucas thought this would be exceedingly shabby, and might also prove foolish; for, should they refuse to pay their share, in the event of a Joint Water Trust being formed, they would probably find Bexley excluded from the advantages. It was decided that further inquiries should be made.

The London Vestries and the Water Supply.—At the last fortnightly meeting of the Bermondsey Vestry, presided over by Mr. A. Pomeroy, the Finance Committee reported that an account had been sent in to the Southwark and Vauxhall Water Company, amounting to £144 18s., for supplying the inhabitants of the parish with water during the severe frost of last winter. The Company had written stating that they could not accept or recognize any liability or responsibility whatever in the matter. Mr. Ball said he was not sure that the Vestry had any real claim on the Company; but the Committee were strongly of opinion that the money should be paid. If the Company persisted in their refusal to pay, he believed the Vestry had no power to force them to do so. He moved the adoption of the report. Mr. Maule seconded the motion, and said the Lambeth Water Company had reimbursed the Vestry in a similar case; and he thought the Southwark and Vauxhall Company should be made to do the same. The Vestry ought also to express their opinion of their sense of the injustice of the matter. The report was adopted; and it was decided to send two of the officials of the Vestry to see if they could come to any settlement with the Company. The General Purposes Committee reported the receipt of a letter from the Lambeth Water Company asking if the Vestry would be prepared to assist them in supplying householders with water by means of water-carts in the event of a severe frost; and inquiring what the charge would be per day, including a horse and two men. The Committee advised that the Company should be informed that the Vestry was prepared to do so. This was agreed to; and it was also decided that a communication should be sent to the Southwark and Vauxhall Water Company stating that the Vestry were also prepared to supply them in a similar manner.

Reduction in Price.—The Directors of the Brighton and Hove Gas Company have decided to reduce the price of gas 2d. per 1000 cubic feet as from Jan. 1 next.

The Burnley Corporation and Prepayment Gas-Meters.—The Gas Committee of the Burnley Corporation have decided to apply to the Local Government Board for power to borrow £5000, the greater portion of which sum is for the purchase of prepayment meters. A larger number of the poorer class of the inhabitants within the area of supply have shown a disposition to avail themselves of this system of obtaining gas.

Rejection of the Sheffield Water Scheme by the Barnsley Corporation.—The Town Clerk of Barnsley reported to the Town Council last Saturday week that the letter which had been received from the Sheffield Corporation respecting the Barnsley Water Bill (*ante*, p. 936) had been before an informal meeting of the Council; and it was unanimously directed that the following reply should be sent: "Your letter of the 24th ult. has been duly considered by the Barnsley Town Council; and they desire me to express their surprise that the letter has been made public before it was possible to lay it before them. In the opinion of the Council, your letter does not disclose any grounds of objection to the Barnsley Water Bill which were not urged on behalf of the Sheffield Corporation when the Bill was before the Committee of the House of Lords, by whom it was approved. The Council are unable to accede to the proposals contained in your communication, and they therefore instruct me to inform you that it is their intention to proceed in the next session of Parliament with the Bill, which they believe, but for the dissolution of Parliament, would have become law."

Cost of Works for Safeguarding and Filtering the Water Supply of Bolton.—During the recent municipal election campaign at Bolton, Mr. Lythgoe (one of the candidates) ventured to assert at a public meeting "that the rates were being kept down at the expense of the public health." This charge was characterized by Alderman J. Miles, also at a public meeting, as a "base and calumnious one;" and he has since supported his words in a letter to the local press. In this, he deals mainly with the work of the Water Committee, in order to show what they have done to render the water supply as pure as possible. He says that since 1879, no less a sum than £77,409 has been spent by the department to this end; the following being the work executed, and the cost: Heaton watershed—enclosing streams in earthenware pipes, stone drains, &c., £2647; Heaton filter-beds, £7794 4s.; Sweetloves filter-beds, £39,857 4s. 9d.; Egerton filter-beds, £611 3s. 2d. Entwistle watershed—enclosing streams in earthenware pipes, stone drains, &c., £3000. Entwistle reservoir—stone breaching slopes, &c., £20,000. Dingle reservoir—removing dirt from inside, £3500. Alderman Miles also mentions that, since 1875, the sum of £154,820 has been transferred from the profits of the department to the relief of the borough rate. He has authority for saying that the water supplied in the district at the present time is as good, wholesome, and pure as any water gathered and supplied in Lancashire.

Proposal to Acquire the Deal and Walmer Water-Works by Local Authorities.—The Walmer District Council have been discussing the question of the purchase of the local Water Company's property; and the Deal Town Council will be invited by one of their number to consider the matter at their next meeting. The member who introduced the subject at the meeting of the Walmer authority was Mr. T. Denne, who, having stated that the public had suffered great inconvenience from want of a proper supply of water, advocated the desirability of coming to an arrangement with the Deal Town Council to purchase the concern. He showed that it was a profitable undertaking, by declaring that the Company were paying a 10 per cent. dividend. Quoting several figures, he worked out the present capital value as £46,715; and compensation and other expenses ran up the total estimate to about £50,000. The actual capital subscribed was £28,000; so that he thought it would be a fair bargain. The income from rentals on the rateable value was £2560; from meters, &c., £890; and from rents and sales, £20—making a total of £3470. The expenses Mr. Denne calculated at £2750. There would thus be a balance of £720; and he thought they would get even more profit than this, if the concern were properly managed. It was agreed that a Committee should be appointed to confer with the Deal Town Council as to the desirability of the supply being taken over by the two authorities; and five gentlemen were afterwards selected.

Purchase of the Shoreham Water-Works by the Brighton Corporation.—At a special meeting held on the 7th inst., the Brighton Corporation decided to acquire the undertaking of the Shoreham Water Company. The terms of purchase are as follows: A sum of money which, if invested in Consols at the market price current on the day of the date of the agreement, will produce an income of £1304 per annum (that being the total amount of the yearly interest payable on the Company's called-up share capital), and the following several sums in addition—viz., the sum of £4875, being the par value of the debenture capital; the sum of £1000, being the amount of the reserve fund; the sum of £500 to be divided among the Directors in settlement of their fees; and the sum of £5300, being for and in respect of back unpaid dividends and prospective value. The Company will be prepared to accept, in lieu of the first item, sufficient Brighton Corporation stock to produce the yearly income of £1304. The amount of such stock to be given would be £47,250; representing, at a quotation of £120, a cash equivalent of £56,700. The Corporation will include, in a Bill they intend to promote next session, an application for power to raise £100,000 to cover the cost of the purchase of the undertaking and of any additional works that may be necessary in connection therewith. We learn from a local correspondent that the decision of the Corporation has come with some surprise to the other governing bodies of the neighbourhood, for a Committee was appointed some time ago by the New Shoreham Urban District Council and the Steyning East and West District Councils, with a view to purchasing the undertaking. But they have been so long in getting to work that they find the ground cut from under their feet, and now they threaten opposition to the Corporation's Bill.

Fletcher, Russell, and Co., Limited.—The fourth annual meeting of this Company was held at their showrooms, No. 30, King Street, Manchester, on Monday last week. The trading account presented showed a gross profit of £23,822, after writing off depreciation. Deducting the Managing Directors' and Directors' salaries, interest on debentures, premiums on debenture redemptions, the interim and final dividends paid on the preference shares at the rate of 6 per cent. per annum, and the interim dividend paid on the ordinary shares, at the rate of 7½ per cent. per annum, the balance remaining for disposal amounted to £13,367. The Directors recommended that £4000 should be further written off the property accounts; £5492 be added to the reserve fund, which will make this fund £9786; and use the remainder in the payment of a dividend at the rate of 12½ per cent. per annum on the ordinary shares—making, with the interim dividend paid, 10 per cent. for the year. A vote of thanks was passed to the Directors for the satisfactory results of the year's working and the reports laid before the shareholders.

The West Bromwich Gas Undertaking.—At a complimentary banquet given to the retiring Mayor in the West Bromwich Town Hall, on Monday evening last week, Alderman R. Farley, the Chairman of the Gas Committee, gave some interesting particulars relative to the Corporation gas undertaking since it was acquired by the Town from the Birmingham Corporation, nearly sixteen years ago. He said the gas undertaking was transferred to the West Bromwich Corporation in 1880; and since that time, though they had kept the price of gas low, they had applied out of the profits on the gas-works £17,640 in relief of the rates, they had placed to the depreciation fund £4000, £9980 had been set aside out of the profits for working capital, and £22,400 to the sinking fund; and yet the gas undertaking had not cost the ratepayers of West Bromwich one farthing. He thought this was a result of which they might well be proud. When the loan capital was paid off, the works would, he believed, produce large sums in aid of the rates of the borough. There were in West Bromwich at the present time 930 street-lamps, which was double the number in existence fifteen years ago; and they were expending out of the rates £1000 a year more in public lighting. The newly-elected Mayor (Mr. G. Salter) and others spoke in complimentary terms of Alderman Farley's services to the borough, especially in connection with the gas undertaking.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1018.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	22½—23½	+½	4 9 5
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	..	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	14 Nov.	6½	Bombay, Limited	5	7—7½*	..	4 6 8
40,000	5	,,	6½	Do. New	4	5—5½*	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	205—210	..	4 5 8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	125—130	..	3 16 11
320,000	20	27 Sept.	11¼	British	20	54½—55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4 17 10
51,510	10	,,	8½	Do. 7 p. c.	10	18½—19½	..	4 7 2
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	8—8½*	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	26 Oct.	13½	Commercial, Old Stock	100	320—325	..	4 3 1
165,000	,,	,,	10½	Do. New do.	100	247—252	..	4 3 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	278—283	.	4 11 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	..	4 11 10
535,000	Stck.	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4 3 0
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	292—297	..	4 5 10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	284—288	+1½	3 9 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	147—152	..	2 19 2
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	237 242*	−2	4 19 2
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6—6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4 6 2
541,920	20	14 Nov.	5	Monte Video, Limited	20	17—18*	−½	5 11 2
150,000	5	24 May	8	Oriental, Limited	5	7½—8	..	5 0 0
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105—110	..	5 9 1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11—12	..	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	308—313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325—330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	295—300	+1	3 6 8
1,719,514	Stck	16 Oct.	7	East London, Ordinary	100	220—225	−3	3 2 2
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	7	Grand Junction	50	118—122	..	2 17 5
708,000	Stck	29 Aug.	12	Kent	100	307—312	..	3 16 11
1,014,800	100	26 June	7½	Lambeth, 10 p. c. max.	100	249—254	−1	2 19 4
400,000	100	,,	7½	Do. 7½ p. c. max.	100	208—213	..	3 10 5
440,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 13 4
500,000	100	14 Aug.	12¾	New River, New Shares	100	380—390	5	3 3 7
1,000,000	Stck	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,[illegible]	Stck	12 June	4	S'thwk & V'xhall, 10 p.c max	100	146—151	..	2 12 11
126,500	100	,,	4	Do. D 7½ p.c. do.	100	110—115	..	2 15 2
1,155,000	Stck	12 June	10	West Middlesex	100	293—298	..	3 7 1

*Ex div

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TO CORRESPONDENTS.

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EDITORIAL NOTES.

The Parliamentary Notice for the South Metropolitan Bill.

FIRST of all the parliamentary notices for next session, we have to draw attention to that issued by the South Metropolitan Gas Company, who intend to reintroduce, with some not unimportant modifications, their dropped Bill of last session—this time with the famous workman-director clause in its appointed place. The notice covers the conversion of the whole capital of the Company into a uniform consolidated 4 per cent. stock, and the similar conversion of the existing 5 per cent. debenture stock into a substituted stock bearing interest after the rate of 4 per cent., or such other rate as may be defined by the Bill or prescribed by Parliament. The Bill is to make provision "with respect to the investment by persons in the employ "of the Company in the capital of the Company, and for "their representation in or upon the management of the "Company." Provision is also to be made for the offering of new stock to consumers at the market price; for the extension to certain stockholders of some of the provisions of the Savings Bank Acts; and for effecting one or two other objects of minor importance. There is, of course, no news in this notice, which was inevitable, except the change of the proposed new uniform standard rate of dividend from 5 to 4 per cent. The alteration is a decided improvement, as bringing the nominal rate of dividend into close accord with the return which an investor in the Company's stock would actually receive—this being the idea of the proposed stock operation. We suppose there is good reason for making the proposed converted debenture stock bear a 4 per cent. rate of interest (nominal); but seeing that, as a matter of fact, it does not return 3 per cent. to the purchaser, and bearing in mind the custom which makes debenture stock carry a lower rate of interest than the stock which supports it, it might be thought that the new South Metropolitan debenture interest would be 3 per cent. only. It is too late in the day to argue that the undertaking will benefit by the abolition of its high-priced stocks, and the substitution for them of a uniform low dividend-bearing stock of only one denomination, value, and rank. This is understood and conceded on all hands. Nor is it much more to the point to argue about the other leading proposals of the Bill. It is to be hoped that, when the Bill is committed, it will be to a Committee too strong to be frightened by an opposing Counsel. Mr. Worsley Taylor, Q.C., did this last time on behalf of the London County Council; and he did it very well, as we acknowledged at the time. There is another Parliament now, and also, to all intents and purposes, another County Council; so that the opposition tactics of last session could hardly be hopefully repeated. All the same, it is to be trusted that the Committees before whom the new Bill will come in due course, will be strong and courageous; for the Bill deals with issues of the first importance to the Metropolis, to the public of small investors, and to the well-wishers of labour. It is quite true, as Mr. Worsley Taylor put it last session, that the consolidation and conversion of a Metropolitan Gas Company's stock is a business evoking other considerations than such as attach to the performance of the same operation by a Suburban or a Provincial Gas Company; but if the thing is good anywhere, it is likely to be at least as good for London. Again, the case of the small investor—be he gas consumer or not—is sure of a sympathetic hearing from the new House of Commons. In opposing this part of the Company's scheme last session, the London County Council were blindly fighting for the autocrats of the Stock Exchange—a mistake which is not likely to be repeated next year. The measure, of course, will hang together, and must be taken or left as a whole. Every reader of the JOURNAL who is solicitous for the advancement of gas company administration will wish well to this particular measure, even though all its projects may not command universal admiration. It represents a policy of progress, in the proper sense of this greatly-abused word; and progress stands for life, as inaction invites and predisposes to decay.

The Cause of the Strand Explosion.

As will be seen by our special report of the proceedings at the adjourned inquest on the fireman who came by his death in consequence of the Strand gas explosion on the

29th ult., there is no longer room for any doubt as to the cause of this deplorable occurrence. The man died from injuries accidentally sustained while doing his duty in searching the ruins of a house which was wrecked by the explosion of a mixture of coal gas and air that had accumulated in the closed basement storey. The gas came from a fractured main passing in front of the house, underneath the pavement of the court towards which it faced. The main was laid in 1879, at a depth of about 2 feet from the surface; and in all human probability it would have remained sound and in good serviceable order for many years to come, had it not been for the circumstance of the supporting earth being washed from under it by a leakage of water from a broken water-main which ran within a foot of it. The escape of water showed itself in a neighbouring cellar; but no injury to the gas-main was either noticed or suspected, even by the Water Company's workman who attended to the leaky water-main. Subsequently, however, a smell of gas was perceived in the vicinity; and the usual measures were being taken for dealing with this sign of something being wrong when the explosion took place. There was plenty of evidence to show that the effect of the escaping water upon the subsoil that should have supported both the gas and water mains was extensive; that the gas-main had newly cracked under the strain thus brought upon it; and that there was every facility offered in the practically closed and uninhabited cellar or basement storey of the wrecked house for the unnoticed accumulation in large quantity of an explosive mixture due to the infiltration into this empty space of gas from the fractured main. These are all the elements needed to account for the explosion; and the Coroner's inquiry could not therefore terminate otherwise than as it did—with a verdict exonerating the Gas Company and everybody else from blame in respect to the disaster. This is completely satisfactory, so far as the personal question is concerned. The other question, of who is liable to pay for the damage to property, apparently remains open.

Contemplated Gas-Works Transfers.

Measures are being taken, both in Derby and Cheltenham, having for their object the acquisition of the gas undertakings by the Corporations. In neither case can such a movement be deemed surprising; for both concerns are first-class properties, such as any local authority might be glad to possess. Excellence of this kind must be paid for; and it is quite possible that, when it is made known upon what terms the proprietors of the undertakings in question would be willing to relinquish their interest, the local authorities will indulge in reflections as to the price at which even gold becomes dear. The Cheltenham Gas Company are coming to Parliament; and the Corporation mean to oppose the Bill, with the overt intention of purchasing if they can come to terms with the Directors. With this object, they will also promote a Bill of their own. This seems a superfluous proceeding, and one that is not likely to be of advantage to the town if there is the remotest prospect of an agreement being arrived at between the Corporation and the Company. We notice that, at a recent meeting of the Cheltenham Town Council, it was stated that 25 years' purchase was a "probable basis" upon which the proprietors of the Gas Company might be bought out. It is not for us to say anything about the value of this undertaking; but it is pretty safe to indulge the reflection that, in these days of almost fancy quotations for investments of the "gilt-edged" order, it will take a strong inducement to persuade the contented holders of first-class gas stock to part with it. Parliament also will hardly encourage local authorities to undertake the responsibilities of gas supply unless there is good reason for it besides the hope of making a little money to aid the rates. The Leamington Corporation have also given notice of a Bill which is to contain provisions enabling them to acquire the undertaking of the Leamington Priors Gas Company "by compulsion or agreement."

The Engineers' Strike

No visible change can be recorded this week in reference to the engineers' strike, except that the confederation of employers seems firmer than ever, and likely to extend to the East Coast of England; while the Amalgamated Society of Engineers have issued an appeal for support "in defence of Trade Unionism," which they declare has been assailed through them. If these manifestations of the spirit that is actuating the parties to the dispute are to be trusted, there is no other conclusion to be drawn from them than that this is going to be a decisive campaign. There is yet some hope, however, that as all the trouble sprang up suddenly over what from one point of view was a small question, so it may as suddenly subside, if both sides can be brought to accept a compromise in respect of this initial question—leaving the larger issue to be disposed of on some more convenient occasion. Possibly, if work is resumed before any further developments are opened up by either party, the threatened "Waterloo of Trade "Unionism" may be indefinitely postponed. Meanwhile, the disclosures respecting the financial weakness of the Amalgamated Society of Engineers made by the special correspondent of *The Times* in Glasgow have greatly incensed the Executive of the Society, who have put up the Secretary, Mr. Anderson, to reply to their "reckless and "irresponsible" critic. As we have had occasion to observe in connection with certain efforts of our own in this line, the official view of outside criticism is always that it is "irresponsible," and the official conclusion is apt to be that to say this is to answer the critic. Fortunately or unfortunately, according to the side from which an issue of this kind is regarded, officialism has no authority to dispose of hostile criticism otherwise than by refuting it; and in the case in point, the Secretary of the Engineers' Society has not even met the point raised by *The Times* correspondent, much less answered it. This point is that the Amalgamated Engineers' Society is a benefit or friendly society, with certain liabilities to its subscribing members, which are susceptible of actuarial determination; and that, owing to its affairs having been started upon a wrong basis, these liabilities cannot be met. This assertion is either well founded or it is mistaken. The only possible way of settling the question is to have a reliable valuation of the liabilities and resources of the Society made and published. But this obvious method of confounding their critic does not commend itself to the Union Executive. He, for his part, offers the information that "a full actuarial investigation of the published "accounts of the Society is being made up to date"—and he will probably take care that when completed the results of this inquiry shall be duly made public. It is clear, however, that the ordinary resources of the Society cannot be drawn upon to maintain the conflict with the Federated Employers in the shipbuilding industry, and consequently that the strikers will have to be supported by the proceeds of a special levy. One of the very worst features of the trouble, in the estimation of those witnesses of the state of things in Belfast and on the Clyde who would gladly see work restored, is the calmness and silent determination with which the conflict is being carried on. Doggedness is even worse to persuade than passion.

A Danger of Arc Lighting.

It was reported in the newspapers of the 18th inst. that on the previous day but one a terrible accident happened in the city of Cleveland, Ohio. An electric motor car, conveying between twenty and thirty passengers, plunged over a drawbridge in the central span of a viaduct, and fell into the river a hundred feet below. It was stated that, as the moving car approached the drawbridge, the conductor went forward to see if the line was clear; and being, it was supposed, "dazzled by the electric light," he gave the signal to the motor-man to go ahead, although the gates across the road were closed. The motor-man accordingly turned on the current; and the car dashed through the gate and fell into the water. Everybody who did not see what was happening and could not jump off was drowned—including the conductor, who was responsible for the mistaken order. We mention the dreadful occurrence here because it brings into prominence the great defect of the electric arc as a means for the lighting of public thoroughfares. When the lighting of the Tower Bridge was decided upon, and preference was given to gas for this service, the choice was determined chiefly in the interest of public safety. It has been a standing rule of the authorities responsible for the navigation of the River Thames that no arc light shall be permitted to shine upon the stream where it might dazzle the eyes of a look-out man or helmsman of any river craft. What has happened in Cleveland amply confirms the judgment of those who have framed and acted upon this rule. It would be deplorable if any similar disaster

in streets lighted by arc lamps were to bring the system into general disrepute; but this danger can only be prevented by keeping such lamps out of the direct line of vision of the drivers of vehicles. Arc lighting is not so generally admired by the British public that it can afford to run any additional risk of becoming discredited.

Mr. A. J. Balfour on the Metric System.

Among the most interesting of the recent deputations to Ministers was that representing British Chambers of Commerce, which waited upon Mr. A. J. Balfour, the First Lord of the Treasury, last Wednesday, to urge upon the Government the necessity of action being forthwith taken for carrying into effect the recommendation of the Select Committee in favour of the adoption of the metric system of weights and measures. The deputation was introduced by the indispensable Sir Albert K. Rollit; and Sir Henry Roscoe and other believers in the advantages of the substitution of metric for the Imperial and customary system of weights and measures had everything their own way, so far as the argument for uniformity was concerned. It is almost with feelings of pity that one contemplates the picture of Mr. Balfour—even supported silently by the President of the Board of Trade—exposed to the plausible pleadings of the metrical enthusiasts who would have their fellow-countrymen believe that British trade has a paralyzing incubus in the familiar triad of yard and gallon and foot. It is so easy to make out a case against these unrelated, "unscientific" units; so simple to ask that they should be abolished as obsolete; so attractive to forecast the results of the adoption of a universal system. We discussed the report of the Select Committee on July 9, and gave a general approval of its conclusions, although compelled to confess that there would be some difficulty in adjusting British gas prices to sales by cubic metre. We could not say, however, that there is any demand in the gas industry for such a change. The deputation to Mr. Balfour appear to have suffered from the same kind of weakness. They had no difficulty in proving, by logical process, the superiority of the metric over the customary and legal British systems of weights and measures; and they had reason for arguing that the substitution of the former for the latter would be a good thing, especially for foreign traders. But there was the stumbling-block of the difficulty of making the change.

It is all very well for educated gentlemen and men of science to declare that there would be no great inconvenience in making people give up quarts for litres, yards for metres, and pounds for kilos., because they have found the advantage of calculating in metric instead of in Imperial weights and measures. Unfortunately, the deputation did not furnish Mr. Balfour with a tittle of evidence to prove that a single Englishman who does not calculate in, but actually uses, the customary weights and measures has the slightest wish to give them up. This is the weakness of their case; and Mr. Balfour duly noticed it—confessing that, in his own case, he always experienced an "effort" in grasping the significance of metric dimensions met with in the course of reading. He also made a good point in reminding the deputation that even in countries where the metric system is the only legal one, the people still think and traffic in their old-fashioned, customary units of quantity and even of value. It is the truth of the matter that these customary units were not arbitrarily selected, but came into use because they possessed advantages of their own. It is not always possible nowadays to ascertain what these advantages were; and, as in the case of our own chaotic weights and measures, we can perceive clearly enough that the balance of advantage would be on the side of making a clean sweep of them all—if it were only worth while to have a fresh start. "There's the rub." One aspect of the metric system comes out very plainly from comparing it with the old systems which still retain their popularity. It is that, while the metric or any other decimal system of weights and measures commends itself to those instructed persons who have calculations to make in writing, nothing of the kind is so convenient to small dealers and people whose arithmetic is all done mentally as a system with aliquot subdivisions. We do not ever remember seeing this point dealt with in discussions upon the subject. For the rest, Mr. Balfour is willing to see what can be done to remove artificial restrictions upon the use of the metric system, and to help the rising generation to greater familiarity with decimal arithmetic.

WATER AND SANITARY AFFAIRS.

The project laid before the Royal Commission of 1892 by Mr. Walter Hunter and the late Mr. Alexander Fraser, for the construction of an extensive system of storage reservoirs in the neighbourhood of Staines, will receive partial embodiment in an important scheme to be brought before Parliament in the coming session. The plan of 1892 was intended to serve all the Metropolitan Water Companies with the exception of the Kent; and it was estimated to involve, in its entirety, a capital expenditure of £5,391,000. Adding to this certain capitalized charges, the complete sum amounted to £9,702,000. But it was not intended that all this should be undertaken at once. The work was to proceed by instalments, in accordance with the growth of the population—the scheme coming to its close in forty years. The plan now brought forward comprehends only three Companies, and is expected to cover a period of ten years, or perhaps something more than that, should the ratio of increase in the population decline, of which there are some indications. The present estimate for works only, independently of management, is, we believe, a million sterling. Future extensions can, of course, take place as required. In its original shape, the Staines scheme emanated from the Grand Junction Company, of which Mr. Hunter was a Director and Mr. Fraser the Engineer. The Bill of which notice has now been given proposes the creation of a Joint Committee, composed of representatives of the West Middlesex, Grand Junction, and New River Companies. It is sought that power shall be conferred upon these three Companies, and the Joint Committee, "or some or one of them," to make and maintain the specified works. The intake is to be placed a little to the west of Bell Weir—a point on the River Thames situated above the town of Staines. To the north of Staines, about midway to Stanwell, will be two large reservoirs; and about midway between these and the intake will be a pumping-station, contiguous to the River Colne. A conduit is to lead from the intake to the pumping-station, and pipe-lines from the latter to the reservoirs. A conduit from the reservoirs is to run down towards Sunbury, and, skirting Kempton Park on the north, enter a distributing reservoir in the vicinity of the works of the West Middlesex and Grand Junction Water Companies. This reservoir and the works of these two Companies will be connected; besides which a pipe-line will extend across the river into the works of the Chelsea Company, through whose mains a supply can proceed *en route* for the New River district. Power is to be obtained whereby the West Middlesex, Grand Junction, and Chelsea Companies will be enabled to convey water to the mains and pipes of the New River Company; and provision is made for the requisite agreements.

The fact that this project is a large slice taken out of the plan which came before Lord Balfour of Burleigh's Commission tells in its favour, seeing that the complete project was spoken of approvingly in the report of that Commission. The present scheme is virtually one of the instalments by which the larger one would have been carried out. There is nothing impracticable about it, nothing extravagant. It is true that the West Middlesex Company obtained power by their Act in 1894 to raise half a million of capital; and they are now constructing four large reservoirs, two of which it is expected will be ready for use in the course of next summer. When all four are in operation, they will have capacity for 350 million gallons. But reservoirs are useless without water, and are only useful in the degree to which it is found possible to fill them. The limit imposed by the law, as to the quantity of water to be taken from the Thames, is embarrassing. No doubt we shall hear the cry next session that the Thames is being depleted. Any such objection is met by the proposal in the coming Bill of the three Companies, that the flow of the Thames shall in no case be reduced below a certain quantity. We are told that the three Companies are willing to have the minimum flow over Bell Weir fixed at 250 million gallons for the 24 hours. In the scheme laid before the Royal Commissioners, 200 million gallons over Teddington Weir was proposed as the minimum flow. The condition then specified, that no water should be taken from the Thames during the first fifteen days of any flood, is still maintained,

There can be no question that the project to be brought before Parliament next year has been carefully matured, and will commend itself to the approval of the Legislature. Nothing can be said at present as to any advantage that will accrue to the shareholders by the raising of additional capital. Except one per cent. allowed for the cost of management, all the profit that would otherwise go in aid of dividends will be swept into the hands of the City Chamberlain, to form a sinking fund which that functionary will hold and apply as trustee "for the "purpose of purchasing and holding stock of the Company, "and of investing the dividends thereon with a view to "ultimately extinguishing the capital of the Company, or "for such other purposes as Parliament may from time to "time determine." At the outset, the clause corresponding to this was differently worded; and in the case of two of the London Companies, the Chamberlain, having purchased stock, forthwith cancelled the certificates—thereby "extinguishing" the capital after the fashion of the irate Irishman who burnt the notes of the Beresford Bank. This mode of proceeding, which tended to the benefit of the shareholders, is now prevented by a different wording of the clause; and the Chamberlain has to hold on. He has no power to vote at any meeting of the Company in which he holds stock; but should this redemption fund grow to any magnitude, it will have a rather curious bearing on the question of purchase. How lucky the chance which lodged the trusteeship in the City Chamberlain instead of the County Council!

The New River Company are going to introduce a Bill of their own, which proposes an extensive series of works, involving a very considerable outlay, for the purpose of improving and extending the supply. Some historical interest attaches to the provisions of the Bill, as it becomes necessary to ask that the Charter granted to the Company by James the First shall be amended and enlarged, and Acts of Parliament have to be dealt with as far back as the reign of Elizabeth. An important scheme of reservoirs at Walton-on-Thames is described in the notice which has been given by the Southwark and Vauxhall Water Company. A Bill altogether novel in its character is that by which it is proposed to establish what is called a Kent Water Board. This is to buy up the Kent Water Company's works, and so much of the undertaking of the Lambeth Company as lies within the County of Kent. Provision is to be made for the transfer of the part of the Kent Company's undertaking which lies within the County of London, "with or without the sources of supply, "works, wells, and pumping-stations," to the London County Council, "or any company or authority that has "been or may be established by Parliament for the supply "of water within the County of London." This Kent Water Board is to comprehend the urban districts of Beckenham, Bromley, Dartford, Erith, and Bexley, and the rural districts of Bromley, Dartford, and Sevenoaks. The promoters of the Bill are among the Local Authorities of Beckenham, Bromley, and Dartford. So far we have a movement in the outer area—one which is surely fated to encounter the opposition of the London County Council and two of the London Water Companies. The better plan, we consider, is to have a Trust, or Water Board, to comprehend all. In the case of the Staines reservoir scheme, we seem to have a foreshadowing of amalgamation, at least on the north side of the Thames. Engineering considerations, if none other, point in that direction. *London* says the introduction of the three Bills of which notice has been given "puts an entirely new aspect on the water "question." One thing, however, will repeat itself, and that is a parliamentary contest in which at least some of the Metropolitan Water Companies will be engaged. This may be accepted as inevitable; and as the gauntlet has now been thrown down by the Companies, the case—apart from the Bill by which the County Council seek to raise the height of supply in the East London district—differs in some measure from that incessant and gratuitous harassing by attacks from the County Council, of which Sir W. H. Wyatt made emphatic complaint at the half-yearly meeting of the West Middlesex Water Company last week—a Company who have nobly decided to continue their 10 per cent. rebate, and to meet the heavy expenditure incurred in sinking their mains to a lower depth by drawing on their reserve fund. But of course they will get little credit for giving away £20,000, which, in round figures, is what this work has cost them.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1103.)

ANOTHER wretched week on the Stock Exchange. At the close of its predecessor, some hope was indulged that the worst was all over, and that better times were in store. But things went all to pieces again. The very slight recovery which had been effected in prices was the signal for a rush to snap up the benefit; and all the advantage was soon extinguished. An immense volume of speculative accounts still await adjustment; weak people are being propped up on their legs by others who cannot afford to let them drop, and who are beginning to find themselves overweighted with the burden. Then political affairs were highly disquieting; and, as if more alarming factors were needed, rumours affecting the value of the gold-fields themselves were circulated. So, altogether, the week has been a most distressing one. Prices, of course, were knocked down liberally, and nothing escaped, whether gilt-edged or "wild cat." The Money Market had a better time of it; and rates hardened considerably at one time. The Gas Market showed some increase in activity; transactions being decidedly more numerous than in the week before. The tendency, on the whole, was not quite so good; and what changes there are in quotations are mostly downwards. They are, however, extremely few, and are for the most part mere fractions. Dealings in Gaslight "A" were numerous; and the inclination at first was favourable—the stock advancing a point on the opening day. Later on, however, a reaction set in; and the quotation closed half a point worse than the opening. The 7 per cent. maximum was freely dealt in at good middle figures; but none of the other secured issues was touched. South Metropolitans were moderately active at the old prices; but they showed no disposition to rise. In the Company's new Bill for conversion of their stock, the substitution of a 4 per cent. basis, instead of the 5 per cent. proposed in their old Bill, is a decided improvement. Commercials were quiet and unchanged, after their recent strong buying. Little was done in the Suburban and Provincial Companies; and changes were few. But Alliance advanced; while Bristol receded. Business in the Continentals was a fair average. Imperial showed further weakness; but the rest were steady. None of the others made any sign, except Bombay, which fell back a little. The Water Companies were not particularly active; and the general tendency was adverse. Grand Junction had a fall of 15 per cent., in view of the reduced dividend. The reduction in the Lambeth dividend had been anticipated. East London and Southwark were weaker. New River could not reach higher than 387, although at the Mart on Wednesday it fetched 400.

The daily operations were: Gas opened well on Monday, and was pretty lively. Gaslight "A" rose 1; and Alliance, ½. Transactions were fewer on Tuesday; and Imperial Continental receded 2. In Water, Grand Junction fell 1½. Business was up to the mark on Wednesday, and prices were steady. Bristol, however, dropped 1½; and Bombay, ¼. The turn on Thursday was unfavourable; and Gaslight "A" receded 1½. Grand Junction Water fell 3. Gas was active and unchanged on Friday; but Water was very weak. Grand Junction went down 3; East London, 2; and Southwark ordinary, 1. There was scarcely a bargain marked on Saturday; and quotations did not move.

ELECTRIC LIGHTING MEMORANDA.

The Conference upon the New Board of Trade Regulations—The Ventilation of Street Boxes—The Regulation of Interior Fittings—The Notification of Gas Leakages.

A CONFERENCE of an important character was held at the Westminster Town Hall last week—Sir Courtenay Boyle, the Permanent Secretary of the Board of Trade, in the chair—to consider the revised regulations made by the Board of Trade under the Electric Lighting Acts. The conference was largely attended by representatives of the various interests affected by the regulations; and the fairness and courtesy of the Board of Trade officials, in taking counsel with those who are identified with the interests in question, were duly acknowledged. The whole transaction supplies an admirable example of the readiness with which British administrators and the heads of important industries co-operate for the establishment of good mutual relations, and for furthering the best interest of the community which they serve in their different ways. In another column will be found a report of the proceedings in which the gas industry is closely interested. The first important subject discussed at the conference was electric pressure; and it was strongly urged, on behalf of the electric lighting industry, that the limit of pressure for low-pressure supplies should be raised from 300 to 600 volts. The Chairman intimated, at the close

of this discussion, that he was disposed to advise the Board of Trade to concede something in this direction. But he did not appear convinced that it would be advisable to go to the full length suggested by the electricians interested in central station lighting. The point was eventually reserved for reference to a small expert Committee. Upon the subject of the proposed requirement for a weekly testing for insulation of every complete circuit, which was objected to as unnecessary, the Board of Trade representatives stood firm. When the conference arrived at the consideration of the clause of the regulations which requires electric conduits to be so constructed as to keep out gas, there arose, as might be expected, a chorus of protestation from the electricians. It was urged that it would be unfair to electric lighting undertakers to lay upon them the burden of preventing the influx of gas into their conduits; it being sufficient for them to be responsible for preventing its accumulation in their subterraneous receptacles. This view was warmly supported by Mr. W. H. Preece, from his Post Office experience; and Mr. R. E. Crompton succeeded in persuading the Chairman that the difficulty might be overcome by making it incumbent upon electric lighting undertakers to use reasonable means to prevent the influx and accumulation of gas in their street-boxes, and to give notice to the gas companies whenever an accumulation of gas therein is discovered. Sir Courtenay Boyle accepted this proposal, on the understanding that there must be some further regulation in this respect.

On the second day of the conference, the subject of the ventilation of street-boxes and chambers was closely debated. Sir Courtenay Boyle declared that he had been forced to the conviction that the ventilation of transformer chambers is absolutely necessary; but he was not clear as to how far it is needful to ventilate street-boxes. In this mental attitude, he might have had the satisfaction of feeling that he was not singular; for this question of what is absolutely necessary to be done in the matter of ventilating street-boxes has exercised a good many people. Herein, however, the advantage of an opportunity for talking the matter over in conference was exhibited; for no difficulty was experienced in settling the point that, at any rate, transformer chambers, and street-boxes containing transformers, ought to be ventilated. This decision narrowed the problem down to one of street-boxes pure and simple. Then arose the question of when a street-box is a "box," and when a "chamber," as to which there has been much debate elsewhere. One speaker at the conference wanted the requirement as to ventilation to be applied to street-boxes exceeding in size one cubic yard, and another asked for an extension of the size of unventilated boxes to double this capacity. No agreement was arrived at upon the point; the Chairman observing that he would consider whether the Board of Trade could frame a regulation calculated to settle the question of size.

In regard to one set of regulations, the electric lighting interest will have an advantage denied to the gas industry. This is the facility which the regulations give for the prevention of bad interior fitting work. It appears from what was said at the conference by Professors Ayrton and Kennedy as well as by the Chairman, that, under the new regulations, householders will be made to feel that, unless the work put in is up to the standard established by the Board of Trade, there will be no prospect of the supply company turning on the current. Moreover, whenever the insulation resistance of interior fittings is found to fall below a certain amount, to be fixed by the Board of Trade, the supply of current will be cut off. This provision is, of course, primarily in the interest of public safety; but inasmuch as safe work also means good work in other respects, the electric lighting undertakers will have the satisfaction of knowing that their efforts to do their duty by the public will not be rendered nugatory by the remissness of housholders themselves. Gas companies have no such safeguard. What voltage is to an electric supply, that, broadly speaking, is illuminating power in a gas supply. But there are at present no statutory means of protecting the gas consumer from sacrificing the quality of his gas to his own careless or ignorant usage.

We have no reason to doubt that the new Board of Trade regulations, when issued, will prove reasonably satisfactory in operation. Our report of the conference shows that particular attention has been given to those points in which the interests and obligations of gas and electricity supply undertakers come into contact, not to say conflict, with one another. It must be regarded as reasonable that the owners of electric supply conduits and their accessory street-boxes and chambers have admitted it to be their duty to give notice of the presence of gas in these cavities; and it may be taken for granted that such notifications are not likely to go unregarded. Gas companies have no desire to fall foul of other statutory users of the public highways; but they cannot waive the point of their own priority in this occupation, when electricians complain of the occasional presence of escaped gas in the holes they make in the ground for their own purposes. Gas companies are bound by law to exercise due care to prevent escapes, and diligence in dealing with them when discovered; and they will be grateful to electricians or anybody else who may be able to warn them when escapes occur. Whatever the Lord Chief Justice of England may affect to think, gas companies are not omniscient, nor are their employees omnipresent throughout their district; and they are always open to receive information as to where leaks are to be found.

M. BLONDEL ON STREET LIGHTING.

A LENGTHY and elaborate memoir on "Street Lighting by Arc Lamps" has been communicated to *Le Génie Civil* by M. André Blondel; and a full translation of the text has been published in the *Electrician*. As a large proportion of this memoir deals with problems of street lighting in general, and is not limited to the application of electricity to this object, we propose to make an abstract of these portions of the paper, relying upon the accuracy of the rendering of the author's original text given by our English contemporary.

M. Blondel begins his learned disquisition by observing that our eye, growing accustomed to an ever-increasing brightness of lighting in the interior of dwellings, modifies little by little, and almost without our knowledge, its standard of luminous sensation; so that the quality of the public lighting which satisfies one generation appears meagre to the next. Hence, to satisfy this progressive demand, the most important streets of a city are first provided with a more intense system of lighting, which has the effect of making all the other thoroughfares look darker by contrast, so that the improved lighting has to be gradually extended throughout the town. So it happened at Toulouse, when the 45 street gas-burners of 10-candle power in the Rue Alsace-Lorraine were replaced by 16 arc lamps of 1200-candle power, it was found necessary to almost immediately extend arc lighting to the boulevards. It is the same in Paris, where the arc lighting of the grand boulevards has so increased the demand for better lighting that the advisability of brightening up the other streets is at present under consideration. M. Blondel believes that people will not be satisfied in this matter until artificial lighting becomes equal to that of average daylight. We are yet a long way from realizing this condition, seeing that the comparison of artificial and natural lighting presents something like the following practical order: Illumination of a plane area by the full moon, 0·6 to 1·0 *lux*; mean lighting of an ordinary roadway by a flat-flame gas-burner, 0·12 *lux*; the same by regenerative gas-burner, 1·29 *lux*; the same by electric arc, 2·0 to 3·5 *lux*; minimum lighting necessary for reading (Kohn), 10 *lux*; proper lighting for a picture gallery (Fleming), 10 to 30 *lux*; mean daylight for reading, 50 *lux*; direct sunlight, 70 to 100 *lux*. [For the meaning of the units of lighting measurement employed by M. Blondel, reference should be made to the JOURNAL abstract of a previous article by this author.*] M. Blondel declares himself to be of the opinion that the adoption of arc lamps for street lighting, and the popularity of incandescent gas-burners for private lighting, will oblige all large towns to make another step in advance. This, he thinks, cannot be attained except by largely extending the use of arc lamps, which, according to him, is the only solution offered by the present state of knowledge as to the means whereby good general street lighting can be realized. It will be gathered from this observation that M. Blondel is not in accord with the newest school of lighting experts, who hold that the advantages of arc lamps for street lighting have been greatly overrated.

In opening up his subject, M. Blondel declares that he means to treat it in an original manner. His guiding principles embrace two independent views of the problem of street lighting—the physical or photometrical, and the physiological. The latter he admits to have been too often neglected. To take the photometrical aspect first: It is necessary to begin by knowing the properties of the class of light source to be considered. The time is past when students of photometry were content to assume the candle power of lights as equal in all directions. This unjustifiable assumption usually perverted all their arguments. It is necessary to-day to discuss sources of light as they really are. As a rule, these sources have radiations which are symmetrical round the vertical axis; but the intensities of the radiations at different angles to this axis vary very considerably indeed. M. Blondel regards the "mean spherical luminous intensity" which is usually taken as representing the general effect of a light source as a mere useless artificiality, of no service in connection with the solution of problems of lighting, but rather the reverse. He discusses, with minute particularity, the effect of inclining the plane which receives the rays of a light source, and the influence of the height of lamps on the effect produced by them. The classical formula for determining the height of lamps for a known radius of lighting is $h = l\sqrt{2} = 0{\cdot}7\,l$, which M. Blondel rejects, at any rate for continuous-current arc lamps, and calculates that the proper elevation ranges from $0{\cdot}95\,l$ for the naked arc to $0{\cdot}5\,l$ for opal or holophane globes. Conversely, to secure a maximum range for a given light source, it is necessary to heighten the lamp by a corresponding amount in excess of the elevation determined by the classical formula. It further follows from the considerations advanced by M. Blondel that very different distributions of lighting effect can be derived from the same sources, by simply varying the height of the sources above the ground. Reference is made to the instructive work done by Maréchal, Wybauw, and Trotter in plotting the values of street lighting in Paris, Brussels, and London.

M. Blondel admits that it is a disputed point whether the value of the lighting actually received by a street surface, or

* See JOURNAL, Vol. LXIV., p. 1166.

the sum of the values of the light sources, should be taken as representing the lighting effect. Some engineers consider only the illuminating power of the lamps themselves; others give pre-eminence to the effect that is produced upon the ground. M. Blondel considers that to the latter should be added the complementary quantity of the vertical illumination, which is the degree of lighting received by the house fronts and everything else which stands up from the roadway. It is true that, as a rule, if the horizontal effect is satisfactory, the vertical one is sure to be even better; but this is not always the case when lighting a street is in question, different descriptions of light sources having different ratios of horizontal and vertical duty.

The manner in which the requirements of public lighting are stated is a very important consideration in connection with the letting of contracts for this service; and, in his remarks upon this head, M. Blondel makes certain admissions which cannot be esteemed otherwise than as a valuable testimonial to the usefulness of gas lighting. It appears that generally upon the Continent, and especially for the Belgian State Railway service, it was the practice to specify the area to be lighted, and the minimum lighting effect required. So long as this single condition was fulfilled, the contractor was left absolutely free to employ any principle of distribution he chose. Accordingly, as M. Blondel somewhat naively confesses, "In these conditions, it was very advantageous for the undertaker to exceed this minimum by the least possible amount, and, in consequence, to use small lights very close together, and to adopt gas in preference to electricity." Naturally, this state of things did not satisfy the electrical interest; and accordingly M. Weissenbruch lost no time in preparing an elaborate memoir demonstrating the "inconvenience" of such a condition, and asking for recognition of the value of the "superabundant light emitted by large lanterns at short distances." M. Weissenbruch desired to establish the new condition that the mean illumination of the lighted surface should be taken into account; and, to satisfy this requirement, M. Wybauw introduced his new conception of the "volume of illumination," which M. Blondel approves as having the merit of more fairly re-establishing the balance in favour of large lamps, since it takes account of the lighting effect which is produced at all distances. M. Wybauw wished, however, to strike out of the reckoning of useful lighting effect all increased brightness only found within a circle surrounding the lamp-post having a radius equal to the height of the lamp, on the score that this excess is useless. M. Blondel will not hear of any such device for discounting the gross value of high-power lights, while admitting that the characteristic of all light sources is the superabundant illumination produced by them in the immediate vicinity of the foot of the lamp-post. The effect of this is that of a spot of light with edges more or less clearly defined, outside which the lighting follows an extremely rapidly reducing law. All lighting engineers have been struck by this fact, and have been unanimous in criticizing it, and desiring a more equable distribution. If the lighting of the ground is the sole consideration, it appears obvious that the more uniform this can be made, the better. M. Blondel claims, however, that this is a mistaken view of the requirements of street lighting; and he denies that the perfectly uniform distribution of lighting in a thoroughfare, if it could be attained, would be popular. He declares that what the public desire is to have a street moderately well lighted as a whole, with some parts more brightly lit than the rest. The absence of the bright spots would not be compensated for by a slight rising of the general lighting value.

Let the general lighting be improved, by all means; but not at the expense of the bright spots under the lamps—this appears to be M. Blondel's position. At these points, he regards it as necessary to have lighting good enough to permit of easy reading; and the idea of uniformly distributing light must be given up, unless this relatively high illuminating effect can be secured everywhere. Even this might not be in every respect desirable. M. Blondel exposes the fallacy of attempting to improve the distribution of artificial light by elevating the lamps on towers; and he shows that the only situation in which lofty lamps are calculated to be effective is not in the open, but in narrow alleys surrounded by high houses. Experience proves that it is advisable to restrict public lamps to heights between 15 or 30 feet; the latter being permissible only for narrow thoroughfares without trees, in which diffusion by the frontages plays a really useful part. With regard to the location of street-lamps, various plans may be followed. The most economical and effective is that of placing the lamps in the axial line of the street; but, in order to secure a good effect, it is necessary to make the lighting at the point midway between two lamps the minimum, and let the lighting of the house fronts opposite the single lamp be slightly in excess of this standard. Where the streets are very narrow, however, the rule cannot be worked. M. Blondel lays it down in such cases that spacing the lamps 25 metres apart is the minimum below which arc lighting will not prove effective. Where the axial line cannot be followed in the disposition of lamp-posts, these may be placed in triangles, alternating on each side walk, or in opposed pairs. If central lights be combined with the latter arrangement, the effect is the best that can be obtained.

The quality of public street lighting, however, cannot be expressed simply in physical quantities. Over and above all that the photometer can indicate respecting it comes the verdict of the ultimate judge of such things—the human eye, which frequently refuses to submit to photometrical guidance. Since the opening of the pupil of the eye may vary in the ratio of 1 to 16, an object may appear to be anything from equality to sixteen times more brilliant for the same photometric illumination, according to the dilatation of the iris through which it is viewed. Hence the practical value of shading the eye from the direct vision of the source of light. Again, there is the well-known effect of contrast, which makes dark objects, in the immediate proximity of a luminous surface, look darker than they are. These are two physiological phenomena which modify, the first the virtual, and the second the relative, value of lighting, and are competent to render all physical measurements illusory. "This explains the singular fact," says M. Blondel, "that an absolute increase of light does not always give rise to a relative increase in public satisfaction. Let us replace, for instance, lighting by gas with lighting by arcs, and give 20 to 30 per cent. more total luminous flux. Very often the public will complain, and demand an increase in the number of lamps. This is a fact that it is necessary not to lose sight of when it is desired to substitute electricity for gas." M. Blondel further admits that, for really effective lighting, the eye should be permitted to take in as much of the light as possible, which means the employment of only such sources as have feeble luminous intensity. He confesses that the ordinary full-sized arc lamp, of 10-ampère consumption, is too much for many thoroughfares, and avows a preference for 8 and even 5 ampère lamps, which he must know are neither satisfactory nor economical in operation. It appears, therefore, that, on the whole, the effect of M. Blondel's essay is to discredit the system of lighting which it was intended to advocate, and to restore the reputation of lights of more manageable intensity, such as coal gas is fully competent to supply.

Society of Engineers.—At the ordinary meeting of this Society next Monday, Mr. W. T. Sugg will read a paper on "Ventilation and Warming." He will deal with the various requirements of buildings, show how to get rid of vitiated air, and indicate the best level at which to take in fresh air in London. The "gas aspirator" will be described; and church lighting and ventilation, as well as ventilation by diffusion, will be discussed.

The Bandsept System of Intensive Lighting.—The Société d'Incandescence Minérale has acquired a new intensive gas-burner, covered by the Bandsept patents, which the Company propose to work in England, France, Germany, Austria-Hungary, Italy, Portugal, and Holland. Surmounted by the Auer mantle, the Bandsept burner is claimed to give a light three times more powerful than any other, while at the same time effecting a saving of 25 per cent. on the gas consumed. The Société Belge du Bec Auer has entered into an agreement with the Société d'Incandescence Minérale to adopt the Bandsept system for public and private lighting whenever possible.

Personal.—Alderman Sir A. Forwood, M.P., has been elected Chairman of the new Lighting Committee of the Liverpool Corporation, in place of Alderman F. Smith.——Mr. Hayes has been appointed Secretary of the Greenhithe Gas Company.——In view of certain proposals for reorganization which are now before the London County Council, the Clerk (Mr. H. de la Hooke) will relinquish his position on March 31 next. The reason assigned for his retirement is a continual sense of physical inadequacy to discharge the duties of his office. Mr. De la Hooke has been Clerk of the Council since the retirement of Mr. J. E. Wakefield, on the dissolution of the Metropolitan Board of Works in 1888.——Mr. John Coates, M.Inst.C.E., was entertained at dinner last Wednesday by the Directors of the Colonial Gas Association, prior to his departure for Australia. Mr. Coates has erected gas-works in twenty-seven towns in Australia; and he also designed and carried out the hydraulic power works at Melbourne and Sydney.

Obituary.—We record with much regret the recent death of Mr. John Clapham, of Keighley. Deceased, associated with his brothers, Thomas and William, founded the well-known firm of ironfounders and gas apparatus makers which was subsequently converted into Clapham Brothers, Limited. He retired from the firm at the end of 1892. Mr. John Clapham was an octogenarian, and enjoyed remarkably good health until about three or four years ago, when heart disease made him a confirmed invalid. His removal breaks a long record of immunity from death in the family; and his many thoughtful acts, prompted by a kindly disposition, will be greatly missed by a large number of relatives and friends.——The death is announced as having taken place on the 20th inst., of Mr. W. Thorman, the Engineer of the Lea Bridge District Gas Company. Deceased was the eldest surviving son of the late Mr. E. H. Thorman, the Engineer of the West Ham Gas Company. After completing his articles, he entered the service of the Lea Bridge Gas Company. He was in his 51st year; and he leaves a widow and five children.——The Tynemouth Gas Company have lately lost their Chairman, Mr. John Moffatt, who had been a member of the Board for about twenty-three years.——Mr. Egerton Burnett, of Wellington, Somerset, a Director of the Wellington Gas Company, died on the 17th inst., in his 61st year. Deceased was proprietor of one of the largest mercantile concerns in the West of England.

NOTES.

A New Coal-Trimming Appliance.

A new and ingenious appliance for saving labour in coal trimming is being introduced by the Temperley Transporter Company; and a good example of the arrangement and its effect is to be seen at the Midland Coal Company's Woolwich Wharf. Originally the device was applied to the coaling of ships at sea, for which service it is held in good repute at home and abroad. As used for forming heaps of coal on land, the appliance consists essentially of a swinging beam, or spar, suspended by means of a hook from a gantry. Underneath the spar is attached a rail carrying a traveller, from which the skip is suspended. The traveller can be stopped at any one of a number of fixed points of the rail; and the skip can then be lifted or dropped. The load cannot move up or down while it is being traversed; nor can it be traversed while being hoisted or lowered. The whole movement of every kind is controlled by a single wire rope, which passes over a gin pulley at the end of the spar. At the Woolwich coal wharf, the spar is 85 feet long, and can be moved a distance of 40 feet along its gantry; so that the arrangement covers a large storage area. The beam and its working parts being self-contained, moreover, there is no reason why it should not be shifted from one gantry, or even pole, to another as required. In short, it appears to offer most of the advantages of a coke or coal stacking crane or gantry of a heavy permanent description. At the Woolwich Wharf, it has enabled the proprietors to dispense with the labour of eight of the trimmers formerly employed in stacking the coal as delivered by an ordinary crane.

Unsuitability of the Carbon Arc for a Standard of Light.

Referring to the efforts of Professor Violle and others (including himself) to base a standard of light upon the crater of the carbon arc light, Professor Silvanus P. Thompson has remarked that the suggestion of using (say) a square millimetre of incandescent carbon at arc temperature, as the standard of white light, is a very fascinating one. The result of all attempts to realize any such idea is, however, failure. Not only are there inherent difficulties, at the very high temperature that prevails, in getting the light through a small diaphragm fixed close to the arc, but Mr. Trotter has found in the light emitted from the carbon crater variations so extraordinary, that at present it seems unlikely that a true standard of invariable value can be attained in this way. These variations are due, in the first place, to the occurrence of impurities in the carbon, which lower either the temperature or the emissivity of the carbon. Most serious of all hindrances to the steady shining of the carbon arc, however, is what is now called, from its discoverer, the "Trotter phenomenon," because this is no question of the state of purity of the carbons. Mr. Trotter has found in the carbon arc an appearance of an object having a sickle, or comma shape, extending from some place near the centre of the crater to its edge, and continually revolving in a singularly capricious manner. Professor Thompson has described the phenomenon to a Society of Arts audience as a "chaff-cutter" action—sometimes going in one direction, sometimes in the reverse. Whatever it may be, however, the phenomenon is always exhibited when a carbon arc is in being; and this circumstance alone would be an effectual barrier to the use of the crater as a standard of light. Mr. R. E. Crompton has lately observed other apparently incurable vagaries of the arc light, which seem to indicate that, whatever other qualities it possesses, steadiness is never likely to be among its good points.

Are Free Hydrogen and Methane Present in the Upper Air?

Mr. Francis C. Phillips, of the Western University, Pennsylvania, has raised the curious question of whether free hydrogen and methane exist in the higher regions of the earth's atmosphere. The inquiry was suggested by the consideration that a good deal of these gases must have escaped into the atmosphere throughout all geological periods, and, if so, must still exist somewhere. Whatever may have been the process by which organic remains have in the course of time become converted into coal, petroleum, and natural gas, a considerable portion of the gases evolved in the early stages of decay of such remains must have poured out into the air before they became buried under sedimentary deposits. A very long time must have elapsed between the commencement of decay and the final burial of organic remains under marine deposits of sufficient thickness and compactness to cause the retention of the hydrocarbons until the sediment became consolidated into rock. In an earlier paper published in the *American Chemical Journal*, Mr. Phillips has shown that when organic remains are submerged under water, and protected from atmospheric influences, there is a great difference in the nature of the changes which occur first and last. The early stages of decay may be rapid, and much hydrogen may be produced. The later stages are more gradual; and methane may be the chief product of the decay. Swamp gases collected by the author indicate that shallow marshes may produce carbonic acid, nitrogen, and methane. In some deeper swamp waters, where masses of decomposing vegetable matter of great thickness occur, hydrogen is often found in small quantities mixed with carbonic acid, nitrogen, and methane. Carbonic acid and nitrogen are absorbed by vegetation; not so hydrogen or methane. Every bubble of these gases, once set free at the earth's surface, probably escapes unoxidized and unabsorbed to ascend into the upper strata of the atmosphere. Of all the forms which hydrogen and carbon can assume in Nature, free hydrogen and methane are among the most stable, unalterable, and insoluble. What, therefore, has become of all the gas of these two kinds that has gone into the atmosphere since the earliest geologic times? Mr. Phillips thinks it is somewhere high up in the air; and he has accordingly sought for it by means of the delicate reaction of palladium chloride at the summit of Mount Washington, which has an elevation of nearly 7000 feet. The experiment yielded only negative results. He still thinks that the gases are there; but he admits that serious difficulties would be encountered in any attempt to reach an altitude where the results of chemical tests could be regarded as conclusive.

Sands for Cement Mortar.

Some instructive tests of cement mortars mixed with different kinds of sand have been published in the *Journal of the Franklin Institute* by Mr. A. S. Cooper, U.S. Assistant Engineer. The occasion of making the tests in question was the construction of a concrete casemate for the United States Government, when there happened to be a choice between a fine beach sand, which was cheap, and a coarse river sand, which was very much dearer. Consideration of the strength of the proposed work would have decided the selection of the sharper sand; but it was found by experiment that the finer kind gave even better results. This was surprising to the experimenters, who accordingly looked further into the whole subject of cements and sands, with results set forth in Mr. Cooper's report. Without giving the data upon which Mr. Cooper has based his conclusions, it may be sufficient to state that he finds, other things being equal, that coarse is preferable to fine sand for cement mortar up to the size that passes a sieve with 12, and is stopped by one with 16, wires to the inch. Below the grade of sand that will pass 40 and be stopped by 60 wires to the inch, there is no practical difference in the value of any sands, so far as the size is concerned. The shape and condition of the surfaces of the grains of different sands has as much to do with their value for cement mortar as the size. The best sand is not necessarily the sharpest, if at the same time the sides of the grains are so smooth that the cement cannot properly adhere to them. Trap or granite sand, when sharp, appears to be the best kind of all for the purpose.

The Management of the Blackpool Electricity Department.—In the paragraph in the JOURNAL last week on the sale of gas and electricity at Blackpool, it should have been stated that the management of the Electricity Department of the Corporation, which was originally entrusted to Mr. W. Chew, is now in the hands of a separate staff and Committee. Mr. Chew is engaged entirely at the gas-works.

Manchester District Institution of Gas Engineers.—The 104th quarterly meeting of this Institution is to be held next Saturday at Leeds, under the presidency of Mr. Geo. Smedley, of Buxton. According to the programme of arrangements issued by the Hon. Secretary (Mr. S. S. Mellor, of Northwich), the members will meet at the Victoria Station, Manchester, and shortly after noon will leave for Leeds, where the meeting will take place at the Great Northern Hotel. The business will consist of the election of new members (five of whom have been proposed) and of the President for the ensuing year. Two papers are to be read—one by Mr. W. Newbigging, of Manchester, on "Tower Scrubbers and Horizontal or Washer Scrubbers;" the other by Mr. S. R. Ogden, of Blackburn, giving an account of the installation of carburetted water-gas plant at his works. After the business, the members will, as usual, take tea together.

New Pumping Machinery at the Hereford Water-Works.—New pumping machinery has lately been erected at the water-works of the Hereford Corporation; and on the occasion of putting it in operation for the first time, the City Surveyor (Mr. J. Parker, Assoc.M.Inst.C.E.) read a report which contained the following particulars: The engine (supplied by Messrs. Worth and Mackenzie) is of the triple-expansion condensing type, direct-acting with overhead marine pattern cylinders 13½, 21¼, and 36 inches diameter and 30-inch stroke, driving three single-acting ram pumps 16 inches diameter lifting 100,000 gallons per hour. The engine-house (erected by Messrs. Bowers and Co.) is arranged to correspond with the existing buildings; and the floor is depressed 1 ft. 3 in. below the old engine-house floor, in order to reduce the suction as far as possible. All special pipes and valves are so arranged as to provide for future extensions, if or when required. Two valves with standards and hand-wheels with two 6-in. self-acting reflux valves, in one operation regulate the supply to the tower or the storage reservoir without stopping the engine. The arrangement is an ingenious one, and is much better than that of disconnecting the high-lift pumps, which would have rendered a stoppage of the engines necessary each time the tank on the tower was filled. The duty discharged by the old high-pressure pump is performed in an economical manner by a pair of high-lift pumps attached to the intermediate engine, capable of delivering 15,000 gallons per hour, either to the tower or the reservoir at pleasure.

COMMUNICATED ARTICLE.

KEEPING UP THE GAS SUPPLY WITHOUT A GASHOLDER.

By G. Ernest Stevenson.

A question having been asked in the columns of the JOURNAL as to the feasibility or otherwise of keeping up the gas supply to a town without the use of a holder, it has been thought that a reference *in extenso* to the instance in the author's experience in which this was satisfactorily accomplished, would be of interest to the readers.

The instance occurred in the year 1890, in connection with the establishment of a gas-works in the Argentine town of Paraná. The author had acted as Engineer in the construction of the gas-works, which had been opened without any hitch in February of that year. The gasholder was a two-lift one, 60 feet in diameter, in a cast-iron tank. The inlet and outlet pipes were connected in the manner usual with such tanks, by duckfoot bends underneath the tank; the bends being bolted through to stand-pipes inside the tank. About six months after the opening of the works, in July, the joint of the bottom flange of the outlet stand-pipe gave way, and the water in the tank flooded the mains. A temporary connection was immediately made between the inlet-pipe and the outlet-pipe in the ground outside the tank, and the outlet-valve closed; and the supply was continued through the inlet-pipe. The Directors of the Company, however, desired to have the outlet-pipe repaired, and consulted the author regarding the steps to be taken to effect this. As the joint was inside the tank, it was impossible to repair it without emptying the tank. To stop the supply of gas for this purpose would have seriously prejudiced the Company with its consumers; and it was therefore determined to attempt to continue it without the holder.

At the time the accident occurred, the consumption of gas was about 60,000 cubic feet a day; there being two settings of six retorts each fully at work. Before commencing the experiment, it was necessary to put additional retorts into action, sufficient to produce gas at a rate equivalent to the maximum draught on the mains in the heaviest hour of consumption. The amount of maximum draught was arrived at by observing the make of gas and the delivery from the holder during each quarter of an hour of the evening; and it was estimated that one additional setting of retorts would just suffice for the purpose. When this setting had been heated up and brought into full working order, preparations were made for the experiment. First of all, the day before commencing it, all the purifiers were emptied and recharged with clean oxide; and during that night the charging of the retorts was suspended in order to empty the holder. During the next day only two retorts were charged alternately; and it was found that the gas they produced was just sufficient to balance the day consumption at 5-10ths pressure, the gasholder remaining stationary although still afloat. A pressure-gauge was fixed in the retort-house communicating with the leading main, so that the pressure in the mains could be observed. The gasholder was then shut off, the bye-pass valve of the governor opened, and the governor itself thrown out of action; and supply direct from the retorts commenced.

As the time of sunset approached, the author stationed himself at the gauge in the retort-house; and, the stokers being ready assembled, with coal laid down for charging all the retorts, as soon as the pressure began to fall, the order was given to charge one retort after another—the rise and subsequent fall of pressure being noted between each charge, until several retorts were under weigh. It then became necessary to pause for a time; for the production of gas from the retorts already charged continued to develop, and the pressure to rise. It was not long, however, before more retorts were required; and the charging was continued until all were at work. The danger to be feared was either that the pressure would increase too rapidly and blow the water out of the consumers' meters, or that it would fall too low and a deficient supply occur. By care in charging, it was found possible to prevent the former occurrence; and when all the retorts were charged, it was found that a pressure of about 20-10ths was maintained throughout the remainder of the evening.

As the consumption fell off before midnight, a reduced production was necessary; but as the retorts had been charged at different times, extending over a period of two hours between 6 and 8 o'clock in the evening, the diminution in the production as the charges became exhausted was so nearly equivalent to the reduction in the consumption of gas that no difficulty was experienced. About midnight it was found necessary to recharge some of the retorts, to supply the gas consumed in the public lamps; and these second charges sufficed till daylight arrived—a pressure of about 10-10ths being kept up after midnight. The next morning the alternate charging of two retorts was reverted to, which again sufficed to keep up the day pressure of 5-10ths.

The first night's attempt having been successful, there was nothing to fear subsequently, except in the case of a sudden change of weather. Fortunately, however, the weather remained absolutely uniform the whole of the period during which the experiment lasted—not a cloud being once seen in the sky. The emptying and refilling of the gasholder tank, together with the repair of the joint, occupied eight days; and at the end of this time the holder was again brought into action without the consumers being aware that anything unusual had taken place.

There were some circumstances that favoured the success of the experiment, which might not be found in conjunction in this country. In the first place, the steadiness of the weather prevented fluctuations in the consumption day by day, which were also absent largely as a consequence of the residential character of the town. Secondly, the mains were of ample capacity for the draught put upon them. The leading main proceeded in a straight line for nearly a mile before entering the town; and there was a gentle rise the whole way; so that even if the pressure in the works had fallen to zero for a moment or two, there would still have existed pressure in the town. The long main of ample diameter formed a compensator for variations in pressure. Also a large proportion of the consumption was due to the public lamps, which, once lighted, continued to consume the same fixed quantity per hour throughout the night.

There is, however, one thing that would assist such an experiment in any town; that is the compensatory power inherent in the consumers' burners. These not being fitted with regulators, would be the cause of an increased or diminished consumption proportionate to the pressure, and would facilitate the establishment of an equilibrium if certain limits of variation were not exceeded.

One difficulty would arise if the experiment were very prolonged; and that would be connected with a change of purifiers. It would not be possible to preserve unbroken the day pressure when the purifiers were changed, unless the air in the newly-filled purifier were allowed to go forward into the mains, which would probably produce a disastrous effect on the illuminating power of the gas when the time for lighting up came, for the air would remain together in a mass in the mains, and move forward in a wave when the draught set in. In a small township, however, if notice were given to the consumers, no serious objection would exist to the suspension of the day supply for a short time, during which the air could be blown out at the vent-plugs of the purifiers. The time occupied in doing this would be too short to cause infiltration of air into the mains through loss of pressure.

It should be remarked that in the experiment recorded, care was taken in the first instance to have the retorts very hot, so that rapid evolution of gas commenced immediately they were charged. The standing off in the day-time itself brought about the condition of high temperature so necessary in order that the experiment should each evening be successful.

Grand Junction Water Company.—In consequence of the very heavy expenses entailed by the frost of February last, the dividend of this Company for the past half year will be 3 per cent. on all classes of shares; making 6½ per cent. for the year ended Sept. 30.

The Polarization of the Light of Incandescent Bodies.—The polarization of the light emitted by incandescent bodies has not yet, says *Nature*, been fully investigated. Arago, indeed, made some experiments on incandescent iron, platinum, and glass; but these were only qualitative, and did not extend to liquids. Mr. R. A. Millikan publishes, in the *Physical Review*, an account of some careful tests of light emitted by glowing solids and liquids, with a view to discover the laws of its polarization. This phenomenon is exhibited strongly by incandescent platinum, silver, and gold, and by molten iron and bronze. A somewhat feebler polarization is shown by copper, brass, lead, zinc, and solid iron. The most significant result is that polarization is minimum with rays emitted normally to the surface, and maximum at a grazing emission. This indicates that the vibrations take place in a plane at right angles to the emitting surface. To show the phenomenon at its best, a smooth surface is essential. Glass and porcelain also emit polarized light, but to a lesser amount. Fluorescent bodies do the same; so that evidently a high temperature is not necessary.

The Development of Artificial Light.—In the course of his Cantor Lectures at the Society of Arts on the subject of the "Arc Light," which have lately been printed in the Society's *Journal*, Professor Silvanus Thompson, F.R.S., dealt with the question of luminous and non-luminous energy. He remarked that one of the things we have to look forward to in the development of artificial light is the production of lamps which shall be of a higher efficiency than the arc lamp. They must, for an equal amount of energy supplied to them, emit a far greater percentage of waves of a length that will affect the eye as luminous waves, and a far less percentage of those longer waves which do not help the illumination, but which only warm. Such a transformation had, he pointed out, been wrought for gas lighting in recent years by the introduction of Dr. Auer's incandescent mantle. He discovered a material of which the emissivity, at the temperature of the gas-flame, is higher than that of the carbonaceous matters in the ordinary flame of coal gas. It emits a greater percentage of waves of the sorts that affect the eye, and a lesser percentage of the non-luminous waves. The vacuum tube lamps, and their modern varieties—such as Tesla's lamps and Ebert's luminescence lamp—are attempts to procure a better specific luminescence from a given amount of energy.

TECHNICAL RECORD.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting in Philadelphia.

(*Continued from p.* 1034.)

Mr. W. W. Goodwin, of Philadelphia, delivered a lecture on "Acetylene." He exhibited a drawing of the apparatus used by Mr. Willson for the manufacture of this substance, which includes a twin Leffel turbine, 30 inches in diameter, making 206 revolutions per minute at 28 feet head, and developing 300-horse power at ¾-inch gate opening. This is belted direct to two Thomson-Houston alternating current dynamos run in parallel, and separately excited by two standard exciters from a 120 kilowatt machine. Each machine generates 1155 volts at full load, at a speed of 1070 per minute, with 125 alternations per second. The primary wires are connected in multiple to sixteen Thomson-Houston transformers of 15,000 watts capacity; and the primary windings have a range of from 52 to 104 volts, and have 60 cycles per second. The secondary windings are connected in parallel to the two furnaces by means of eight wire cables, respectively attached to the anode and cathode of each furnace. Each anode is made of six carbons, each 4 inches square and 3 feet long, held in a group by a holder. After running seven consecutive periods of four hours each, these are reduced in length ½ inch. The cathode is an iron plate 2 inches thick, on which is superimposed a layer of carbon 12 inches thick. The carbon pencil is raised or lowered by a screw and hand-wheel, and is adjusted by the attendant as the current varies. The average shown during three days' working was 64 volts and 1980 ampères; the horse power consumed was about 160; and the quantities of mixture (87½ lbs. of lime to 56½ lbs. of carbon) operated upon were respectively 1142, 1246, and 982 lbs. The proportion named is calculated to yield 100 lbs. of calcium carbide, and 43¾ lbs. of carbonic oxide. One hundred pounds of the carbide yields 40·62 lbs. of acetylene and 115·62 lbs. of slaked lime; or 5·9 cubic feet of acetylene per pound of carbide. Several experiments with the carbide and acetylene were then exhibited. The carbide was submitted to the heat of a blow-pipe flame, to show its infusibility and uninflammability. The properties of liquid acetylene were also illustrated, as well as the use of acetylene for enriching ordinary town gas. The lecturer also showed the explosive properties of acetylene when mixed with air, which he considered fatal to its dilution with air for practical use. As to the commercial cost of acetylene, £4 per ton was a liberal estimate.

Mr. F. Egner, of Norfolk (Va.), followed with a paper bearing the title of "Notes on the Storage of Oil at Gas-Works." Wooden vessels were the first used for this purpose; and it was soon found that they would not remain sound, so they were surrounded with a water-jacket. The first improvement seems to have been the adoption of the principle of the gasholder, by using a tank open at the bottom, placed in a reservoir of water. Oil admitted to the interior kept on the surface and displaced the water, until it was full of oil. This was the precursor of an oil-tank for gas-works, designed by the late Mr. T. H. Forstall. A little later, a further improvement was made, consisting of keeping the tank always under pressure and full of liquid, so as to avoid accumulation of gases or vapours, and the consequent danger of explosion. Next in order was the use of a coil of steam-pipes at the bottom of the tank, for the prevention of the accumulation of solid deposits. The water-covered top, the entirely submerged tank, and the safety-tank placed at a lower level so that the contents could be run off in case of fire, were also introduced a quarter of a century ago; and various devices were suggested for getting rid of the vapours with safety, the prevention of firing-back, &c. Attention was then directed to a drawing of the oil-tank patented by Mr. Forstall in 1871, which was on the gasholder principle, with a slight rise and fall. Any tight gasholder and tank could readily be adopted for this purpose. The late Mr. Flannery, when pressed for room, used a part of the water space in his relief holder as an oil-store; and this was a convenient and absolutely safe arrangement. For large works, the author preferred Mr. Forstall's plan; and for small ones, a vertical cylinder with glass gauges connected at the top with the inlet of the gasholder, by which means it was kept under pressure, and quite safe. He had adopted the plan of connecting the oil-tanks with a gasholder more than 20 years ago; and having used it with perfect success, he was surprised when it was called into question a few months ago. He described the arrangement of tanks he now employed, as well as some special experiments showing that there was no loss of oil by evaporation. The plan of keeping the oil under a slight pressure greatly diminished the production of vapours. He always provided a light resistance vacuum valve, and also a light pressure safety-valve.

In the course of the discussion, Mr. Alex. C. Humphreys remarked that tanks containing naphtha required to be protected from the direct rays of the sun. Mr. Newell said that at New Brunswick the tanks were all underground; and Mr. Thompson objected to underground tanks, as during a heavy storm he had known them to be lifted out of the ground by the water. Mr. Gartley had his tanks connected with the holder by a 6-inch main, but always found traces of naphtha vapour in this pipe. Mr. Pinckney said that at Utica the temperature was sometimes 40° below zero; and then the oil would not run. He had adopted the plan of running a steam-pipe parallel with the suction, and lapping both together with non-conducting material.

Mr. E. G. Pratt, of Des Moines (Ia.), read a paper on "Bench-Firing with Soft Coal." He said that the only reasons which would justify this plan were cheap coal and a large demand for coke at a good price; and it was these circumstances that led him to endeavour to design a setting that would show the best results obtainable with coal as fuel. He tried various plans as used successfully in other places, but with very indifferent results—probably on account of the poor quality of coal available both for fuel and for gas making, and also because coal furnaces required more care and attention than those for coke. This was particularly the case where the quality was apt to vary. With coke-fires, the ports and dampers could be adjusted once and for all; but with coal, a great deal more was needed. There was more frequent firing and clinkering, coal to be wheeled in, and more clinker to be removed, all of which meant increased labour to the stoker. During the past six years, he had tried three different settings. The first was three beds of sixes, built in 1889, on the half-depth regenerator principle. The second, three similar beds, with the exception of an additional foot depth in the furnace, and the arrangement of the flues and upright pipes in the regenerator. The principle was right; but the construction was not strong enough—especially in the regenerator—for the extra strain. Although fairly good results were shown at first, trouble soon arose from the stopping up of flues and pipes, and breakage of the latter, notwithstanding the fact that coke was used once a week to burn out accumulations of soot, &c. In 1893, six new beds were constructed in the old arches, having greater strength and larger flues, and abandoning the upright or so-called organ-pipes in the regenerator. The furnaces were also still further deepened, so as to get a larger combustion chamber. These were started in October, 1893; and the results of four months' working were 3,090,500 lbs. of coal carbonized, 14½ million cubic feet of gas made, four-hour charges averaging 305 lbs. per charge, a yield of nearly 8000 cubic feet per retort, a make of over 2,000,000 lbs. of coke, of which 95 per cent. remained for sale (the remainder being used for fuel on Sundays), and a consumption of 73 lbs. of coal for fuel per 1000 cubic feet of gas made. The figures for the corresponding period of the following year, when the same furnaces were used with coke as fuel, were: 2,868,900 lbs. of coal carbonized, to make 14 million cubic feet of gas; the average weight per charge being 362 lbs., and the make over 9700 cubic feet per retort. About 30 per cent. of the coke, or 33 lbs. per 1000 cubic feet of gas made, was used as fuel. After allowing for the extra cost of labour, &c., the conclusion was arrived at that the use of coal instead of coke for fuel resulted in an actual saving of about £500 for the four months. Not considering the results obtained with coal to be altogether satisfactory, the author had lately arranged a month's trial under more rigid personal supervision. He then found he could get results nearly as good as those obtained with coke fuel, with a consumption of only 59 lbs. of slack coal per 1000 cubic feet of gas made. Another month's trial, with lump coal as fuel, gave rather better results, with a consumption of only 41 lbs. of coal per 1000 cubic feet.

Mr. Thompson opened the discussion by pointing out that the coal for fuel was liable for various reasons to much greater variation in quality than coke, and that more intelligent attention was therefore required on the part of the men. At St. Louis, he had used coal as fuel for five years, in furnaces resembling those described, with material economy and satisfactory results. Like the author, he had found the need for more space in the flue-ways. If it was necessary for any reason to fall back on the coke, there was a difficulty in keeping up the heats. He found an increased supply of air, with a little steam at the outlet to increase the draught, better than coke firing for clearing the flues. Lately, having a cheap fuel coal and a good demand for coke, he had found it better to go back to old-style furnaces, as recuperators did not pay with cheap fuel. He quoted figures from his last ten months' working, showing an average weight of 448 lbs. per four-hour charge, and a consumption of 570 lbs. of coal as fuel per ton of coal carbonized. It would be noticed that in the summer he used about one-fourth of coke breeze as fuel. An essential novelty in these particular furnaces was the provision of five ports for the admission of air above the furnace, each controlled by a cover or damper. When the furnace was charged, all these ports were opened; and they were gradually closed as the fuel became coked. The outlet-damper required adjusting in a similar manner. With the use of breeze mixed with the coal, this regulation was not of so much importance. He expected to see coal firing generally adopted wherever the prices of fuel were anything like those in his district. Mr. Mitchell said that, after many experiments, he had devised a furnace on the half-depth regenerator principle that gave good results with coal. He attached a great deal of importance to regeneration and a secondary air supply, which was necessary to secure proper combustion of the gases. He had used organ-pipes for the last twelve years, and considered them the best and simplest means of heating the air. They were not liable to break; but if they

did, they were cheap and easily renewed. He claimed to be the first to use coal as fuel under the retorts, and said he had made a great success of it. The extra work was not so great as appeared at first sight. Very little more weight of fuel was used, and the bulk was less; while the clinkering was not more laborious than with coke. The fires, however, did require more attention. Mr. Russell thought perfect recuperation was of great importance in coal-burning. In the West, it was always advisable to be able to use coal or coke as desired, according to the markets. Both Mr. Harper and Mr. Ramsdell said they had used coal firing with good results, and with no difficulty.

(*To be continued.*)

THE COMMERCIAL VALUE OF PHOTOMETRY.

(*Concluded from p.* 1035.)

Photometrical Works.

Now let us consider briefly the photometer and its manipulation. Photometry has been developed as the result of the conscientious independent labours through many years of many scientists and engineers. Photometers have been devised upon different principles in optics, including diaphragmation, dispersion and the phenomena of absorption, polarization, compensation, &c. Chemical photometry has also received attention. But the photometers which we are most interested in are those based upon the direct comparison of two illuminated surfaces—as the Rumford, the Bouguer, the Foucault, the Bunsen, and the Arnoux. The first four depend upon the law of distances; and the last, upon the cosine law. The Bunsen is chiefly employed in America, Great Britain, and Germany; and the Foucault in France. The Rumford is generally regarded as obsolete, though such a high authority as Captain Abney prefers it above all others. On the other hand, Mr. Dibdin pronounces against it.

Inferential photometry has been the subject of much investigation; and the jet photometer and the illuminating-power meter have been largely used. Many schemes have been suggested for calculating the candle power of a gas from its contained illuminants, or from the composition of the products of combustion. Investigations as to the cause of luminosity in gas-flames, and especially the recent investigations of Professor Lewes, William Young, Irwin, and others, indicate that inferential methods cannot safely be employed for the general comparison of the illuminating power of gases; and for long we have known that the character of the diluent gases modified the readings of inferential photometers. But for the comparing of gases made from the same class of materials and by the same apparatus and methods, they can be made to serve a useful purpose.

In the so-called Bunsen photometer, we find an instrument which is practically accurate, and as simple as any such laboratory instrument can well be. It gets its name from the grease-spot disc. Bunsen's photometer was quite different from the one now employed. Mr. Alfred King, of Liverpool, took the Bunsen disc, and built round it the photometer much as we use it to-day. He employed the open photometer in a dark room, the bar 100 inches, the two lights fixed, and the disc set up without sight-box and without mirrors, but reversible with regard to the lights. This photometer has since then been modified in many ways. A wide departure was made in the Evans. As originally made, it was not adapted for general testing. In some of its present forms, it is no doubt a reliable instrument, and especially so when the lights are fixed and the ventilation better provided for, and the sight-box properly screened. Dr. Letheby introduced the sight-box as now generally used. This is an improvement, inasmuch as the mirrors enable us to see the two sides of the disc simultaneously; but it fails to provide, as did King's arrangement, for the reversal of the disc with regard to the lights, to compensate for differences in its two sides.

The elaborate and able report of the Dutch Photometry Committee* makes a strong point of the necessity for this reversal. It goes farther, and says the readings should be made one-half from one side of the table and the other half from the other side—this to compensate for differences in the eyes of the observer. The report condemns the English practice of correcting for candle and gas consumption by the proportional rule; and also the employment of two candles instead of one, especially if the distance between the disc and the candles is allowed to vary.

Mr. Dibdin urges the importance of the reversal of the disc; and he has improved the sight-box by pivoting at the back the frame containing the disc and mirrors, so that it can be revolved around a horizontal axis. His design is to thus compensate also for any differences in the mirrors. This is possibly a refinement; but it behoves us to adopt all such refinements, if they do not lead to complication of apparatus and methods.

The selection of a disc is all-important. No matter what form is used, it should be tested by the reversal method; and unless the readings are then alike, it should be rejected. A disc should be rejected wherein the spot entirely disappears.

After a good disc has been selected, we must remember it is liable to change, and especially under constant exposure to light and a dirty atmosphere. A disc that becomes soiled or marred should be abandoned.

In my opinion, the Leeson star-disc is a decided improvement over the regular Bunsen disc, and especially in connection with difference in the colour of the two opposed lights. Mr. Dibdin strongly endorses the star disc; but he holds that, as first made, it was not satisfactory on account of "buckling." He improved it by fastening the three pieces of paper together with thin starch water, under pressure. Captain Abney and Professor Lewes endorse the Dibdin-Leeson disc for its reliability, even when this difference in colour exists. Captain Abney suggests, as an additional safeguard against error in disc reading, the oscillation of the disc between points too dark and too bright, gradually reducing the length of swing.

Referring again to the other points noted as made by the Dutch Committee, I believe the majority of American and English experts agree that, under certain restrictions, the use of two candles tends to decrease rather than increase the total error. The obliquity of rays does not sensibly affect the reading if the disc is not closer than 12 inches; and a reference to the following table shows that, up to 30-candle power gas, this distance is more than 12 inches, even with the 60-inch bar.

But these and other sources of error connected with the use of the much-abused candle standard can apparently now be eliminated by the adoption of Dibdin's 10-candle pentane Argand air-gas standard. This standard (as a development from the Harcourt 1-candle pentane standard) has been under careful examination by English scientists and practical photometrists for some years; and the Photometric Standard Committee, in their recent report to the Board of Trade, recommends its adoption for the testing of London gas.* The strength of the Committee and the record of their work will, no doubt, secure the adoption of their recommendations. It seems to be demonstrated that this standard gives uniform results, even with considerable variations in temperature, pressure, height of flames, and the composition of the pentane mixture. Mr. Dibdin states that the height of the flame may vary 1½ inches without sensibly affecting the amount of light reaching the disc therefrom. It is true that there are those in England who do not endorse the Committee's recommendation.

Mr. Williams has recently objected to this standard on the ground that it refers back to the candle as its unit; and, therefore, its use is simply a roundabout way of using candles. The reasoning does not appear to be sound; for if the pentane lamp gives constantly uniform results without too great complexity, we make a decided gain. Further, the unit of the proposed standard is the mean obtained from a great number of readings by most competent photometrists, and therefore is, in that regard, far more reliable than any isolated observation.

Another decided advantage possessed by the pentane standard is that it is of a relatively high candle power. Referring to the following table, we see that, with this standard, the intensity of illumination of the disc more nearly corresponds to moderate degrees of diffused daylight, and the eye is capable of making, under these circumstances, finer distinctions than if the intensity of illumination was either excessively low or high.

With regard to the comparison between bars of different lengths, the statement is sometimes made that the change from King's 100-inch bar to Letheby's 60-inch bar was an improvement. I confess I have not in the past agreed with this statement.

Comparison between 60-Inch and 100-Inch Bars.

D. Distance of disc from light standard, in inches.
I. Intensity of illumination of disc in terms of 1 candle at 1 foot.

Candle Power of Gas.	60-Inch Bar.					
	Standard.					
	One Candle.		Two Candles.		Ten Candles.	
	D	I	D	I	D	I
16	12·00	1·00	15·66	1·17	26·49	2·05
20	10·96	1·20	14·42	1·38	24·84	2·33
25	10·00	1·44	13·23	1·64	23·24	2·66
30	9·26	1·67	12·32	1·90	21·96	2·98
	100 Inch Bar.					
16	20·00	0·36	26·13	0·42	44·17	0·73
20	18·27	0·43	24·04	0·49	41·41	0·84
25	16·67	0·52	22·04	0·58	38·74	0·96
30	15·44	0·61	20·52	0·68	36·66	1·08

An examination of the table confirms the claim to improvement. On the 100-inch bar, with the 1-candle standard, the intensity is only from 0·36 to 0·61 foot-candle; and even with the 10-candle standard, the intensity only reaches 1·08 foot-candles. The 60-inch bar is, therefore, to be preferred for the ordinary gas testing; for the testing of high-power light-sources, a larger bar should be employed. If we have our dark-room of

* This report was noticed in the JOURNAL, Vol. LXIV., pp. 1161, 1209.

* The Committee's report will be found in the JOURNAL, Vol. LXV., p. 1010; and a description of the Dibdin standard on p. 1021 in the same volume.

sufficient length, and we are not constantly making such tests, they can be conveniently enough provided for by having a full-length portable table, the calculations to be made from tape measurements. But in this connection it is well to bear in mind that, with new forms of light sources, and especially with high-candle power lamps, the candle power should be taken spherically; and for this a radial photometer is required.

For the comparison of the illuminating power of gases, a horizontal test is sufficient, because the character of the gas does not change the result, except in a minor degree by reason of the flames of higher candle-power gases having a greater absorptive power for their own light than lower candle-power gases, as already referred to. With the flat-flame burner, this can be provided for by making the test with the burner at such an angle as will give the mean angular candle power.

For spherical photometry, Mr. Dibdin has improved the Hartley "Universal" photometer by arranging the disc so that it can be readily adjusted to receive the rays from the standard and the light-source under examination at the same angle of incidence. This at once eliminates the necessity for correction on account of the cosine law, and also the departure from that law by reason of variation of absorption and reflection with the angle.

Upon the important questions of corrections for variations in the gas and candle consumptions, there exists considerable difference of opinion. The English method, which is followed in America, provides for correction by the rules of proportion. Many English experts have long held that a method more nearly like the French—viz., the measuring of the quantity of gas required to give a standard candle power—should be employed. The report of the Photometric Standard Committee recommends that the present rule "be rescinded, so as to allow the Gas Referees to sanction a mode of testing in which the gas shall be burned from the standard 'London' Argand burner at whatever rate is found requisite, in order that it may give a light equal to that of the prescribed number of candles in which the illuminating value of the gas shall be calculated as being inversely as the rate at which such gas had to be burned during the testing, so as to give this amount of light."

This may, on the average, be a fairer rule than the present one. It more especially applies to the testing under English conditions, when there is in each case a prescribed candle power to be maintained. But any such rule must be arbitrary; and its discussion is not necessarily involved in the question of measurement of light. If we could, in the case of each gas, fix such conditions as would give the nearest possible measure of the absolute illuminating value of the gas, we should have made a great step, and be in a position to avoid many of the difficulties involved in the question of difference between candle power and illuminating effect.

But I cannot see that we can ever hope to make a direct comparison between the absolute illuminating value of gases; for how can we ever say that any given burner accords to any two gases of different composition the same percentage of illuminating efficiency? At the best, our success in this direction can be only approximate. But it is to be remembered that the ability of the photometer to accurately compare the illuminating value of any two light-sources, or of any two gases burned under prescribed conditions, is not involved in this last question.

As a matter of commercial fairness, it would seem as if the comparison should be made with the gases burned in each case in a way which the consumers could easily, simply, and economically employ, and would, under those conditions, give each gas so burned the greatest possible efficiency. This would seem to point to the general use, for testing, of high-grade, though cheap, flat-flame burners.

I have thus endeavoured to touch upon some of the more important features involved in accurate photometry. Of course, we must always remember that the photometer is an instrument to be used as prescribed, and with all limiting conditions well in mind. We must see that the disc is completely protected from diffused light, and that this condition is maintained. Accumulation of dust, &c., may cause sensible error. The room should be maintained, as far as possible, at the normal temperature. The various parts of the instrument should be re-adjusted and re-standardized from time to time. It should not be taken for granted that the two lights are exactly 60 inches or 100 inches apart, and that the centre of the bar is exactly midway between the lights; that the meter is accurate; or that the candle balance is sufficiently sensitive. I have seen numbers of balances in American photometer-rooms which were attractive enough in appearance, but which were better adapted for use in a grocery than in a laboratory. The ventilation of the photometer and the room should be well cared for. An accumulation of carbonic acid from the products of combustion and an increase in temperature are prolific sources of error. The instant a disc becomes discoloured or marred, it should be replaced.

To the younger members I may, perhaps, venture to suggest that it is necessary to study photometry to be sure of results. Do not be willing to blindly follow the methods prevailing at your station.

As gas engineers engaged in the practical, every-day work of our profession, we cannot expect to do much in the way of original investigation in the science of optics. But we can keep informed as to the progress in practical photometry; and possibly we may assist the men of science in putting the results of their patient labours into more practical shape.

Before concluding, I wish to raise my voice in earnest protest against a too ready condemnation of the photometer. Before a recent meeting of a sister Association, a remark was made to the effect that the photometer could be made to give any reading to suit the prejudices of the observer. Is it not at once to be understood that, in any laboratory test, the statement of the result is absolutely dependent upon not only the accuracy of the instrument and the skill of the experimenter, but upon his honesty? Why should we expect the photometer to give accurate results irrespective of the observer's wishes?

Commercially reliable results can be obtained, and are constantly being obtained, with the bar photometer; and if they are not so obtained, the one charged with the making of the tests should be held responsible. Of course, where we get results far outside of the beaten track, it is reasonable that we should ask if these abnormal results were not obtained while some of the sources of error were out of mind. In such extreme cases, no honest investigator would object to the request for confirmation.

No doubt lack of uniformity in the instruments, and in the manipulative methods employed, adds to our difficulties; but this can be improved, not by condemning the photometer as worthless, but by recognizing its intrinsic worth, and then co-operating to make its statements more uniformly comparable. Further still, after we get our statements from the photometer, let us bear in mind that it still rests with us to properly interpret those statements. The prime importance of sending out a uniform quality of gas will be readily admitted by all. Without the photometer, how shall this be ensured?

In conclusion, I maintain that "candle-power" is a true measure of illuminating power under the conditions prescribed for the test; that the photometer can be relied upon, with confidence, to correctly measure the illuminating power of a light-source; that the total illumination and the intensity of illumination must of necessity vary with the subdivision and distribution of our light-source, and with the nature of the surrounding surfaces; that a measurement of the spherical candle power of the light-source, and a determination of its colour composition, will, as far as possible, enable us to estimate the light-effect obtainable under varying conditions; that the actual measurement of the total illumination of an enclosed space and of the different degrees of intensity of illumination is well-nigh impossible, and that our failure in this direction is no criticism of the photometer or of the principles upon which it operates; that the intensity of illumination, either of an open or of an enclosed space, cannot be made uniform by the employment of any artificial light source, but our aim should be to modify the effect of the law of distances and the spherical distribution from the light-source, so that, as far as possible, the illumination should be distributed uniformly where required; and that it should be our aim, as far as possible, to shield the eye from the direct light-rays, and so give it the fullest possible opportunity to appreciate the illumination afforded.

[In an appendix to his paper, Mr. Humphreys gave a list of standard works, extracts from gas periodicals, and other literature on the subjects of photometry and illumination.]

Making Water-Works Ornamental.—The Water Commissioners of St. Catherines (Ont.), in their report for the past year, have briefly described some of the improvements they have made in the grounds surrounding their reservoirs by planting ornamental trees, hedges, &c.; thus adding materially to the attractiveness and beauty of the landscape. They say they have considered it their duty not merely to manage the works with care and economy, and to furnish the inhabitants at all times with an abundance of good water, as well as an efficient pressure for the extinction of fires, but have also thought it incumbent to beautify and adorn the grounds; and they rely upon the refined taste and higher sentiments of the citizens for support and approval of their efforts to give the reservoirs the best setting which natural scenery and tastefully laid-out and well-kept grounds can afford.

Society of Arts.—The opening meeting of the 142nd session of this Society took place last Wednesday evening, when Major-General Sir John Donnelly, as Vice-President and Chairman of the Council, delivered an address. In continuation of his address of last year, he discussed the present position of technical instruction in this country, and reviewed what was done as a preparation for it in elementary schools, and to promote it through the Science and Art Department, as well as by voluntary associations. He then analyzed the returns as to the appropriation of the beer money and the levying of rates by local authorities, classified the subjects selected by them, and suggested that the suspicion of waste—the possible price of experience—should be met by concerted action and more systematic inspection and examination. At the close of the address, Sir John Donnelly presented the Society's medals awarded to authors of papers read last session; one being to Professor Vivian B. Lewes, for his communication on "The Commercial Synthesis of Illuminating Hydrocarbons."

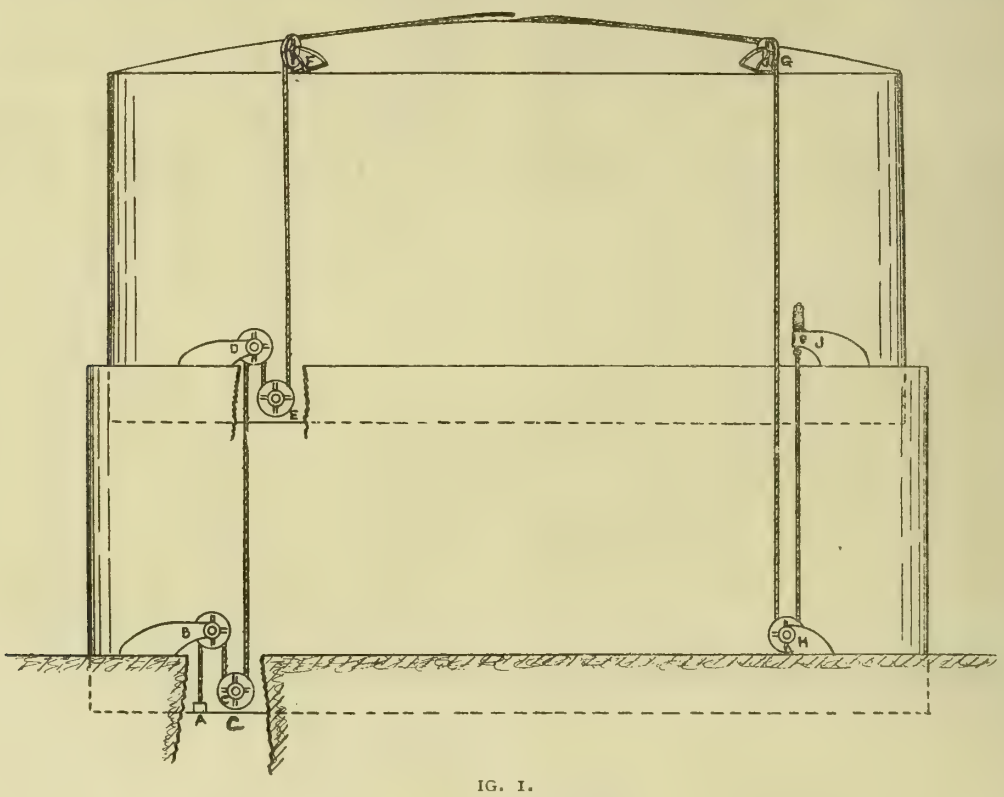
THE NEW HOLDER AT THE MIDDLESBROUGH GAS-WORKS.

In the JOURNAL for the 29th ult. (p. 884), we gave some particulars, supplied by Mr. David Terrace, the Gas Engineer to the Middlesbrough Corporation, in regard to the new holder with the wire-rope system of guiding lately erected at the works under his supervision. We are now able to supplement those particulars by other details furnished by the manufacturers (Messrs. Ashmore, Benson, Pease, and Co., Limited), and to give a view of the holder fully inflated, and diagrams showing the method of training the ropes.

The main feature of interest regarding this holder is the fact of its being the largest erected up to the present time without the usual guide-framing; and it may be remarked at once that the system of rope control has proved itself capable of maintaining the holder in an absolutely level condition, or, speaking more correctly, within half an inch. This was found to be the full amount of variation from the dead-level when the holder was inflated to its full height and standing during a gale of wind, and working without any vibration or irregular movement. The pressure-register also supplies an excellent diagram as to the regularity of pressure in the rise and fall.

Work on the tank, which is 186 ft. 6 in. diameter and 31 feet deep, and composed of steel plates, was commenced in the beginning of December last year; water being turned in the first week of the following October, and the holder inflated on the 15th of that month. It may be mentioned here that the contract was signed on Oct. 12, 1894, and Messrs. Ashmore were allowed sixteen calendar months for the completion of the work. They are therefore more than six months in advance of their time.

There is little to be noted with regard to the holder itself, as the design varies very slightly from that usually adopted, with the exception that a certain number of guides, with corresponding carriages, are placed on the outside. These prevent any twisting motion to which there may be a tendency by the action of the wind. The method of supplying the rope support, however, illustrates a development which has not previously been adopted—viz., the feature of the utilization of the power that is obtainable by the use of suitably placed pulleys. By this means, the twelve ropes that pass over the inner lift have, broadly speaking, the effectiveness of twenty-four ropes when applied to the second lift. The outer lift is roped quite independently of the two inner lifts. It is supplied with eighteen ropes for the support of the bottom curb, and eighteen ropes for the anchoring (if it may be so termed) of the dip of the outer lift, on the same principle as that applied to the second lift. The thirty-six ropes on the outer lift (or, more correctly speaking, eighteen, seeing that each rope acts in a double capacity in controlling the dip at one extremity and the bottom curb at the other) possess a gross aggregate effectiveness of seventy-two ropes.



IG. 1.

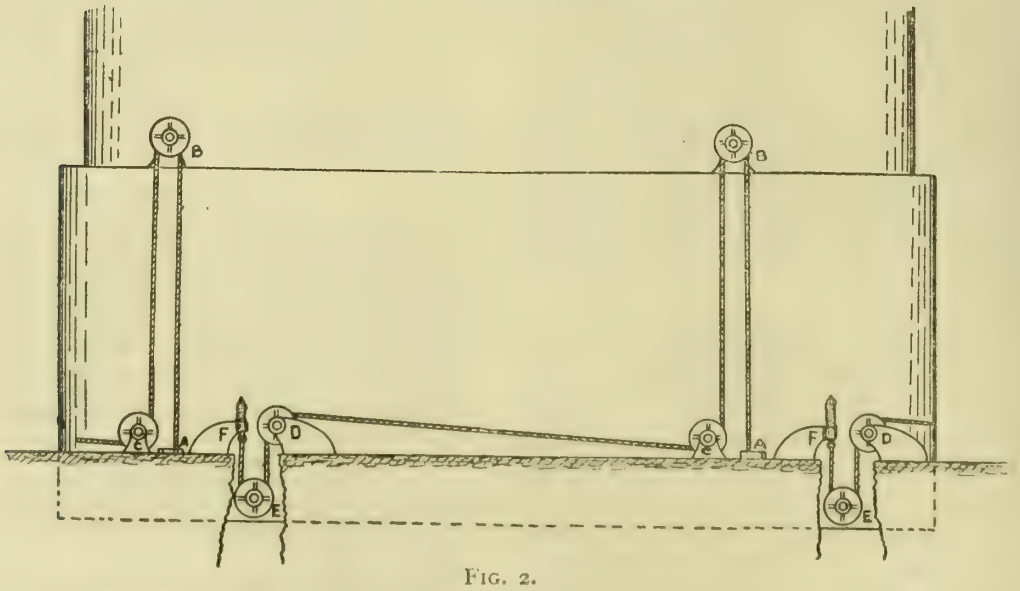
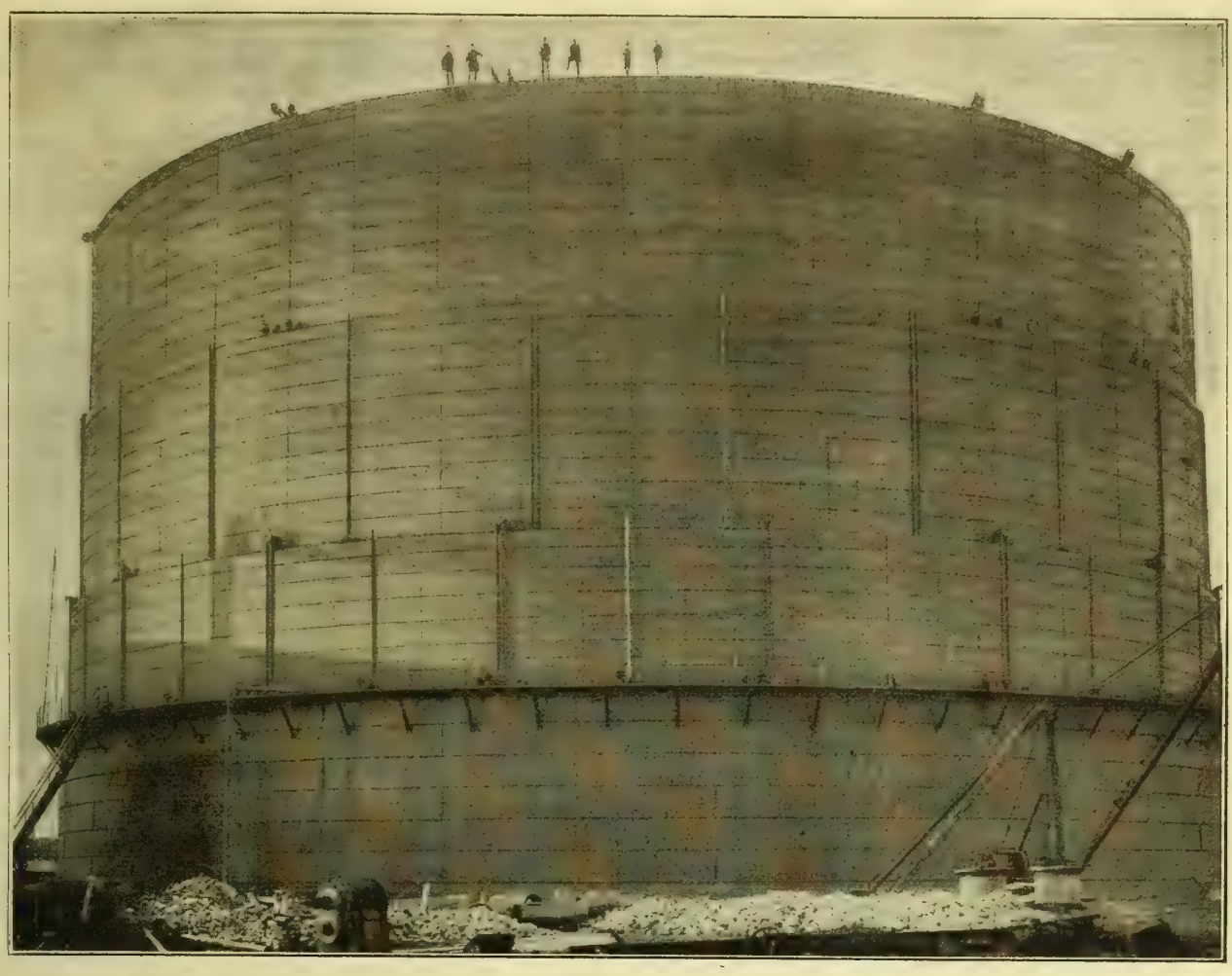


FIG. 2.

The accompanying diagrams are in no way correct in detail, but merely indicate the position of the pulleys and brackets in regard to one another. Fig. 1 illustrates the two inner lifts. The ropes cross the centre of the crown, and are attached at either end in the manner shown by the two portions of rope which combined form one complete rope. As the inner lift rises, E approaches D, while G leaves H. When the outer lift rises, the two points A and C approach B, while the two points



ROPE-GUIDED GASHOLDER AT THE MIDDLESBROUGH CORPORATION GAS-WORKS.
Capacity, 2,250,000 cubic feet. Tank, 186 ft. 6 in. diameter, 31 ft. deep.

G and J leave H. The traverse of each rope is thus twice as rapid, and the support it is qualified to afford double as great, as in its passage over the inner lift. Perhaps it is hardly necessary to remark that a minimum of three ropes is necessary.

Fig. 2 does not show the horizontal pulleys that are required to carry the ropes round the circle of the holder. The number of parallel ropes on these pulleys will vary according to the distance apart of the two ends of the ropes, and the number of ropes employed. In the present case there are four, which run for a certain distance in company. The essential principle of the arrangement is plainly shown in the diagrams, and needs no further elucidation. Attention may, however, be drawn to the means of adjustment, and to the springs on the tops of the brackets. Ample margin is left for tightening the ropes if required; and the effect on its neighbour of tightening one rope, owing to their juxtaposition, is very clearly shown. A, C, D, and F are all fixed to the tank.

In all cases the brackets of the pulleys on the holder that receive the strain of the ropes are firmly attached to strong vertical stays on to the ironwork of the curbs, or cups and dips, in close proximity. Intermediate between the eighteen stays carrying the pulleys corresponding to those marked B in fig. 2, are thirty-six stays of lighter section. While the vertical stays provide for the stiffening of the outer lift, they also, to some extent, secure its vertical rise. Opposite to the thirty-six exterior vertical stays, corresponding pulleys are placed on the top of the tank. These, in conjunction with the tank-guides, have, irrespective of the ropes, a controlling power, which, however, decreases as the holder rises.

NORWEGIAN MINERALS CONTAINING THORIUM AND YTTRIUM.

The following is an abstract-translation of an article on the above subject by Herr L. Schmelck, which appeared in the *Zeitschrift für angewandte Chemie*, and has been reprinted in *Der Gastechniker*.

Norway is one of the chief localities for the minerals containing thorium and yttrium oxides and the allied rare earths, which are used for incandescent lighting. Several of these minerals have been but little examined; and the text-book statements concerning them are unreliable and deficient. Since there is now a great practical application for them, the following information, based on the author's own observations, may be of service.

The following are the more important Norwegian minerals which serve as raw materials for the oxides: Thorite, orangite, aeschynite, euxinite, fergusonite, monazite, gadolinite, orthite, xenotime, and yttrotitanite. Thorite, a thorium silicate containing about 50 per cent. of thoria as well as uranic and ferric oxides, lime, and small amounts of ceria and yttria, and orangite, which contains about 70 per cent. of thoria besides the other constituents of thorite, have no precise differences, and are varieties of the same mineral—being often found in contiguity. Thorite is chestnut brown to pitch-black in colour; more rarely touched with green, fracture conchoidal, and streaked with brown. Orangite varies in colour from orange red (in the purest varieties) to brownish black, and is diaphanous and lustrous. Thorite and orangite are of the hardness of apatite, and are infusible before the blowpipe; thorite becoming brown, and orangite white in the flame. Both minerals are easily and completely taken up by concentrated hydrochloric acid. On diluting the solution with its volume of water and boiling, the addition of ammonium oxalate immediately throws down characteristic quadratic tabular crystals of thorium oxalate. Commercial thorite and orangite usually contain only 45 to 60 per cent. of thoria.

Aeschynite and euxinite resemble one another externally, and have nearly the same constituents—viz., earths of the yttria group, titanic and niobic acids, uranic oxide, ceria, and thoria. There is usually 10 per cent. of thoria in aeschynite, and only 3 to 4 per cent. in euxinite. Both minerals are brownish-black to black in colour. They are only slightly attacked by strong hydrochloric acid, but, if finely powdered, are gradually dissolved in concentrated sulphuric acid. They are infusible before the blowpipe. Fergusonite (yttrium tantalate, with about 30 per cent. of yttria) resembles these minerals in outward appearance and solubility. Gadolinite contains about 45 per cent. of oxides of the yttrium group, and about 25 per cent. of silica, as well as the oxides of iron, beryllium, lanthanum, and cerium, and small quantities (0·5 per cent.) of thoria. Orthite—an aluminium-iron-calcium silicate, with about 20 per cent. of the oxides of cerium, lanthanum, yttrium, and didymium, and small quantities of thoria—closely resembles gadolinite in appearance. Both are ordinarily quite black, streaked with grey or brown. Before the blowpipe, orthite swells up considerably and melts; while gadolinite swells but little, and is infusible. Orthite is generally readily soluble in concentrated hydrochloric acid; gadolinite usually requires strong sulphuric acid for its solution.

Norwegian monazite (lanthanum-cerium-didymium phosphate) contains from 3 to 12 per cent. of thorium oxide—

usually about 8 per cent. It is brown, brownish yellow, or brownish grey in colour, is infusible before the blowpipe, and is decomposed by strong sulphuric acid, but not hydrochloric acid.

Xenotime is an yttrium phosphate containing about 50 to 60 per cent. of yttria and erbia, as well as ceria. It generally occurs intimately associated with other rare minerals; and it is yellow to brown in colour, and infusible. Some of the purer varieties are soluble in strong hydrochloric acid; others are only decomposed by concentrated sulphuric acid.

Yttrotitanite, or keilhauite, is a titanosilicate of calcium, aluminium, and iron with 6 to 12 per cent. of yttria and allied earths. It is black in colour, and intumesces; and it melts before the blowpipe. It is decomposed by concentrated sulphuric acid, but very little by hydrochloric acid.

The other Norwegian minerals containing thoria and the yttria earths—such as tritomite, pyrochlor, polymignite, polycrase, eucrasite, &c.—occur in such small quantities that they have up to the present no practical importance.

SUPPLYING GAS WITHOUT A HOLDER.

In another part of the JOURNAL will be found a communication from Mr. G. E. Stevenson, of Manchester, furnishing particulars, in answer to an inquiry by a correspondent, of a case which came within his experience of keeping up a supply of gas without a holder. An instance of a somewhat similar kind occurred a few years since to Mr. J. W. Dunbar, of New Albany, Ind., who gave an account of it in a paper submitted to the Western (U.S.A.) Gas Association. An abstract of the paper appeared in the JOURNAL at the time; but it may be interesting to reproduce it in conjunction with Mr. Stevenson's article.

The holder in question—the only one on the works—had a capacity of 60,000 cubic feet; and the supply of gas had to be kept up while it was undergoing repair. The maximum output per diem was 75,000 cubic feet; and the minimum 21,000 cubic feet. It was, of course, during the period of minimum make that the gas was supplied without the holder—direct communication being effected between the inlet and the outlet. The inlet and outlet pipes were 2 feet apart inside the holder, and both 10 inches in diameter. The outlet had been abandoned for several months, on account of the leakage of water at the joints; and the inlet was also admitting water to an alarming extent. The condition of the seams and rivets in the holder was very bad, as the leakage amounted to 20 per cent. of the gas produced. Commencing operations on a Monday, the first thing was to empty the tank. Some adjacent low ground enabled about half of the contents to be syphoned off by means of two 3-inch syphons; and the remainder was pumped out by the aid of the city fire-engine. On the following day, Mr. Dunbar was able to inspect the inside of the holder; and it was then found that the lead joints of the stand-pipes had become loose. They were well caulked, and this stopped the leakage, which did not occur again. Mr. Dunbar could only account for this defect by the extreme cold, which ranged to 15° below zero in the winter, as the leakage commenced during a spell of severe weather. Turning to the holder seams, it was found that many of the rivets had not been properly set up in the first place. An ordinary knife-blade could be introduced at many points. These places were filled up with a putty composed of litharge and red and white lead, worked up with glycerine; and the whole of the seams, inside and out, were thoroughly painted with the mixture. This method proved to be a satisfactory cure; and on being again put into use, the holder was perfectly sound. Having previously tried all sorts of expedients on the outside of the holder, to render it tight, the author formed the opinion that a leaky holder could not be made sound from the outside.

No difficulty was experienced in keeping up the supply of gas, except for a short time on the first night. The amount of pressure required was 12-10ths; and as the evening of the first day came on, the retorts, which had been standing empty, were set to work. A sufficient number were charged to bring up the pressure to 3 inches. But it soon fell off from this; and before the remaining retorts were charged, it had fallen to 5-10ths. The charging being completed, it went up to 2 inches. After this a momentary decrease of pressure was caused by a stoppage in the washer, which had to be at once bye-passed. With this experience, a better start was made on the following evening—the pressure being run up to 5 inches at first; and some of the retorts were drawn and recharged as soon as the pressure fell to 2 inches. This was continued through the night. The street-lamps were not lighted except on one night, and then only for a few hours. Without the public lamps (475 in number), a make of 8000 cubic feet of gas per hour was sufficient; with them, 11,000 cubic feet per hour were required. But with this extra demand, a pressure of 13-10ths was maintained. No complaint was received from consumers, as the illuminating power of the gas was kept slightly above the usual standard.

The Leeds Gas Committee and Retort House Machinery.—The Gas Committee of the Leeds City Council have arranged to visit the East Greenwich station of the South Metropolitan Gas Company and the Bromford Gas-Works, to inspect the installations there of retort-house machinery and inclined retorts, with a view to their adoption in the Meadow Lane works extensions.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Carburetting.

SIR,—As it appears likely, unless a material rise in price takes place, that benzol will largely displace "carburine" as an enriching material, it may not be out of place to direct attention to a matter which so far does not appear to have been duly considered in this connection—viz., that commercial benzol may contain carbon bisulphide, thiophen, and possibly other sulphur compounds.

Of the samples which have passed through my hands, one contained as much as 972 grains of sulphur per gallon, which is equivalent to an increase of 10 grains of sulphur per 100 cubic feet of gas for every candle of enrichment. It is, however, not a very difficult matter for distillers to materially reduce this figure; and upon attention being directed to the subject, benzol containing less than one-third the above amount of sulphur was obtained.

It is perhaps needless for me to point out that gas undertakings working under "sulphur restrictions," and desirous of using benzol as an enricher, would do well to ascertain that their purchases contain no large amount of volatile sulphur compounds.

E. LLEWELLYN PRYCE.

Windsor Street Gas-Works, Birmingham, Nov. 22, 1895.

Standards of Light.

SIR,—The interesting and able article by "Veritas" on this important subject makes brief reference to the letter from me which you inserted a short time ago. I join with "Veritas" in regretting that so large a subject obtains so little notice, and fall into the belief that there is not such an urgent demand for a change of standard as some have said exists. In fact, I think that "to leave well alone" is a general feeling, because of the noticeable advances in accurate testing by means of candles of late years, and secondly the cautious conclusions of the last Royal Commission made an impression whose influence has not yet left us.

The improvements in the make and use of candles entitle me to say that much of the odium which condemned them years ago has been removed. The late Mr. F. W. Hartley contributed largely to the better employment of candles by arranging a candle-balance so that they might be weighed in position and whilst burning; and since his time their composition, and the weight and number of strands in the wicks, have been brought under scientific control. How great a contrast is this to what was practised only fifteen years back—viz., one candle of uncertain make and number of strands weighed before being lit and snuffed and trimmed during burning. Although so much has been done, the recent Committee took candles by their past reputation, and rushed into action as if determined to reach conclusions without fail. And yet they had less reason, in the light of present day practice, to condemn candles and to adopt the Harcourt pentane standard than had the Royal Commission of twelve years ago, which (wise and cautious in its generation) refused to do one or the other. The recent Committee helps itself over the practical defects of the one-candle pentane lamp by adopting Mr. Dibdin's ten-candle lamp, which seems to me a very lame and doubtful step for a body of scientific gentlemen to take. This is so, because though the pentane standard may give quicker results than are obtained by candles, the showing of the Committee is that the results need not be more accurate; and if time calls for quick determinations, we have in the Methven screen a standard which I have found fairly accurate, and believe is so for all qualities of gas within the range of public gas supply in this country.

I have used both the one-candle pentane lamp and the ten-candle, and agree that the first is unsuitable for general use. I further think that more difficulty lies in fixing the disc upon the neutral point at the position of the ten-candle standard than at that of two, and certainly the smaller length of movements of the disc upon the bar to declare the one-candle value is a further drawback. I do not think that a liquid or gaseous standard can compare in general usefulness with a solid one; and I believe that as a candle determination of value appeals so strongly to public sentiment, by giving a demonstration of value which is satisfying to popular claims and expectation founded upon long usage, so at present there is much less need for a change in the standard of light than for a change in weights and measures to the metric system, which a distinguished member of the present Government (Mr. Balfour) has so strongly condemned.

The writer of the article in question says that with candles, honest 16-candle gas can be anything between 15 and 17 candles. I do not think so; and the returns of the Chief Gas Examiner for London do not show it. The constancy of the published reports leads me to believe that the Gas Companies are much more likely to send out inferior gas than that the tests of the Gas Examiners are inaccurate. I must urge my former plea, that one certain make of candles only be sanctioned by the Board of Trade; and I believe this course is more likely to meet with general approval than the change recommended by the recent Board of Trade Committee.

E. WILLIAMS, F.C.S.

Manchester, Nov. 23, 1895.

Secretaries as Members of District Associations.

SIR,—I have read with interest (as I always do your admirably authentic reports) your account of the meeting of the Southern District Association of Gas Engineers and Managers; and, from remarks made in the discussion on the proposed amalgamation of this with the South-Western Association, I—as one of the "pure and simple"—would like to ask why so much stress was laid upon the matter of allowing secretaries of gas undertakings to become members of the Southern Association, as it appears that the South Western Association by their allowing secretaries to participate in the privileges of their society have raised a barrier to their amalgamation with their brothers, the Southern Association.

There may be some grave reasons for not countenancing "pure and

simple" secretaries; but, in my simplicity, I fail to see one. Surely, we are all interested in one and the same object—self and mutual improvement, to better enable us to manipulate and carry out the responsible and onerous duties which devolve upon both engineers and secretaries in the judicious conduct of the affairs of modern gas industries.

The Institution of Gas Engineers admit, as Associates, "pure and simples;" and, so far as I know, they have not detracted from, if they have not added to, the dignity of that society. Could not, therefore, the Southern Association follow so worthy a precedent?

Nov. 21, 1895. A "PURE AND SIMPLE."

Keeping Up the Gas Supply without a Gasholder.

SIR,—Your correspondent "Storage" will be glad to know that his idea has been practically carried out; and, by working as he proposes, he will be quite safe. At the same time, such a plan should only be adopted when there is no better way of accomplishing the work.

In many years' connection with the smaller gas-works, I have had sometimes to resort to the method "Storage" proposes. Upon one occasion, the existing holder tank had to be enlarged—there being no other room for extension; and in this case an annular excavation was made round the old tank, and the wall of the new tank was built before the holder was taken out. The water, however, was pumped down, at the commencement, to within about 20 inches of the bottom—thus giving very little working room for the holder. Still it was worth having. While the holder was being taken out and the new one put in, gas was supplied direct from the retorts to the town.

There are small portable holders to be had from some of the makers, which are useful in such cases to pass the gas through. But in the absence of them, we clear out one of the purifiers, unshackle the cover and weight it to the required pressure. This will act as a safety-valve should the retorts at any time make faster than the consumption. With watchful care, however, there will be little gas lost here.

As it may be, perhaps, a small day consumption, "Storage" will find an advantage in having at hand for the occasion a very slow working coal for the day charges. Of course, no exhauster will be worked; and there are reasons why the governor will be best, either bye-passed or loaded out of action for the time.

Rhayader, Nov. 19, 1895. W. H. MORGAN.

Proposed Association of Water-Works Engineers.

SIR,—We are again reminded by the "Water Companies' Directory" that "there is no institution wholly given up to water engineering questions in England, although such questions are occasionally treated of by the Institution of Civil Engineers." That is, I am led to understand, the opinion of many engineers, managers, and others connected with water undertakings. The exceptional and severe winter of 1894-5 itself was a subject-lesson to those interested in water-works. The controversy as to the use of two-gallon or three-gallon cisterns for water-closets, the question of the employment of registered plumbers only for water-works purposes, and the better control of fittings for the prevention of the waste, misuse, and contamination of public supplies, are points, among others, which might usefully engage the attention of, and call for combined action from, those who are engaged in this important branch of engineering; and my object in writing is to initiate a discussion by those interested, with the view of ascertaining what support is likely to be given to such an Association as the one suggested.

Nottingham, Nov. 16, 1895. D. M. F. GASKING,
Engineer, Nottingham Corporation Water-Works.

A Public Lighting Difficulty at Newport (Mon.).—Last Wednesday the Lighting Committee of the Newport Corporation had a conference with representatives of the Gas Company, with the object of adjusting a difficulty which has arisen in consequence of the Corporation giving the Company notice that they would not want gas for the 50 or 60 Sugg lamps in the area of the electric light installation. The Company were given notice of the intention of the Corporation twelve months ago; but it was contended that this notice had lapsed. On behalf of the Company, it was asserted that the Sugg lamps were a source of profit; whereas from the ordinary street-lamp, at £2 17s. 6d. per annum, no profit was made. Ultimately a compromise was effected, by which the Committee agreed to recommend to the Corporation to pay for the 50 or 60 Sugg lamps up to Dec. 1, or seven weeks beyond the time they had been needed. The Company abandoned a demand that the Corporation Road and other areas should be lighted, in order to bring the quantity of gas burned in public lighting up to the standard contracted for.

A Sensational Trick Explained.—A correspondent sends us the following: A great sensation has been caused on the Continent by the performance of two men, styling themselves "The Great Fire Kings," who stood on an open stage and, without any visible apparatus, caused long brilliant flames to dart from the tips of their fingers, and also from their mouths, for nearly a minute at a time. The trick is now accounted for. "The Great Fire Kings" stood on a daïs, seemingly designed to lift them into plainer view, but really concealing two rubber bags filled with coal gas, and compressed by heavy weights. To the heel of each man's right shoe a contrivance was fixed which, when pressed, joined a nozzle on the gas-bags, and opened the passage for the gas to escape through a tiny tube carried up the leg and back and down both sleeves—a connection being made at the wrists with flesh-coloured tubes, which traversed the palms of the hands, and terminated at the tips of the fingers, while another flesh-coloured tube was arranged to end by the chin. The ignition was brought about by an electric spark; and it was the failure of this spark to work at one of the *séances* which brought about the exposure of the trick. An escape of gas resulting, there was a small explosion, which blew up the daïs and slightly injured these ingenious "sons of fire," or should we not say "gas consumers?"

LEGAL INTELLIGENCE.

Action to Recover Possession of a Foreman's Cottage.

At the Bromley County Court last Tuesday, the Bromley Gas Consumers' Company brought an action to recover possession of a cottage, and rent for same, from a man named Bennett. Mr. Gregory stated that the defendant was formerly employed by the Company as foreman; and the occupation of the cottage was part of the remuneration paid for his services. On Sept. 14, he was told his services were no longer required; and he was given £12 in lieu of notice and the cost of removing his furniture back to Manchester. Defendant had refused to quit, although he took the £12; and the Company wanted the cottage for their new foreman. Judge Emden said the defendant might, as he had alleged, have a grievance against the Company; but he had no right to hold the cottage after his discharge. The defendant must give up possession at once, and pay 30s. for his occupancy of the place since his discharge.

Theft of Cannel Coal.

At the Tenterden Petty Sessions on Saturday, Ambrose Rose, an engine driver, was charged with stealing 7 cwt. of cannel coal, value 9s. 9d., the property of the Tenterden Gas Company. Mr. W. T. Mercer, the Secretary of the Company, said the defendant was delivering coal at the gas-works for the Contractors, when he was seen by the Manager (Mr. S. E. Bark), who asked him about the coal which was in the tender of the traction-engine in his charge. Mr. Bark's attention was first attracted by the smell of cannel coal burning; and before the defendant was spoken to, the gas-works were examined—it being thought that there was an escape somewhere. Mr. J. E. Mace (the Chairman of the Company) was communicated with, and a prosecution ordered. The defendant said he had run short of coal for his engine, and he had tried "a little of the cannel." When the tender was examined 7 cwt. 20 lbs. of coal was found—there not being more than a shovelful of ordinary coal in it. The excuse was that the defendant, having run short of coal on the journey, thoughtlessly took some of the cannel coal. A fine of £5 was imposed.

The Public Lamp Meter Question at Dublin.

In the High Court of Justice, Ireland, last Tuesday, the Master of the Rolls again had before him the application for attachment by the Alliance and Dublin Consumers' Gas Company against the Corporation of Dublin (see *ante*, p. 1041). The Solicitor-General, with whom was Mr. Blood, on behalf of the Company, said this was an application that a time should be limited for compliance by the Corporation with the order of the Court of July 6, 1895. By that judgment, it was ordered that the Corporation should remove defective meters from the public lamps, and provide in lieu thereof proper meters within the award between the Corporation and the Company. A case had been submitted on behalf of the defendants to Serjeant Campion to advise as to whether there ought not to be an appeal. He understood the Corporation were not going to take any further proceedings; and the question now was what time ought to be given for the removal of the meters. He would suggest three months. Mr. C. O'Connor, Q.C., said the Corporation did not intend to appeal; and it was their desire to carry out his Lordship's order with the utmost expedition. The fixing of the old meters extended over a period of sixteen months; and his instructions were that it would be impossible to carry out his Lordship's order in three months. What he proposed was that the Corporation should give an undertaking that they would proceed to carry out the order with the utmost expedition; and, on this undertaking, that there should be no rule on the motion, with liberty to plaintiffs to re-enter it, if necessary. The Master of the Rolls said there did not appear to be any disposition on the part of the plaintiffs to unduly press the matter. The suggestion was that three months would be a reasonable time. He thought, perhaps, it would be better to give the Corporation four months, on the understanding that, if they used diligence and could not comply with the order in the time, they could apply for an extension, which, if necessary, would be favourably considered. The Gas Company (who, it was stated, were perfectly satisfied with the decision) were given the costs of the motion.

New Sewage Purification Works at Chorley.—The Corporation of Chorley have just completed their new sewage purification works at Common Bank farm, at a cost of about £15,000; and Alderman Hibbert, the Chairman of the Sewage Committee, performed the opening ceremony on the 28th ult. The works have been designed by the Borough Engineer, Mr. William Leigh, Assoc.M.Inst.C.E.; and the whole has been carried out under his direction. The "International" is the process adopted. Mr. Leigh has provided tanks of a total capacity of 1,120,000 gallons; and "Polarite" filters of a total area of about 1500 square yards. The sludge pressing machinery has been supplied by Messrs. Goddard, Massey, and Warner, of Nottingham. These new works have been rendered necessary by the fact that the Chorley sewage farm has failed in producing an effluent to satisfy the requirements of the river authorities. At the conclusion of the opening ceremony in the town hall, Mr. Brierley, C.E. (Messrs. Brierley and Holt, of Blackburn), speaking in response to the toast of the "Visitors," said that, as an engineer of 40 years' experience, and one who held a public office for many years, he was able to judge of the labour involved in carrying out works of the kind they had seen opened that day. He had witnessed all the phases of the great sewage question; and the system of treatment adopted at Common Bank represented the last, the latest, and the most complete development. They had seen in what an efficient manner the work had been carried out; and he thought he should not be doing an important duty to a professional brother if he did not say that there was no part of the work which was not of a sound and practical kind, and that the whole had been admirably conceived and executed.

MISCELLANEOUS NEWS.

SOUTH METROPOLITAN GAS COMPANY.

The Conversion of Capital and Workman-Director Schemes.

The South Metropolitan Gas Company have given notice of their intention to re-introduce their Bill of last session dealing with the above-named schemes, but with certain modifications. The nature of these will be gathered from the following extracts from the notice setting forth the objects of the Bill:—

1.—To convert the capital of the Company, other than debenture stock, into a capital of the same or different classes, having a uniform standard rate of dividend of £4 per cent. per annum on the nominal value of such converted and consolidated capital (subject to decrease or increase with the increase or decrease of the standard price of gas) or such other standard rate of dividend as may be defined by the Bill or prescribed by Parliament; and to allocate such capital to and among the holders of the different classes of stock and shares, and to secure to them respectively the same amount of dividend in every year as that to which they would respectively be entitled in case no such conversion had taken place, or such other dividend as may be agreed on between the said classes, or defined by the Bill, or prescribed by Parliament.

2.—To make provision for the surrender and cancellation of the existing stocks, and the certificates therefor, and for the issue to, and the acceptance by, such holders of the new stock and certificates in exchange for their existing stock certificates.

3.—To empower the Company, for the purposes aforesaid or any of them, to increase their nominal capital, and substitute an equivalent amount of stock of the same or different classes, and entitled or not to any special right or privilege as to participation in dividend, if and when it exceeds the standard rate, and to allocate such capital accordingly.

4.—To enable the Company, by agreement with the holders of any stock of the Company, to alter the dividends payable thereon so as to make the dividend on all or any classes of shares and stocks equal; and to confirm any such agreement which may have been, or which during the progress of the Bill may be, entered into.

5.—To empower the Company, for the purposes aforesaid, to purchase for cancellation, and to cancel, £2333 6s. 8d. of their "A" stock, or such other amount as the Bill may define or Parliament prescribe; and to appropriate out of their reserve fund such a sum as will be necessary to effect such purchase.

6.—To convert or provide for the conversion of the existing 5 per cent. debenture stock of the Company into such larger nominal amount of substituted debenture stock entitled to interest or dividend after the rate of £4 per cent. per annum, or such other rate as may be defined by the Bill, or prescribed by Parliament, as will yield the same amount of interest or dividend thereon as does the said existing debenture stock; and to provide that the remainder of the authorized but unissued debenture stock shall, after the creation and issue thereof under the provisions of the Acts whereby it is authorized, be converted into such nominal amount of substituted debenture stock (entitled to the same rate of interest or dividend as the debenture stock into which the existing stock shall be converted) as to yield to the holders of such substituted debenture stock the same amount of interest or dividend as the debenture stock for which it was substituted, and to make provision for the surrender and cancellation of the certificates of all debenture stock so converted, and the issue to, and acceptance by, the holders of such stock of the substituted debenture stock to be issued in exchange therefor.

7.—To empower the Company to purchase compulsorily or by agreement certain lands situate in the parish of St. Alphege, Greenwich. [Particulars as to these lands follow.]

8.—To make provision, either in the Bill or by a scheme to be submitted to, and approved by, the Board of Trade, with respect to the investment by persons in the employ of the Company in the capital of the Company, and for their representation in or upon the management of the Company, and for prescribing the rights, privileges, conditions, and restrictions under and subject to which such representation shall be given; and to confer on the Board of Trade and the Company all such powers as may be deemed necessary or expedient for effecting the objects aforesaid.

9.—To alter, or provide for the alteration of, the scale of voting of proprietors at meetings of the Company.

10.—To make provision for the offering to consumers of gas of the Company, and to persons employed by the Company, of new stock of the Company at the then market price of their existing stock.

11.—To authorize the signing of warrants for dividends on the stocks and for interest on the debenture stock of the Company by one Director only of the Company.

12.—To confer on persons in the employ of the Company, and holding stock of, or having deposited money with, the Company, the like power to nominate persons to receive such stock or money as is possessed by depositors in the Post Office Savings Bank; and to confer on the Directors of the Company the like powers of transfer and payment of such stock and deposited money as is possessed by the Directors or Committee of Industrial and Provident Societies and Savings Banks.

13.—The Bill will repeal, alter, and amend all such rights and privileges as would interfere with any of its objects, and will confer other rights and privileges, and will repeal, alter, and amend, and, if thought fit, consolidate all such provisions as may be thought necessary or expedient of the following Local and Personal Acts (that is to say): 5 Vict., cap. 79, sec. 2, City of London Gas Act, 1868, and the Schemes of Amalgamation made thereunder; the South Metropolitan Gaslight and Coke Company's Act, 1869; the South Metropolitan Gaslight and Coke Company's Act, 1876, the South Metropolitan Gas Act, 1881; the South Metropolitan Gas Act, 1882; and any other Act or Acts relating directly or indirectly to the Company or their undertaking. It will also incorporate with itself, *in extenso* or by reference, with or without alteration, such of the provisions as may be deemed expedient of the Lands Clauses Acts, the Companies' Clauses Consolidation Act, 1845, the Companies' Clauses Act, 1863, the Companies' Clauses Act, 1869, the Post Office Savings Bank Acts, 1861 to 1891, the Savings Bank Act, 1887, and the Acts relating to Industrial and Provident Societies.

THE DISASTROUS EXPLOSION IN THE STRAND.

On Monday last week, Mr. John Troutbeck, the Coroner for Westminster, continued his investigation, at the St. Clement Danes Vestry Hall, into the cause of the death of Martin Ernest Sprague, a member of the Metropolitan Fire Brigade, who sustained injuries which proved fatal while searching the ruins on the scene of the explosion in New Church Court, Strand, on the 29th ult.

On the present occasion, the Hon. Alfred Lyttelton appeared for The Gaslight and Coke Company; the other interested parties being represented as before.

Evidence was first called to controvert the allegations made at the opening of the inquiry as to the condition of the houses which were destroyed—the principal witness being Mr. *A. O. Collard*, a Surveyor. His testimony was to the effect that the bricks of which the houses were constructed were old London red bricks, kiln burnt; that the mortar, which was composed of chalk lime and sand, was very good; that the walls were of greater thickness than was now required by the Building Act; and that altogether the houses were solidly built. Witness was present at the opening of the ground in the court on Nov. 11; and then saw a fracture in the gas-main. In his opinion, the explosion was caused by the percolation of gas through the loose earth into the basement of No. 26, where it accumulated, as the cellar was practically sealed up. In the vault of No. 27, he had found a crack running about 16 feet of the whole length of 22 feet of the front wall; and it then turned round the angle of the wall separating the vault from the basement of No. 26. This wall was pushed inwards about 3 inches; and the fracture showed evidence of being new. Some external force, he supposed, must have pushed the wall in. From inquiries he had made, he learnt that the shock was felt some 800 or 900 feet away.

Mr. *Roland Plumbe*, Mr. *Robert Walker*, and Mr. *F. W. Porter*, District Surveyors, and Mr. *G. Bywaters*, a builder, gave corroborative evidence as to the construction of the houses.

Mr. *W. G. Cannon*, a gas and hot-water engineer, stated that he had examined the fractured gas-main. Judging from the rust, he thought one part of the fracture was rather aged; but the principal part was of only a few days' standing. The rest of the pipe seemed to be sound and perfect. In his opinion, at the time the main was tapped for the purpose of forming a junction for the service-pipe leading into Loveridge's restaurant, a very small fracture might have occurred, but not large enough perhaps to detect an escape of gas. But such a fracture would extend in course of time. The brickwork which supported the step of No. 26 was of rather a light character; and gas could easily have percolated through the earth, and into the basement of the house.

By the Hon. A. Lyttelton: Witness was not aware that the pipe was laid in 1879. Assuming that water had percolated through the ground for a fortnight previous to the explosion, that would have caused rust, but not to the extent that the rust had eaten into the fractured parts.

Philip Watson, a workman in the employ of the New River Company, stated that he was called, on Oct. 25, to attend to a leakage of water into Loveridge's kitchen. On the following day, they opened the asphalte and cement pavement opposite No. 25; and there found a hollow some 15 feet long by 6 feet wide, and 2 feet deep. This was quite 20 feet from where the fracture in the gas-pipe was discovered. The gas and water pipes were lying about 12 inches apart; the latter being about 2 feet deep, and the former 8 inches nearer the surface. There was no smell of gas in the hole. When they detected an escape, they always gave information to the Gas Company.

Replies by witness to some questions by the Hon. A. Lyttelton showed that the water escaping from the fractured main must have flowed down the court in a southerly direction, past the spot where the gas-main was fractured, to reach Loveridge's kitchen and the machine-room of the *Weekly Times and Echo*. He confessed that he smelt gas in the court, but not in the trench; but as there was no escape from the portion of the gas-main which he exposed, he did not think it necessary to give information to the Gas Company.

By Mr. Debenham (for the New River Company): For reporting an escape to the Gas Company, he would receive a reward.

Mr. *G. F. L. Foulger*, the Distributing Engineer of The Gaslight and Coke Company, deposed that no complaint had been made to him as to an escape in New Church Court before midday on Monday, Oct. 28. Immediately upon receiving information that an explosion had taken place, he himself went to the court. The gas was, as quickly as possible, cut off at the main; and temporary lights were fitted up to enable the firemen to carry on their operations. The place was left undisturbed until the visit of various gentlemen interested in the matter on the 11th inst., on which day the ground was opened, and the water and gas mains exposed. The average depth of the gas-main was 2 feet; and the water-main was 10 or 12 inches below. This was an exceptional depth for a gas-main in a court where there was no vehicular traffic. The main was laid in 1879; and, in such soil, its life ought to be 50 years. The trench which they opened on the 11th inst. was about 27 feet in length. They found the soil was loose, and had the appearance of having been thoroughly washed with water. The gas-main was practically unsupported, and acted as a kind of girder to the footway above. It was discovered that the gas-main had been fractured immediately where the service entered Loveridge's kitchen. The main was completely broken; and there was considerable depression in it at the fracture. It took seven pennies on one side of the depression and five on the other to adjust a spirit level. This great depression, in his opinion, was due to the falling of some of the brick-

work immediately after the explosion. He thought that, before the explosion, the main was simply cracked without the depression, and that the crack was caused by the soil being washed away. He was quite certain the crack was of recent date, from the fact that the escape from it would have been equivalent to 50 cubic feet an hour, and more than that at times of greatest pressure; and such an escape could not continue without being detected. Taking into consideration the quantity of water that must have percolated through the ground, and passed round the fracture, as well as the amount that was poured on to the ruins at the time of the fire after the explosion, there was no more oxidation at the fractured ends than he would have expected to find in the case of a recent fracture. Besides, the pipe had been lying in the wet soil from Oct. 29 to Nov. 11 before being examined. The rest of the main was put under air-pressure; and tests, by means of a water-gauge, showed that it was perfectly tight. He agreed that the explosion was caused by the accumulation of gas in the cellar of No. 26. The cellar being sealed up, and the ground floor of the house uninhabited, were specially favourable conditions to an explosion of gas. In his experience, it was usual for any company who had opened ground, and found a state of things that might endanger the gas-mains, to give notice to the Gas Company; and, the mains in this instance being so close together, it might reasonably be expected that what had caused damage to one main would cause damage to the other. A considerable escape of water, such as must have flown from the water-main, would wash away a large amount of the soil.

By Mr. Rubinstein: In laying a main, if the soil was of a loose friable nature, it was usual to pack the main with timber to give it greater support. That was done in this instance, which showed the work was well carried out.

By Mr. Lincoln Reed: The fact that the service to Loveridge's kitchen had been there six years was sufficient proof that there was not a crack at the junction with the 4-inch main when it was put in. The main was an exceptionally thick one; and he thought it was an absurd suggestion of a previous witness that a slight fracture was made at the time the service was screwed in, and that it gradually enlarged. When opened, the ground had a honeycombed appearance.

Arthur Thirby, a foreman fitter in the employ of The Gaslight and Coke Company, deposed to having received information from Mr. Scourfield of a smell of gas at the office of the *Weekly Times and Echo* about 1.30 on the day before the explosion. He went immediately with a fitter; but they failed to trace any escape on those premises. They also examined the gullies and ventilators in the court, but could not detect the faintest smell of gas. He gave instructions for another examination to be made when the night pressure came on.

Charles Hartwell, the fitter who accompanied the previous witness, stated that, in accordance with his foreman's instructions, he visited the court at 6 o'clock in the evening, and again at 9.30; but could not discover any leakage. On the following evening, he made a further examination, and detected a smell of gas in the archway of the court; and at the time he was reporting the matter at the office, the information was received that the explosion had occurred.

Sir *Frederick Bramwell*, F.R.S., examined by the Hon. A. Lyttelton, stated that he attended the investigations in the court on the 11th inst. He found in the asphalte, just above where the fracture proved to be, a very extensive and considerable depression, which could not possibly have existed at the time the surface of the court was formed. He had photographs taken of the depression from two points of view. He was told that the buildings had fallen to a very large extent over the surface of the court; and the depression seemed to him to be evidence that the ground underneath must have been very defective. When the fractured gas-main was laid bare, they found that, if measured a foot on either side of the fracture, the depression of the main in the middle would be about ⅜ to ½ inch. The effect of this was to materially open the crack on the underside of the main. His opinion was that a depression of a slighter character had taken place, through the subsidence of the ground, before the heavy weight of material had fallen upon the asphalte, because there was a crack in the pipe sufficient to allow the issue of gas to cause the explosion. A hole was dug down on one side of the main; and probing showed that the ground was quite unfit to afford ample support for the main. It was evident to him that the ground had been very much disturbed by the escaping water. He was quite prepared to say that the crack in the main was absolutely new; and that the main was of apparently good metal, and of very adequate thickness. The hole which had been made in the main to receive the service-pipe to Loveridge's restaurant was an ordinary and well-tapped one; and he could not discover any evidence of a crack having been made there at the time the connection was effected, as had been suggested.

Questioned by other Counsel, witness said he thought the extreme depression in the asphalte might have been about a foot. The condition of the soil would be quite consistent with the opening of the court for the purpose of carrying out sewerage works. He should think the water-main had broken from want of support, and the gas-main was fractured through the passage of water dealing prejudicially with the soil a short time before the explosion.

Three police constables who had been on duty in New Church Court during the preceding week at different hours declared that they had not noticed the smell of gas; and that, if they had done so, it would have been their duty to report the matter.

The Coroner then addressed the jury. He remarked that the inquiry had extended somewhat farther than was absolutely necessary to ascertain the cause of death, in order that as much light as possible should be thrown on the cause of the explosion. What the jury had to decide was whether the explosion was due to the culpable neglect of any person. If they were satisfied that the Gas and Water Companies, and everybody who had any dealings with them, had carried out their duties in a proper way, then there could not be, in that Court, any further question. He might point out that there had not been the slightest suggestion that anybody had been guilty of culpable negligence. It had been hinted during the evidence that the Water Company, in some way, had not done their duty; and the leakage of water had been the cause of the gas-main breaking. It was perfectly clear that the water-main did break, and was mended; but the Company certainly did no injury to the gas-main when repairing their own pipe. It was quite possible that the water-main broke through the settlement of the ground. A most serious attack had been made on The Gaslight and Coke Company, or their officials; and it was suggested, by the evidence, that it might be due to their neglect that the explosion took place. It was clearly, without any manner of doubt, a gas explosion; and, if it could be shown that the Company knew there was a dangerous leak, and neglected it, it would be a serious thing for them. If it could be shown that there was an official whose duty it was to look after the leak, and he neglected to do so, it would be a question whether there would not be criminal liability. Complaints were made generally in the court as to a smell of gas; but these did not come to the knowledge of the Gas Company. Only Scourfield made complaint to some of the Company's men; and it appeared to him (the Coroner) the Company did all they could. Their men, who were experienced, made several examinations of the court; and they gave their honest opinion that there was no escape. There was no cause for them to go into No. 26 unless invited. There were three parties interested; and he could not impute blame to any one of them.

The jury, after a short deliberation, returned a verdict of "Accidental death."

THE CHELTENHAM CORPORATION AND THE GAS-WORKS.

A Special Meeting of the Cheltenham Town Council was held on Monday last week, for the purpose of considering the propriety of promoting, in the ensuing session, a Bill to enable the Corporation to purchase, by compulsion or agreement, the undertaking of the Cheltenham Gas Company, and the Company to sell and transfer it to the governing body of the town; also for the purpose of considering the expediency of opposing a Bill intended to be promoted by the Company for obtaining further powers. The Mayor (Alderman Colonel Rogers) presided. Alderman Norman (the Chairman of the Lighting Committee) first submitted a resolution in favour of the promotion of a Bill to acquire the gas undertaking. The present share capital of the concern, he remarked, was £155,000, more than half of which (£80,000) was created in 1872. The dividends varied from 10 per cent. on the original stock to 7 per cent. on the newer stock. The loan capital was £17,500, which bore interest at 4 per cent. The Company had power to raise a further loan of £20,000, subject to the same interest. The amount required for dividends and interest was £12,550 a year. The profits in 1894, taken from the Company's balance-sheet, and including Directors' fees, amounted to £15,543; and this notwithstanding the fact that during the year there had been a lowering of the price of gas by 2d. per 1000 cubic feet. If the Corporation bought the undertaking, they would have to do so on the basis of so many years' purchase of the dividends now paid to the shareholders. The number of years was a varying quantity in such purchases; but Mr. Stevenson, who had been called in to advise the Town Clerk, had suggested 25 years as the probable basis. On that assumption, the purchasing price would be £313,000. This amount could be raised by the Corporation at 3 per cent. interest—probably lower—which would absorb (say) £9413 a year. In addition, a sinking fund would be needed, absorbing a further sum of £2761. Thus a total of £12,174 would have to be provided before any financial benefit would accrue from the purchase. As already stated, however, the profits last year were £15,543; and assuming that they would be kept up (the probability was that they would be increased), there would remain a margin of £3369, which would be available for town purposes; and this after £2761 had been invested out of the profits towards the redemption of the borrowed capital. Further, the Company possessed a reserve fund of £15,500, and stocks valued at £8000, which would come into the hands of the purchasers, and would raise the surplus profits to upwards of £4000 a year. The present market price of the gas shares was 22½ years' purchase. Therefore, on a 25 years' basis, the shareholders, who would receive £175 for every £100 of stock, would get an advantage of £17 over the present market value. Thus both the ratepayers and the shareholders would benefit by the transfer. Mr. Parsonage seconded the motion. Alderman Wethered expressed himself in opposition to the proposed purchase, but said he would not vote against the present proposition, because, by defeating it, the Corporation would deprive the ratepayers of the opportunity of saying whether or not they desired the gas-works purchased. The motion was carried by 16 votes to 1—the dissentient being Mr. Moses Davies. Alderman Wethered did not vote. Alderman Norman next proposed a resolution sanctioning opposition to the Company's Bill; and this was agreed to without discussion.

EXTENSION OF THE WOLVERHAMPTON GAS-WORKS.

The extensive alterations and additions to the works of the Wolverhampton Gas Company which the Engineer and Manager (Mr. John Annan) commenced in the spring of last year have now been completed, and the works are consequently in a condition to meet the increased demand which will doubtless be made upon them in the coming winter. The principal feature of the extensions is a new gas-holder, which has been put up to supplement the four now existing at Stafford Road. The contract for the tank for this holder was let to Mr. H. Holloway, of Wolverhampton, and he was the first to commence operations—the site selected being a meadow at the rear of the old works, and close to the main line of the London and North-Western Railway. The tank is of brick; the dimensions being 165 feet in diameter and 30 feet deep. This part of the work was completed by the close of 1894, and left ready for the Contractors for the holder (Messrs. C. & W. Walker, of Donnington), who were engaged in its erection until the middle of the present year. The holder is supported by 18 guide-columns 60 feet high; and it will afford an additional 1,200,000 cubic feet of storage—bringing up the supplying capacity of the works to 2,000,000 cubic feet per day. That this quantity may be needed may be inferred from the fact that the output of gas in the first week of the present month exceeded by more than 1,600,000 cubic

feet the make in the corresponding week of 1894. With regard to manufacturing plant, eight generator furnaces have been put up by Messrs. Jonas Drake and Sons, of Halifax. Other additions to the works are in contemplation. On a site comprising about three or four acres, recently acquired just outside the borough, it is proposed to put up another holder and erect a retort-house with the necessary auxiliary manufacturing plant. In course of time, a canal basin will be constructed for unloading the coal-barges; and an extra line of branch railway is to be laid down. These projects are occupying Mr. Annan's attention. The carrying out of the entire scheme will have for result the reduction of operations at the Horsley Fields branch of the works, which has always been cramped.

LARGE EXTENSIONS AT THE KEIGHLEY GAS-WORKS.

The past year has been busily occupied at the Keighley Gas-Works in making some important extensions; and the work which has been in hand is now practically completed. The additions are of such a character that the productive capacity of the works (which was previously put at a million cubic feet per day) has been doubled. A new retort-house has been erected at one end of the old retort-house; the dimensions being 160 feet by 90 feet, with a height from the floor to the springing of the roof of 26 feet. The house is fitted with ten beds of through retorts (with 180 mouthpieces), set on the regenerative principle. The house has been fully equipped with machinery. The railway coal-trucks, as required, are pushed along rails into the retort-house by an engine; and the coal is delivered at several positions on either side. At these points, coal-breaking machines are fixed on the ground floor; and, after the coal is broken, it is lifted by small buckets fastened to an endless chain to receiving hoppers. From these hoppers it is fed, as needed, into the stoking-machine—both the charging and drawing machines, made by the West's Gas Improvement Company, Limited, of Manchester, having been removed from the old house, which was found unsuitable for their use. After the coke has been drawn, by the machines in the new house and by the stokers in the older premises, its disposal is brought about by an ingenious mechanical arrangement, fitted up by Messrs. Newton, Chambers, and Co., of the Thorncliffe Iron-Works, Sheffield. Parallel with the lines of retorts, a travelling web of metal plates has been fixed in the basement, upon which the coke is dropped from an iron receptacle carried in front of the drawing-machine, and through shoots in the old house; and, in its passage, it is automatically cooled by water. At the north end of the old house, it is deposited by these plates into a bucket elevator, and placed in another metal channel running at right angles to the plates—this new channel conveying it to the side of the old building. Here another elevator is at work, together with a breaking-machine; and this elevator takes the coke on still another journey to the very top of the building, on to an additional structure which has been placed at the side. There, if the breaking-machine is not in operation, the coke is tumbled over a shaking screen to free it from dust, into a large receiving hopper, from whence carts and railway waggons can be easily filled. On the other hand, if the breaking-machine is working, the burden of the elevator is conducted into a graduated screen which separates the coke into the three usual sizes of blacksmith's coke, household coke, and large coke, each being distributed into its separate storage hopper; the dust again finding its way into the receptacle already mentioned. Concurrently with the increase in the productive capacity of the retort-houses, other extensions and re-arrangements have been necessary in the plant. The condensers have been made equal to the greater demand upon them; and it has been considered advisable to put down a new engine and exhauster, capable of dealing with 70,000 cubic feet of gas per hour. This machinery has been made by Messrs. G. Waller and Co., and fixed in an extension of the old exhauster-house. A new washer has also been put down. Before the work of extension can be said to be thoroughly complete, it will be necessary to increase the number of purifying beds and the storage accommodation. Among the new works which have been erected are a store-shed and a mechanics' shop; and a new meter has been fixed. The cost of the improvements carried out up to the present is above £20,000. The whole of the new works have been constructed to the designs of the Gas Engineer (Mr. J. Laycock); and among the contractors were: Messrs. Clayton, Son, and Co., Messrs. Clapham Bros., Messrs. Newton, Chambers, and Co., Messrs. Drake and Son, and Messrs. J. & J. Braddock.

It will be interesting here to refer briefly to the great advance that has been made in the demand for gas, which necessitates these large extensions. The Keighley Local Board was one of the first public bodies in the country to establish gas-works; the old plant at Low Bridge having been put down in 1825. These works met the needs of the town for many years. But in 1876 the present works at Thwaites were opened; and the additions above described are the first real extension which has been made of them. The greatest day's consumption in 1876 was 463,000 cubic feet; in 1882 (when the town was incorporated), it had grown to 681,000 cubic feet; and last winter the maximum day's make was 1,165,000 cubic feet—a figure which, it is expected, will be raised to 1,400,000 cubic feet during December and January. In 1876, the number of consumers was 4486; in 1882, 6324; and last June, 10,259. In those years, the total quantity of gas made was respectively 76,216,000, 116,298,000, and 226,400,000 cubic feet.

Continental Union Gas Company, Limited.—The Directors of this Company have decided to recommend dividends of 8 per cent for the past half year on the ordinary, and 6½ per cent on the preference stocks, the same rates as last year—both free of income tax.

Holyhead Flooded and in Darkness. Owing to a continuous heavy fall of rain on the 16th inst., several parts of Holyhead became completely inundated. The torrent of rain burst into the gas-works, and put out the fires. The street lamps were unlit in the evening; and in many houses paraffin oil and candles had to be resorted to.

THE SALE OF THE SOUTH MOLTON GAS-WORKS.

A Meeting of the shareholders in the South Molton Gas Company was held last Wednesday, to consider the agreement provisionally made for the sale of the works to the Town Council for the sum of £3300, the par value of the shares. Mr. J. E. Eldridge, the Chairman of the Company, presided. Mr. W. Oram, the lessee of the works, said that he thought the Directors had acted hastily, and that, before any agreement was entered into, they should have consulted the outside shareholders. The Secretary (Mr. T. Chapple) said the lessee's term expired in June next; and if the Town Council had not been able to advertise now that they intended to apply for a Provisional Order, the matter must have stood over for twelve months; and from June the shareholders would have had to carry on the works themselves. Despatch was therefore necessary. Mr. J. Sanders moved that the provisional agreement be confirmed. Personally, he did not care whether the sale was carried out or not, but he wished to benefit his native town; and if the matter fell through, it would be a lesson to those who did not appreciate the manner in which the Directors had met the Town Council. The motion having been seconded, Mr. Young moved an amendment to the effect that the works be valued and offered to the Corporation at the valuation price. He strongly objected to the manner in which the outside shareholders had been treated. His interest in the Company was only a small one, for he held six shares, for which he would get £90. But he had been receiving £5 8s. per annum interest; and where could he obtain this return on his money? He firmly believed the purchase price was too low; and a practical man had told him they were throwing away at least a thousand pounds. On a vote being taken, four shareholders were for the amendment, and thirteen for the motion, which was therefore carried. The Directors were authorized to take all necessary steps to carry the agreement to completion.

ELECTRIC LIGHTING REGULATIONS.

Conference on the Proposed Revision of the Rules.

A Conference of Corporations and Companies concerned in the regulations made by the Board of Trade under the Electric Lighting Acts of 1882 and 1888 was opened last Tuesday in the Town Hall, Westminster, to consider proposals for revising the regulations in question. A draft of the proposed revised regulations had been sent to the parties interested, and their observations upon them had been invited. Sir Courtenay Boyle, K.C.B., of the Board of Trade, presided; and he was accompanied by Sir T. Blomfield, Bart., Mr. Hopwood, C.M.G., and Major Cardew, R.E., of the Board of Trade, and by Mr. W. H. Preece, C.B., Electrician to the Post Office.

In opening the inquiry, Sir Courtenay Boyle stated that the Board of Trade, finding it necessary to revise the regulations made by them under the provisions of the Electric Lighting Acts of 1882 and 1888, had thought it convenient as well as courteous to give to all who had raised objections an opportunity of stating them verbally; thereby assuring that the Board of Trade's final decision might not be come to until after carefully hearing all that could be said on the various matters dealt with in the regulations. Though the entire responsibility rested on the Board of Trade, who could not divest themselves of their statutory obligations, he assured those present that the Board would carefully weigh all the arguments and representations that might be placed before them. The regulations would apply to undertakers only, and not to works put up by consumers. The Board hoped to make them retrospective; but this point could not be decided at present.

The conference then proceeded to consider the proposed revised regulations in detail. The first controversy arose on a definition of the word "pressure." It was argued on behalf of the British Insulated Wire Company that the old regulation, prohibiting working at above 150 volts pressure, had not answered well. Mr. Hammond said it was well known that great improvements had been made in the distribution of electricity, and that reliable electric lamps had been introduced working at from 200 to 250 volts. It was most desirable that this improvement should be facilitated. They hoped in time they would be allowed to go up to 600 volts. The instances of persons being killed at a pressure of 600 volts were very few. In his own case, it only slightly burned his hand. Mr. Siemens was satisfied that the proposed new regulation would be sufficient to secure the safety of the public. There could be no limit that would be absolutely safe, because the effects of the electric shocks depended so much on the condition of the individual. He had known the case of a workman who had survived a shock of 2000 volts. Dr. Hopkinson pointed out that in Manchester a pressure of 400 volts was occasionally required. Sir C. Boyle, though not pressing the point home, remarked that Manchester had been infringing the regulations. Dr. Hopkinson replied that, whether they had done so or not, their experience was such as to justify the Board of Trade in sanctioning a pressure not merely up to 300, but up to 500 volts. Earl Russell, for the London County Council, suggested the propriety of making provision for an intermediate class of pressure without jumping so abruptly from low to high. Mr. Morse supported the suggestion that the voltage should be raised to 500. Major Cardew gave his view of the safety of the public. It was impossible, he said, to lay down precisely the limit where the electric current became fatal—a great deal depending on the person who received it, and particularly the condition of his skin. He thought the low pressure for alternating current might be slightly raised. As regarded the continuous current, 200 or 250 volts might be used in houses with the consent of the consumers. Sir C. Boyle had no hesitation in saying that it was his intention to advise the Board of Trade to raise the 150 volts to a higher figure—220 or some other. In regard to the 300 volts, he thought this too might be slightly raised. All they were insisting upon was that there should be additional precautions in regard to high pressure systems. As to the regulation that no high pressure electric line shall be used for the transmission of more than 200,000 watts except with the consent of the

Board of Trade, Sir C. Boyle promised to consider whether he could not go as far as 500,000 watts.

A good deal of discussion followed on the proposed regulation dealing with faults of insulation. Sir C. Boyle said that, under the existing regulations, it was quite impossible to maintain the insulation required; but he promised to keep the exact wording of the new clause open, so far as regarded the time and nature of the tests to be applied. On the representation of the London County Council, Sir C. Boyle said he would consider whether in London aërial lines over thoroughfares should be 20 feet instead of 18 feet from the ground.

An important discussion arose upon the following proposed regulation: "All conduits, pipes, or casings used as receptacles for electric lines shall be constructed of durable material, and of ample strength to prevent damage from heavy traffic, and, where they are laid in streets in which gas-mains are also laid, shall be so constructed as to prevent any influx of gas from the adjacent soil." Representations from all parts of the country were made in regard to the clause. The Dublin Corporation declared that, if they had to prevent "access of gas," they would have to reconstruct all their boxes; and they doubted if the result would be more efficient. The Dover Electricity Company and the County of London Company suggested the addition of the words "so far as possible," after the words "so constructed as to prevent." The Yorkshire House-to-House Company submitted that the use of a blower for keeping mains free from gas and water should be considered sufficient, without requiring the prevention of influx by a special construction of conduits and boxes. The Islington Vestry were of opinion that the regulation would seriously increase the responsibility of undertakers, and put a powerful weapon of defence in the hands of gas companies. The London Chamber of Commerce believed that a clause providing that all conduits constructed in streets in which gas-mains were also laid should be efficiently protected against an accumulation of gas would meet the requirements of the case. The Glasgow Corporation declared it was impossible so to construct culverts as to prevent an influx of gas; and they suggested that the words "all reasonable precautions shall be taken" should be substituted for that part of the regulation. The Charing Cross and Strand Electricity Supply Company wrote that the clause appeared to be impossible as regarded the prevention of an influx of gas. Ventilation was the only practicable remedy. The Portsmouth Corporation and the Vestry of Shoreditch both strongly emphasized their disagreement with the terms of the clause. It would be quite impracticable, they said, to attempt to render conduits gas-tight. The gas companies should keep their mains gas-tight, and the electric light undertakers should be required to ventilate their conduits. Gas companies would make this regulation a point of defence for any damage that might accrue through gas leaking into conduits. The Westminster Electrical Supply Company, supported by the Corporations of Edinburgh, Aberdeen, Belfast, Oldham, and Sunderland, represented to the Board of Trade that, as gas companies were unable to prevent leakages of gas from their pipes, it was unreasonable to ask electrical undertakers to devise some way of keeping the gas out of their pipes and conduits, and that the only real remedy lay with the gas companies. They suggested that the electric light companies should take every reasonable means to prevent gas entering their pipes or casings; that the companies should subject these to periodical inspections (which might be specified); and that it should be their duty to report at once to the gas company any case in which gas was found to exist, and at the same time either report to the Board of Trade or to the Sheriff or Local Authority if the gas leakage were not found and remedied by the gas company within a reasonable time. A regulation such as this could be enforced and carried out, whereas the proposed regulations could not be carried out; and their existence as a dead letter might stand in the way of any reasonable steps being taken. The Institution of Electrical Engineers sent in the following in substitution of the regulation proposed by the Board of Trade: "All conduits, pipes, street-boxes, or casings, used as receptacles for electric lines shall be constructed of durable material, and, wherever they are laid under carriage-ways, shall be of ample strength to prevent damage from heavy traffic; and reasonable means shall be taken by the undertakers to prevent accumulation of gas. The undertakers shall regularly inspect their street-boxes for the presence of gas; and should any influx or accumulation be discovered, the undertakers are to give immediate notice to the gas authority." The Institution contended that undertakers should only be required to take precautions against the accumulation of gas. The risk from explosions caused by influx of gas was very small, save under exceptional circumstances, such as the frost of last winter. When many gas-mains were broken, it was impossible to prevent influx of gas to chambers underground. They were of opinion that there should be a stricter enforcement of the Gas Acts.

In the course of the discussion on this point,

A delegate from Islington suggested that, in this matter, the onus should rest on the proper authorities. He knew that it had been stated to the Islington Vestry that they had no power over the gas companies; but what he wanted to urge was that they should have some power. He contended that the proposed new regulations—read in connection with some of the other regulations—would put a very powerful weapon into the hands of the gas companies. In the well-known case of the St. Pancras explosion, the Engineers of The Gaslight and Coke Company said that it was the duty of the electric lighting companies to keep gas out of their mains. If this contention were allowed, and such a weapon were placed in the hands of gas companies, it was obvious that the electric lighting proprietors would have to pay for the delinquencies of the gas people. On behalf of his Vestry, he wished to urge that electric lighting undertakings ought not to be hampered by reason of the faults of large corporations and other bodies. He hoped, therefore, that the Board of Trade would carefully consider the matter before allowing the proposed regulation to stand.

Mr. Gay, of the Islington Vestry, dwelt on the impossibility of giving effect to the clause as proposed, which put an onerous duty upon undertakers with which they ought not to be burdened, and which gave a great advantage to the gas companies.

Mr. R. Hammond, on the grounds put forward by Mr. Gay, supported the recommendations of the Dublin Corporation and the Yorkshire House-to-House Company. He had always felt it better to provide boxes without any bottoms—that they should be open to the soil, so that all the land drainage could easily get away. They had no difficulty, in Dublin or Leeds, in getting rid of the water. The word he objected to principally in the draft regulation was "influx;" and upon this point he would certainly support the proposal made by the Institution of Electrical Engineers. He did not think they should be called upon to prevent the influx of gas. He admitted that they should prevent its accumulation; and he had recently, in one or two cases, filled up the boxes with sand, so as to prevent an absolute accumulation of gas, and in other cases with wood blocks. But he repeated that he did not think they should be called upon to take the responsibility of preventing influx of gas from the adjacent soil.

The representatives of Swansea and Shoreditch intimated that they were prepared to support the clause brought forward by the Institution of Electrical Engineers in lieu of that of the Board of Trade.

Sir J. Russell (Edinburgh) said he would like to mention the only two accidents they had had in his city in connection with electrical conduits, just to show the necessity of impressing gas companies with the great importance of keeping their gas in hand. These two accidents occurred through the accumulation of gas; and it was supposed that someone had dropped a match in the street, and so caused the ignition of the gas.

Sir C. Boyle: We sent out a circular to the several companies, calling attention to that very point.

Sir J. Russell: I only mentioned the matter to show the difficulty of preventing gas that leaks in the streets making its way into manholes, boxes, and so forth. We can only try to get rid of it by proper ventilation.

The representative of the Westminster Supply Corporation said that the amended clause suggested by the Institution of Electrical Engineers was the result of a good deal of thought and experience. Last year his Company had no explosions in connection with their system; and they had escaped these by giving timely notice to the gas companies in every case where accumulations were suspected or detected. The true remedy, he believed, was the necessity of due notice being given to the companies, at the very earliest possible moment, of any leakage discovered. In the cases with which he had been concerned, the gas companies had always accepted the responsibility, and stopped the leakage at the first opportunity; and he attributed their immunity from explosions to the good feeling the gas company had shown, and to the way in which they had worked with the electric company. The proposals brought forward by his Company [quoted above] would, he believed, be approved by the gas companies.

The representative of the London Chamber of Commerce mentioned his intention to support the clause suggested by the Institution of Electrical Engineers. It appeared to him to be very hard that the gas companies should be protected by regulations put into the Electric Lighting Acts; thus involving undue responsibility on the part of the electrical undertakers.

Another delegate pointed out that these explosions were not confined to electric lighting conduits. They had occurred in pipes carrying telephone wires, and also in empty pipes.

Mr. Gay remarked that he could also submit proof of explosions other than those caused by the conditions of electric light wires.

Mr. Gunyon, for the London County Council, said the importance of this point could not be overrated. The proposed regulations specified that the conduits were to be so constructed as to prevent the influx of gas. The electric supply companies were agreed in saying that this was impossible; and he believed that, at all events in a city like London, it was so. The electric companies, however, suggested the insertion of the words "as far as possible." It appeared to him that the use of such a saving clause would encourage the companies not to make any effort in the matter. It might be possible in many cases to prevent the influx of gas by filling up the conduits and boxes; and he should think that, in their present state of knowledge, this was the best way. But it must be remembered that in many cases the gas companies, and also the gas-mains, were in possession of the ground; and any company coming fresh into the ground were under an obligation to see that their doing so was not dangerous to the public safety.

Another delegate, speaking on behalf of several companies and municipalities, assured the Board of Trade that there was no need of outside pressure to induce them to take every possible care; and, as a matter of fact, the companies who had not had any explosions were known to be those who were the most careful.

Mr. R. H. Dawe, the Town Clerk of Hull, as representing some of those corporations who possessed electric lighting installations, wished to remind Sir Courtenay Boyle that they represented the public as much as the London County Council; and he dissented from the proposition that had been laid down by that body. It appeared to him to be unreasonable that any regulation should impose on the proprietors of electric lighting installations the responsibility of excluding gas. If gas were not present in the soil, it would be impossible that explosions could occur. It was reasonable to ask electric lighting people to take all necessary care, but not more than that.

Mr. W. H. Preece, C.B., said he should like to remark that, from 44 years' experience of the fight between gas and the pipes, the Post Office had succeeded in getting what they wanted. In London alone there were 8000 boxes, and in the United Kingdom 16,000 boxes, in connection with the Post Office electrical services. It was a very rare thing that a year passed without several explosions taking place. Not much was heard of them. He did not say that the gentlemen of the Press were bribed; but where accidents were frequent, people became callous, and the information did not get into the papers. He should like to point out, in reference to what Mr. Hammond had said, when he advocated the leaving of the bottoms of the boxes open, that this was what the Post Office did not do, and were prevented from doing. They were obliged to fill them up. They had done everything that reasonable beings could do to prevent the influx of gas into the boxes. But it did get in nevertheless; and, owing to people throwing down matches, or from sparks arising from other sources, there would be explosions where there was an accumulation of gas. It was difficult to prevent it. He was in favour of the proposal put forward by the Institution of Electrical Engineers. He admitted that there was a

difference between electric lighting interests and those of the Post Office, owing to the difference in the size of the boxes. There was a little difficulty in keeping gas out of the Post Office boxes, but more in excluding it from the larger boxes used by the electric lighting companies.

Sir C. Boyle said he should like to see the gas companies obliged to keep their gas in their own pipes, and the electric companies obliged to keep the gas out. He knew, however, that it was difficult, if not absolutely impossible, to enforce this obligation in either case. Therefore the clause as it stood on the paper must fall to the ground; and he would propose to the Board of Trade a clause based on the recommendation of the Institution of Electrical Engineers.

Mr. Crompton expressed his gratitude to Sir C. Boyle for the concession he had made.

The conference then adjourned.

On the resumption of the proceedings the following day,

Sir C. Boyle stated that he had carefully considered the very important representations made at the previous sitting on the subject of the definition of low pressure. The point raised was highly technical and scientific; and he thought it would be for the convenience of those interested if a decision was reserved for a short time, so that the Board of Trade might appoint a small Committee (not exceeding three) of expert advisers, to carefully consider the scientific aspect of the question, and make a suggestion to the Department.

General Webber, with whom originated the suggestion made the previous day, said that electrical engineers would most heartily agree in the wisdom of the proposal of the Board of Trade.

Approval having also been expressed by Mr. Crompton and Mr. Hill Dawe, on behalf of municipal corporations,

Sir C. Boyle said he would recommend to the Board the appointment of a Committee.

The conference then proceeded to the discussion of the remaining proposed regulations. Clause 31 was amended so that the inspection of insulators should be made prospective.

On the regulation that "all street-boxes which contain any vacant space shall be so constructed as to prevent any influx of gas or water, either from the adjacent soil or by means of any pipes; and ample provision shall be made, by ventilation or otherwise, for the immediate escape of any gas which may by accident have obtained access to the box, and for the prevention of danger from sparking,"

Sir C. Boyle said he had been forced to the conclusion that it was absolutely necessary to ventilate transformer chambers; but he was not clear as to how far it was necessary to ventilate all street-boxes.

After a good deal of discussion,

Sir C. Boyle suggested that the proposed regulation should apply only to street-boxes containing transformers. The clause would read thus: "In the construction of street-boxes used as transformer chambers, reasonable means shall be adopted to prevent, as far as possible, any influx or accumulation of gas or water, either from the adjacent soil or by means of pipes; and ample provision shall be made, by ventilation or otherwise, for the immediate escape of gas which may by accident have obtained access to the box, and for the prevention of danger from sparking." He would consider whether the Board of Trade could make a regulation for the ventilation of street-boxes of certain dimensions.

On the regulations dealing with the power given to undertakers to cut off the supply when the insulation resistance does not exceed 75 megohms, divided by the number of lamps fixed,

Professor Kennedy said he considered that the regulation ought to provide that undertakers should not connect up any consumer where the insulation resistance was less than 75 megohms divided by the number of points for taking off current; and it should disconnect consumers whose insulation resistance fell below that standard.

Sir C. Boyle promised to frame a regulation upon the basis suggested by Professor Kennedy; reserving the particular standard to be fixed.

A discussion arose as to what was considered, especially by the Town Clerk of Hull, would be the unfair operation of the following proposed regulation as between electric undertakers and gas companies: "If the undertakers make default in complying with any of the preceding regulations, they shall be liable to a penalty not exceeding £10 for every such default, and to a daily penalty not exceeding £10. The imposition of any penalty under this regulation shall not affect the liability of the undertakers to make compensation in respect of any damage or injury which may be caused by reason of such default."

Mr. Dawe said this was a very important clause, and, as it stood, it might result in throwing upon electric lighting undertakers a responsibility which primarily belonged to another company or body. He did not think the Board of Trade, in framing these regulations for the public advantage, intended to confer an advantage on gas companies at the expense of electric lighting undertakers. The electric undertakers were anxious to carry out the regulations as they stood; but they were dependent upon human agency, and therefore were liable to miscarriages. Assuming that, notwithstanding the regulations, an accident did occur, what would happen? The person who had suffered injury would go to the electric supply undertakers and say: "You have not observed the Board of Trade regulations; you have committed an illegal act. I do not care who is primarily responsible; I will take proceedings against you." The undertakers were quite agreeable to be subject to a penalty in case of non-observance of the regulations; and they were also quite willing to run the risk, whatever it might be, of their common law liability. What they did object to was that the public, for whose protection the regulations were drawn up, might use them in order to shift responsibility from the shoulders of the company primarily responsible, and put it on the shoulders of the electric undertakers, who might only be in a secondary degree liable for the accident. In the case of an escape of gas, very stringent regulations were placed upon the undertakers in regard to it; and those regulations they were willing to observe to the utmost of their power. But they suggested that, if an accident did occur, and some person was injured, that person ought to rely upon the common law remedy, and proceed against the company who was primarily responsible, whether they were a gas company or any other body. He thought that words to this effect might be added at the end of the regulation: "And that nothing in this regulation shall impose upon the undertakers any liability to make any compensation in respect of any damage or injury which may be caused by reason of such default." They ought to make sure that the regulation could not be used by one of the public as an engine to place upon the electric undertakers what he might call an unlimited liability and responsibility. But for this regulation, they would, no doubt, be frequently able to successfully combat claims that might be brought against them.

Sir C. Boyle said he did not himself see where the responsibility was shifted; and his Counsel advised him that there was no shifting of responsibility which now lay on any gas company or other body.

Mr. Dawe argued that, by the regulation, if there was a breach of the other regulations, there was the commission of an illegal act; and action would be taken against the electric undertaker quite regardless of the circumstances or of the precise factor which was the cause of the accident, and which they would assume was an escape of gas. What they wanted to obtain was some protection against proceedings of this kind. The clause itself gave protection in respect to the penalty. They wanted similar protection in regard to the matter to which he had called attention. It was quite unreasonable to place an unlimited responsibility upon electric undertakers for a breach of one of the regulations.

Sir C. Boyle said he was advised by his Counsel that the word "affect" in the regulation meant "affect" either way. The regulation did not propose anything new, or remove anything from any party; and it was not very wise to begin experimenting with what was an established meaning attached to the phrase.

Mr. Dawe said he had considered this view of the interpretation of the clause; but he feared it would not be established in Court.

Sir C. Boyle: Would you like these words—"nothing in this regulation shall alter the liability"?

Mr. Dawe: Precisely.

Sir C. Boyle, after consulting with his Counsel, said this gentleman had a little difficulty as to the precise wording of the regulation; but he (Sir C. Boyle) would deal with it the best way he could.

At the close of the conference,

Sir C. Boyle, on behalf of the Board of Trade, thanked the delegates for the assistance they had given him.

In return, the delegates passed a cordial vote of thanks to Sir Courtenay Boyle for the consideration and courtesy with which he had treated their representations.

ELECTRIC LIGHTING NOTES.

The electric lighting question has again come up at Folkestone. At a special meeting of the Town Council last Thursday, the following notices were upon the *agenda*: "(1) To consider the expediency of applying to the Board of Trade for a Provisional Order to be granted to the Corporation and Urban District Council of Folkestone to light the whole or any part of their district with the electric light, and as to site of generating station; plans, estimates, and details to be prepared and steps to be taken. In the event of the Corporation not passing such resolution to apply for a Provisional Order, (2) To consider an application on the part of Mr. Daniel Baker for the Corporation to assent to, and support, an application for a Provisional Order, in the above form, on the part of himself for his nominees. (3) To consider notice from the Capital and Counties Electricity Supply Company, Limited, of their intention to apply, on or before the 21st of December next, to the Board of Trade for a Provisional Order to authorize the Company to supply electricity for public and private purposes within the Borough of Folkestone." The Town Clerk (Mr. W. G. S. Harrison) read a letter he had received from Messrs. W. G. F. Webster and Co., in which reference was made to the offer of Mr. Webster to light the Leas at a certain specified cost, and stating that, if the Corporation decided to go on with the matter, they would undertake to get the installation completed next year. Mr. Baker moved the formal resolution prepared by the Town Clerk. He remarked that they were face to face with an alternative. They must either get a Provisional Order to light Folkestone themselves or allow someone else to do it. In his opinion, they should do it themselves. There were two other notices on the paper—one from himself and the other from a Company; and they heard there was another application from Mr. Webster. No doubt they would get any number of others who would be only too pleased to step into the gap. If they obtained a Provisional Order, and thought fit to sell it, they could make £500 or £1000 out of it. It was imperative that they should have electric light at the west-end of the town; and unless the Corporation were prepared to supply it, he must do it himself. Mr. Hall seconded the motion. He confessed that he thought the step proposed was in the right direction, and the only one they should take. They had had various schemes before them—one to cost £75,000, another £35,000, and another £12,000; and there was a general feeling that the Corporation would be very unwise to speculate with the ratepayers' money to such an extent. But, as Mr. Baker had said, unless they applied for a Provisional Order, they would find other people stepping in and doing so. After some conversation, the motion was carried unanimously

The electric light works of the Coventry Corporation have been completed; and the consumers are now being served with current. The works are very conveniently situated; being on the canal bank, with a railway siding from the Nuneaton branch of the London and North Western Railway. The dimensions of the main block of buildings are 115 feet by 80 feet; the cost of erection being £6859. The plant and machinery were supplied by Messrs. J. Fowler and Co.; their tender being £9672. The total cost of the works was estimated at £20,000; and the actual outlay approaches very closely this amount. Intending consumers will be connected with the mains free of cost until the end of the year. About a fortnight ago 1400 lights of 8-candle power had been applied for; but only 600 were then connected.

The little Cornish town of Saltash is to have its streets lighted by electricity. Last Tuesday, the Town Council received tenders for public lighting for the year commencing January next. Among them was one from Mr. T. Martin, offering to supply the electric light at £2 10s. per lamp. This was accepted, subject to a guarantee for the performance of the work to the satisfaction of the Corporation. The streets are at present lighted by gas.

The Kettering District Council, by six votes to eight, agreed last Wednesday to make application for a Provisional Order to empower them to undertake electric lighting. The Chairman of the Council (Mr. Stockburn) and another member (Mr. H. W. Church) did not vote on the ground that they were shareholders in the Gas Company, and therefore did not think it would be consistent to do so. Had they voted, there would have been an equal division of members for and against the proposed application.

An instance of the instability of the electric light occurred at Wolverhampton on Monday last week, when, about half-past four in the afternoon, it suddenly went out, leaving the shopkeepers and the town itself in darkness. The Town Council were holding a special meeting at the time; and the Mayor (Alderman Mander) was in the midst of a speech when the Council Chamber was plunged in darkness. The gas was promptly turned on; and the debate proceeded. After a short interval, the electric light was restored. The cause of the failure was a mishap to one of the transformers.

FIRE RISKS INCIDENTAL TO THE LIGHTING OF PAPER-MILLS.

In the course of an article on the above subject, by Mr. Ludovic M'Lellan Mann, of the North British and Mercantile Insurance Company, Glasgow, in the *Paper Makers' Circular*, reference is made to the risks attending the employment of gas and electricity as illuminants in paper-mills. The author indicates briefly the precautionary measures to be taken to minimize the dangers arising from gas. He says careful attention should be given to gas-brackets in the machine-room, as they are apt to become loose at the joints, and therefore dangerous. While the newly-formed web is being guided, it, or pieces torn from it, may come near, or into contact with, the gas-lights fixed in close proximity to the machinery. It is therefore expedient to guard these lights by strong wire globes. It, indeed, should be a rule that gas-lights at the dry end of the machine-room, in drying-lofts, and near paper-cutters should be so protected. Where rags are sorted, cut, or dusted, or where esparto is dusted or "dry-picked," lanterns should invariably enclose all gas-lights. In planning the construction of esparto and rag-dusting and storing houses, it would be desirable to arrange to have the source of artificial light—whether oil, gas, or electric lamps—outside, and accessible from the outside only. This system of illuminating from the outside could even be applied to existing buildings in many instances. With regard to lighting by electricity, Mr. Mann says there are dangers in connection with the lamps which call for safeguards not less evident than those just mentioned. For example, the surface round the top of the bulb of an incandescent electric lamp in the dry department is apt to become thickly coated with fluff and dust. Such a deposit upon the heated surface of the glass is dangerous, and should be prevented from forming by placing the lamp in an outer glass globe arranged to exclude dust. Arc lamps are not safe in the vicinity of inflammable matter; and, in order to decrease the risk of the emission of particles of incandescent carbon and the dropping of melted copper, they should be enclosed at the base. Wiring and fittings are liable to injury by the incessant vibration going on; necessitating frequent repairs. Many owners of mills consequently become dissatisfied with the electric light; and some have reverted to gas lighting. The gist of the whole question of safe wiring is really good workmanship. It is more costly in the long run to accept a low-priced estimate for the wiring of premises exposed to deteriorating influences. But given a sound installation, and a competent engineer in charge of the electric lighting machinery, who is always ready to replace broken lamps and do repairs, Mr. Mann thinks the electric fire hazard may be reduced to a minimum.

Incandescent Gas Lighting for Public Thoroughfares.—The Incandescent Gas-Light Company, Limited, have received an order from the Kensington Vestry for a large additional number of burners for street lighting; it being their intention to considerably extend the use of this system for the public thoroughfares. They have also had instructions from the Chiswick Urban District Council to light a large portion of their district; and they are in negotiation with most of the lighting authorities in London and the suburbs. At the meeting of the Commissioners of Sewers of the City of London last Tuesday, Mr. C. T. Harris moved that it should be referred to the Streets Committee to make experiments with incandescent gas-burners concurrently with the proposed experiments in incandescent electric lighting; and he suggested that the trial should be commenced in Wood Street, where not more than eight or ten lamps would be required for the purpose. This was agreed to. A trial, on a small scale, of incandescent gas-burners is to be made in the streets of Guildford. The Lighting Committee of the Town Council reported last Tuesday that the Gas Company were willing to supply incandescent burners in place of the ordinary ones, and to maintain them in good order for twelve months, for an additional payment of 13s. per lamp per annum. According to a letter read by the Mayor (Mr. R. Salsbury), which he had received from the Manager of the Company, the total cost of supplying and renewing the lamps would be £3 13s. 6d. The Committee were empowered to order a number of incandescent lights to replace the ordinary lamps in various parts of the borough; and, after having experience of the system, they are to report further on the subject. The authorities of Rye, Sussex, have decided to adopt a system of incandescent gas lighting for the public thoroughfares; the Gas Company having offered to undertake the work of carrying out the scheme.

METROPOLIS WATER SUPPLY.

Projected Important Extension Schemes.

Last Tuesday, the parliamentary notices appeared for two Bills to be promoted next session to authorize the carrying out of important projects in connection with the water supply of the Metropolis. One is to give power to a Joint Committee of representatives of the West Middlesex, Grand Junction, and New River Companies to proceed with the scheme of reservoirs at Staines which came so prominently before Lord Balfour's Commission; and the other, to enable the New River Company to make considerable additions to their works. The Southwark and Vauxhall Company have also given notice of their intention to apply for power to carry out important works. We indicate below the principal features of these schemes.

The Bill in reference to the Staines scheme is, as mentioned above, to sanction the constitution of a Joint Committee of representatives of the West Middlesex, Grand Junction, and New River Companies, whose powers are to be defined, and their remuneration fixed. Broadly speaking, the "undertakers," as they are called in the notice, are to "make and maintain reservoirs in the parishes of Stanwell and Hampton, in Middlesex; a pumping-station in the parish of Stanwell; aqueducts, conduits, and lines of pipes in the counties of Bucks, Middlesex, and Surrey; an intake from the River Thames in the parish of Wyrardisbury, in Bucks, above the Bell Weir; make diversions of roads in the parishes of Stanwell, Littleton, and Sunbury, in Middlesex; make alterations of levels of roads in the parishes of Wyrardisbury (Bucks), Staines, Laleham, Ashford, Sunbury, and Hanworth (Middlesex); make diversions and alterations of lines and levels of roads and streets; remove sewers, steps, &c.; take and distribute waters of the River Thames, Colne River, Wraysbury River, Colne Brook, and the Mill Stream and Mill Head of the Hythe End Mills; together with the incidental works." Lands and buildings are to be acquired compulsorily. Power is to be given to the West Middlesex, Grand Junction, and Chelsea Water Companies to convey water to the mains and pipes of the New River Company; and arrangements will be made for agreements being entered into between the Companies. There are to be special provisions as to the raising of money, and as to guarantees, &c., by the undertakers; and the maintenance and management expenses are to be apportioned between the Companies they represent. A standing Arbitrator is to be appointed to determine any differences that may arise between the Companies or their representatives on the Committee. Authority will be sought to sell water to other water companies, sanitary authorities, &c. A large number of Acts of Parliament will necessarily have to be altered and amended to enable the scheme to be carried out.

The works specified in the notice are as follows: Two reservoirs (Nos. 1 and 1A) to be situated wholly in the parish of Stanwell; a reservoir (No. 2) in the parish of Hampton; a pumping-station in the parish of Stanwell; an aqueduct or conduit commencing in the parish of Wyrardisbury, in Bucks, by an intake from the north side of the River Thames, about 250 yards westward of the Bell Weir, and terminating in the parish of Hampton, at the south-west corner of the proposed reservoir No. 2—passing in its course through Wyrardisbury, Staines, Stanwell, Ashford, Laleham, Littleton, Sunbury, and Hanworth; an aqueduct, conduit, and line of pipes (No. 2) wholly in the parish of Stanwell, with a short line of pipes (No. 2A) to connect this aqueduct with the reservoir No. 1A; an aqueduct or line or lines of pipes (No. 3) wholly in the parish of Stanwell, with a short pipe-line (No. 3A) to connect it with the reservoir No. 1A; an aqueduct or line of pipes (No. 4) in the parish of Hampton, commencing at the intended reservoir No. 2, and terminating in the pumping-well at the West Middlesex Water Company's works at Hampton; an aqueduct or line of pipes (No. 5) also in Hampton, commencing at reservoir No. 2, and terminating in the property of the Grand Junction Water Company; an aqueduct or line or lines of pipes (No. 6) commencing in Hampton, passing through Sunbury, and terminating at West Molesey, in the subsiding reservoir on the works of the Chelsea Water Company; an aqueduct, conduit, or line of pipes (No. 7) wholly in the parish of Wyrardisbury, commencing in the Colne Brook, and terminating by a junction with the intended aqueduct No. 1; an aqueduct or conduit (No. 8) wholly in the parish of Staines, commencing by a junction with the Wyrardisbury River, and terminating by a junction with the aqueduct No. 1. These works will necessarily involve considerable alterations of levels and diversions of roads, all of which are fully set out in the notice; and the lands (common or otherwise) and buildings proposed to be taken are indicated.

The undertakers are to be empowered, by means of the proposed works, or some of them, to collect, divert, impound, and distribute the waters of the Thames, Colne, and Wraysbury Rivers, the Colne Brook, and the Mill Stream and Mill Head of Hythe End Mills, and their respective tributaries, and of any other streams and waters shown on the plans to be deposited, and of any streams and springs on and near the intended works. But the Bill will provide that the undertakers shall not, by means of the intake by which the aqueduct or conduit No. 1 is intended to commence, "take the waters of the River Thames so as thereby to reduce the flow of water over Bell Weir to a less quantity in any one day of 24 hours than Parliament shall think right to prescribe in that behalf."

Reference has been already made to the arrangement which it is proposed to carry out for the supply of water to the New River Company. The notice specifies that in this respect the Bill is "to empower and, if need be, to require the West Middlesex Company and the Grand Junction Company, and the Governor and Company of the Chelsea Water-Works, upon such terms (pecuniary and other) and conditions as may be agreed or determined by arbitration or prescribed by the Bill, to carry and convey water from any of the works proposed to be authorized by the Bill" by means of any of their existing or future mains or pipes, to the mains and pipes of the New River Company, and "to enable all or any of the Companies mentioned in the notice to enter into and carry into effect agreements with reference to any of the objects or purposes of the Bill."

Turning to the notice given by the New River Company, we find that they intend to apply for power to carry out an extensive series of works, which may be briefly enumerated as follows: A well and pumping-station, to be called the Mardock station, in the parish of Ware Rural; the West Mill Farm well and pumping-station, also in Ware Rural; the Stapleford well and pumping-station, at Stapleford, in Hertfordshire; the Tewin well and pumping-station, at Tewin, in the same county; the Essendon well and pumping-station, at Essendon, also in Hertfordshire; the Blakefield well and pumping-station, at St. John Rural, in Hertfordshire; fourteen aqueducts or pipe-lines, in connection with the several works; a storage reservoir, to be called the Enfield Chase reservoir, and the diversion of a watercourse, at Enfield; a subsiding reservoir (the Highfield reservoir) at Southgate; the enlargement of an existing subsiding reservoir at Wood Green; filter-beds and a pumping-station at St. Mary's, Stoke Newington; the enlargement of the existing service reservoir near the Grove at Hampstead; the widening of the New River; and the discontinuance of part of the waterway. Power will be sought to purchase additional lands in the counties of Hertford and Middlesex; and to acquire by compulsion or agreement other lands specified. The Company will ask to be allowed to enter into agreements with sanitary authorities, public bodies, &c., with respect to the supply of water; and to use their existing capital and raise additional money for the general purposes of their undertaking. The Bill to be applied for will amend and enlarge the Charter granted to the Company by James the First, and, so far as may be necessary, the other Acts relating to the undertaking. The earliest of these are 13 Eliz., cap. 13; 3 Jas. I., cap. 18; and 4 Jas. I., cap., 12. Other Acts were obtained under the second, third, and fourth Georges, as well as during the present reign; the last being the 42 Vict., cap. 10.

The Southwark and Vauxhall Water Company's notice is for a Bill to enable them to construct large new reservoirs and carry out other works. The latter comprise a well, adits, and pumping-station (the Springwell station) at Harefield; another pumping-station (the Harefield Moor station) also at Harefield; four storage reservoirs, each having a superficial water area of 250,000 square yards, at Walton-upon-Thames; and various conduits or pipe-lines passing through Harefield, Hillingdon, East and West Hillingdon, Uxbridge, Southall, Hayes, Norwood, Heston, Isleworth, Twickenham, Hampton, Hayes End, Walton, and West Molesey. Power will be sought to purchase lands and easements, to connect various portions of the works, to purchase or otherwise acquire water in bulk, &c. Additional share and loan capital will be applied for; and special provision is to be made as to the manner of raising it.

The Quality of the Water in October.

The returns furnished to the Registrar-General by the London Water Companies regarding the water supply in the Metropolis during October, show that the average daily supply amounted to 215,433,126 gallons, as compared with 192,939,209 gallons in the corresponding month of 1894. The number of services being 822,124, the rate was 262 gallons to each service. Of the entire bulk of water sent out, 113,597,502 gallons were drawn from the Thames, and 101,835,624 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·8; Tottenham, 0·9; New River and Colne Valley, 1·2; East London, (deep well) 1·6, (river supply) 2·1; Chelsea, 2·3; West Middlesex and Southwark, 2·7; and Grand Junction and Lambeth, 2·8. The unfiltered river waters contained the following proportions: Thames at Hampton, 4·6; New River Cut, 1·9; and the Lea at Angel Road, 3·4. The Thames at Hampton was, on Oct. 16, turbid and yellow in colour, and of moderately good chemical and bacterial quality. As delivered by the five Companies drawing from this river, it was in every case efficiently filtered, and of excellent chemical and bacterial quality for dietetic purposes. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 99·84; West Middlesex, 99·03; Southwark, (No. 3 filter well) 99·52, (No. 8 filter) 99·61; Grand Junction, (general well at Hampton) 99·35, (general well at Kew Bridge) 98·23, (south well at Kew Bridge) 99·84; and Lambeth, 99·52. The New River Cut, before entering the subsidence and storage reservoirs, was, on Oct. 18, turbid and very pale yellow in colour. It was of excellent chemical, and fairly good bacterial, quality. By passing through the storage reservoirs, the number of bacteria was reduced to less than one-third; and, after efficient filtration, the water was delivered to consumers in excellent chemical and bacterial condition for dietetic purposes. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 99·29; No. 7 filter well, 99·29; and No. 9 filter well, 98·93. The water taken from the Lea by the East London Company at Angel Road on Oct. 18 was of very good chemical, and fairly good bacterial, quality; but it was turbid and pale yellow in colour. After storage for 15 days, more or less, the number of bacteria per cubic centimetre was reduced to little more than one-third. It was efficiently filtered before delivery, and was improved bacterially to the extent represented by the following percentage numbers: No. 1 Essex well, 99·12; and Middlesex well, 99·56. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes; and, with the exception of the Tottenham sample (which was very slightly turbid), they were perfectly clear and bright without filtration. The Colne Valley Company's water had been softened before delivery, and thus rendered suitable for washing. Seen through a stratum 2 feet deep, the New River, Kent, and Colne Valley waters were clear and colourless; the East London (deep well), clear and nearly colourless; the Tottenham very slightly turbid and colourless; and the remaining waters, clear and very pale yellow. The bacterioscopic examination of the raw river waters before and after storage, and the supplies delivered by the various Companies and collected on the 16th, 17th, 18th, and 19th of October, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw and Stored River Waters.		
Thames at Hampton, Oct. 16	2480	11·5
Thames, after storage for 14·7 days (Chelsea Company), Oct. 16	1240	12·3
Lambeth Company's water passing on to filter No. 5, Oct. 16	480	12·2
West Middlesex Company's water (supplying filters 1–5), Oct. 17	220	11·0
Grand Junction Company's water at Kew, passing on to filters 2, 3, 4, 5, and 7, Oct. 17	340	12·5
New River Cut, before passing through reservoirs, Oct. 18	1120	9·8
New River Cut, after passing through reservoirs, before filtration, Oct. 18	340	10·4
River Lea at Angel Road, Oct. 18	1820	10·0
River Lea, after storage for 15 days (East London Company), Oct. 18	640	10·6
Filtered River Water as Supplied.		
Thames—		
Chelsea Company's general filter well, Oct. 16	4	12·5
West Middlesex Company's general filter well, Oct. 17	24	11·0
Southwark Company's No. 3 filter well, Oct. 16	12	11·7
Southwark Company's No. 8 filter well, Oct. 16	84	11·7
Grand Junction Company's general filter well at Hampton, Oct. 16	16	12·1
Grand Junction Company's general filter well at Kew Bridge, Oct. 17	44	12·0
Grand Junction Company's south filter well at Kew Bridge, Oct. 17	4	12·0
Lambeth Company's general filter well, Oct. 16	12	12·3
Lea—		
New River Company's general filter well, Oct. 18	8	10·4
New River Company's No. 7 filter well, Oct. 18	8	10·5
New River Company's No. 9 filter well, Oct. 18	12	10·4
East London No. 1 Essex well, Oct. 18	16	10·0
East London Middlesex well, Oct. 18	8	10·0
Deep-Well Waters.		
Kent Company's new well at Deptford, Oct. 19	0	11·3
East London Company's Lea Bridge well, Oct. 18	4	11·3

It deserves to be remarked that the Kent Company's new well at Deptford yielded water which was absolutely sterile; while the supply of the Chelsea Company, Grand Junction Company (from their south well at Kew Bridge), and the deep-well water of the East London Company contained only 4 microbes per c.c.

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied in London during October, as ascertained by tests of samples taken daily on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 189 samples examined, all were found to be clear, bright, and well filtered. We have this month to record an excess of rainfall; the quantity measured at Oxford being 2·85 inches, compared with 2·56 inches (the average for 25 years)—showing an excess of 0·29 inches. The rain was fairly well distributed throughout the month, though more fell in the first ten days than later on. There were 15 days on which no rain fell. Compared with the corresponding month of last year, the quality of the Thames-derived waters shows a marked improvement in every respect; and, in spite of a much heavier rainfall than in September last, the results are almost identical. Our bacteriological examinations give the following results:—

		Colonies per Cubic Centimetre.
Thames water, unfiltered		2603
Do.	from the clear-water wells of the five Thames-derived supplies . highest	108
Do.	do. . . . . lowest	30
Do.	do. . . . . mean	68
New River water, unfiltered		1377
Do.	from the Company's clear-water well	41
River Lea water, unfiltered		3018
Do.	from the East London Company's clear-water well	48

These results show that the Water Companies are able to successfully cope with the extra strain put upon them; their filtering appliances being in excellent condition.

Wages of Leeds Gas Workers. The Gas Committee of the Leeds Corporation last Thursday had under consideration an application from the Gas Workers and General Labourers' Union for improved conditions of employment for about 150 pipe-layers and others in the service of the Corporation Gas Department. The demands of the men were as follows: "Foremen: In place of the four classes, 28s., 32s., 36s., and 40s., we suggest 30s., 33s., 36s., and 40s.; diggers, plumbers' labourers, masons' labourers, flaggers' labourers, and watchmen, a minimum of 23s. per week; setters up, 25s. per week. Flaggers: Men at 21s. and 22s. to be advanced to 24s. Other flaggers to be advanced 2s per week. Meter fixers: A number of these men were reduced last March from 25s. to 21s., on the grounds of incompetency. They are still sent out to perform the same work as heretofore; and, such being the case, we ask for a minimum of 25s. per week." The Committee practically accede to all the points asked.

WEST MIDDLESEX WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held last Tuesday, at the Offices, Marylebone Road, N.W.—Sir W. H. Wyatt in the chair.

The Chief Clerk and Secretary (Mr. F. H. Wybroo) read the notice calling the meeting; and the report of the Directors was taken as read. He afterwards read the Auditors' report for the six months ended Sept. 30, which stated that the capital of the Company remained the same as in the previous half year—viz., £1,432,636—and that the total expenditure on works amounted to £1,445,047, including £43,196 spent in the past half year. The revenue had been £127,257; being an increase of £1566 on that of the corresponding period of 1894. The water-rental received was £108,795; and the balance to the credit of the dividend and interest account was £43,165.

The Chairman said he feared the proprietors would be almost tired of hearing him say that the Directors had had an anxious time, for he had told them this for a good many years. Still, he did not think the past half year gave them less anxiety. They began now, however, he hoped, to see a little more daylight, and more peace and quiet; but the way in which they had been harassed, and the expense to which they had been put were really abominable. Though the outlay did not seem so large this time for parliamentary expenses, this fact was attributable to the circumstance that in the previous half year, foreseeing what was coming, they were prudent in putting by something to meet it. But if they had had to charge all the expense this half year, they would have had to put down a very large sum. The London County Council did not care, as they were not spending their own money; whereas the Directors were spending the shareholders' money, and they were also made to pay a good deal of the expenditure which the County Council themselves incurred. He was, however, glad to say that, since he last saw the shareholders, there had been a fresh election; and no doubt there had been a considerable improvement in that body, who were not so disposed to act unfairly towards them as their predecessors had been. As the proprietors were aware, the County Council brought in last year eight different Purchase Bills affecting the Water Companies; and the expense which each Company would be put to in opposing these Bills would be not less than £2500, or £20,000 in all. Each Company had to pay its own costs. It had been intended to go on with all these Bills. But, happily, by a majority of one, it was decided that they should not go on; so they were free from this anxiety for some time. Still one did not know what the Council might bring forward. The Company's supplies continued to increase; and the Engineer (Mr. M. W. Hervey, M.Inst.C.E.) assured them that all their works were in excellent condition. He thought he should be ungrateful if he did not take this opportunity of acknowledging the skill and care with which the Engineer had planned the new works; and he must also recognize the energy with which the Contractors were carrying them out. They gave the Directors hope that they might have two of the large reservoirs ready for use next summer; and this would greatly facilitate the supply of the district. They had raised £100,000, which was the first portion of the £440,000 of 3 per cent. debenture stock which they were authorized to create at their special meeting last May. It was repayable in 25 years, if they pleased, at £105. The tenders were for five times the amount offered; and those accepted averaged £105 10s. 2d. per cent. Of course, they allotted the stock, as they were bound to do, to the highest bidders. Some of the proprietors thought it was "hard lines" that they should have none of it; but the Directors would have been very glad to give it to them if they could. He thought it was very satisfactory to see the amount obtained for the stock. The price of their shares also had been, and was, very high; showing, he thought, that the public had confidence, and did not believe that the County Council would be allowed to acquire the Company's undertaking without paying a fair price for it. The inquiry before the Select Committee of the House of Commons with regard to the transfer of the various undertakings did not come to anything, because Parliament dissolved, and the whole thing broke up. But the Board thought it was very fair to the Water Companies; and the Committee would not listen to the proposal that their undertakings should be bought up for old iron. They intimated pretty plainly that, if they were purchased, a reasonable price would have to be paid—not a price, he supposed, which would be satisfactory to them, but still something reasonable. Several inquiries had been going on with reference to the waste of the water; but he could not say anything definite about this matter yet. So far as they could judge, they thought the evidence was in the Companies' favour. At the meeting last half year, the Directors reported the dreadful effects caused by the unwonted frost; and they came to the conclusion afterwards that the best thing they could do was to lower all the pipes to a depth of 3 feet wherever it was practicable to do so. They had now done this, but at a cost of £19,000. This was heavy; but they hoped they had now protected themselves against the effects of weather as severe as that of last winter. The difficulty was that many of the consumers had not taken any precaution against their pipes freezing again; but he did not know that the Company could help this. Their own pipes would be quite free from this danger. To meet the expenditure, two courses were open. One was to reduce, if not altogether to abolish, the 10 per cent. rebate which they allowed to the consumer, or to borrow the money temporarily from the reserve fund. They thought that, on the whole, it was better to take the money from this fund, and pay it back year by year by such instalments as they could; and a special resolution on the subject would be submitted at this meeting. The accounts had been certified by Mr. Allen Stoneham, the Official Auditor, who wanted them to charge a certain proportion of the £19,000 to capital. They told him they did not think it was necessary to do this, though there was something to be said in favour of it; and they promised to consider the matter next time. Mr. Stoneham pointed out that he had to adopt a uniform plan for the Water Companies; and he therefore hoped that the Company would agree to what he had suggested. He had since intimated to another Water Company that he thought about one-sixth would be the right proportion. One could not, however, tell. But the point was not of much importance; and they thought it was best to carry out Mr. Stoneham's views as far as they could. Next half year, therefore, they would charge to capital such a proportion as he might decide upon. He concluded by moving the adoption of the report and accounts, together with the report of the Company's Auditors.

The Deputy-Chairman (Mr. Edmund Boulnois, M.P.) seconded the motion; and it was carried unanimously.

Resolutions were afterwards passed authorizing the transfer of any sums not exceeding in all £20,000 from the reserve fund to dividend and interest account; declaring a dividend on the consolidated stock, for the half year to Sept. 30, at the rate of 10 per cent. per annum; and thanking the Auditors and the Chairman and Directors.

The proceedings then terminated.

THE PROPOSED WATER TRUST FOR WEST KENT.

Last Wednesday, a meeting of representatives of Local Authorities of West Kent was held in connection with the scheme on foot for obtaining parliamentary powers to form a Water Trust for the purpose of acquiring the undertaking of the Kent Water Company, and so much of that of the Lambeth Water Company as is situated in the county of Kent. Mr. Baker, the Chairman of the Beckenham Water Committee, presided; and he opened the proceedings by explaining that, though the London County Council were stated to have withdrawn their Water Transfer Bills, this was not actually the fact; indeed, the Council might be compelled to proceed with them, in order to render effective their opposition to those which would be promoted next session by the several Water Companies, with a view of extending their own powers. A series of resolutions which had been prepared were then submitted to the meeting. The Chairman moved the first, as follows: "That a Bill be prepared and deposited, and the necessary notices given of an application to Parliament for power to constitute a Water Trust for West Kent, and to purchase the undertaking of the Kent Water Company and so much of that of the Lambeth Water Company as is situate within the county of Kent." Some objections being raised, the Chairman stated that it was not proposed to proceed with the suggested Bill unless the London County Council went on with their Bills. Mr. Pember had advised that the position would be strengthened, in case of a renewed application by the Council, if the Kentish authorities promoted a Bill to run concurrently with the London Bills. After some discussion, the motion was carried, with the addition of the following words: "All questions of retaining Counsel and obtaining expert evidence to be deferred for future consideration by the Committee, and up to the meeting of Parliament, no expense be incurred except the actual and necessary cost in relation to the preparation of the notice and deposit of the Bill." It was also resolved that each authority should remunerate its own legal representative; but that all other charges are to be borne by the authorities joining in the promotion of the Bill, in proportion to the rateable value of the districts.

The notice for the Bill has now appeared. It sets forth that application will be made for power to constitute a Water Board for the urban districts of Beckenham, Bromley, Dartford, Erith, and Bexley, and the rural districts of Bromley, Dartford, and Sevenoaks, all in Kent. It is proposed to purchase the undertaking of the Kent Water Company, and so much of that of the Lambeth Water Company as is situated in Kent, and vest the same in the Board; the Kent Company being dissolved. The Board are to be empowered to maintain and improve the existing works, and to enter into agreements with other authorities for the sale of water in bulk; also to "transfer the portion of the undertaking of the Kent Company within the County of London, or part thereof, and with or without the sources of supply, works, wells, and pumping-stations, to the London County Council, or to any company or authority that has been or may be established by Parliament for the supply of water within the County of London." The Bill to be promoted for carrying out the above-named objects will contain provisions as to levying rates and charges and the borrowing of money, and enabling the Board, within their water limits, to exercise the powers of an Urban Sanitary Authority under the Public Health Acts, 1875 and 1878, and the Acts amending them, with respect to the supply of water.

BIRMINGHAM CORPORATION WATER BILL.

The Water Committee of the Birmingham Corporation have prepared a report for presentation to the Council, in which they submit the Water Bill which it is proposed to promote in the coming session of Parliament, and comment upon its provisions. The object of the Bill is this: The provisions of the Railway Clauses Consolidation Act, 1845, with respect to the temporary occupation of lands during construction of works (including use of land for the deposit of spoil), so far as regards their application to the aqueduct, were taken out of the Corporation Act of 1892 by the Lord Chairman of Committees. In addition to this, clauses were inserted in the Act for the protection of many large landowners, under which land for the deposit of soil could only be acquired by agreement. The result has been that great difficulty has been experienced in acquiring spoil banks on anything like reasonable terms. The present Bill is drafted so as to give the Corporation compulsory powers in this respect. The Bill also seeks powers to construct a short line of railway from Rubery Station on to the land of the Corporation at Frankley, for the purpose of conveying stone, cement, and other materials to the works at Frankley reservoir and filter-beds. The Water Committee have practically arranged with Lord Cobham, the only landowner interested, on what they consider to be reasonable terms. The Bill also provides for two short deviations of the aqueduct. There are, besides, some technical clauses designed to meet difficulties which have arisen from time to time in the construction of the works. The estimate for the execution of the works and purchase of lands under the Bill is £110,000. It should be clearly

understood, however, that the whole cost of the undertaking from first to last has been provided for in the Act of 1892; and the Committee hope that the estimate of expenditure under the Act of 1896 will stand in place of a greater expenditure which would have been incurred under the 1892 Act. The estimate is only inserted in the present Bill to comply with the Standing Orders of the Houses of Parliament, and does not involve any additional outlay. For the above reason, no further borrowing powers are sought under the new Bill. When the Bill has received the approval of the Council, it will be necessary to hold a public meeting of the ratepayers of the city to authorize the application to Parliament.

THE NEW WATER-WORKS AT WESTMINSTER (BRITISH COLUMBIA).

A recently-issued volume of the Proceedings of the Institution of Civil Engineers contains an account, by Mr. A. E. B. Hill, M.Inst.C.E., of the new water-works at Westminster, British Columbia. The town, which has a population of 8000, is situated about 15 miles from the mouth of the Fraser River; and in 1885 a scheme was prepared for supplying it with water in conjunction with Vancouver. A special Board of Water Commissioners was established, to which Mr. Hill was appointed Engineer, with instructions to prepare plans and specifications of works to meet the existing and prospective needs of the rapidly-growing city. This was done, and the scheme completed.

The source of the supply is the Coquitlam Lake—a body of water of unexceptional quality—about seven miles long and between half and three-quarters of a mile wide. The depth has not been measured; but it is known to be considerable. The lake is surrounded by lofty mountains, which guard it from contamination, and is fed from snow-fields. The lowest level of the lake is 435·8 feet above high-water mark. It is subject to sudden rises of 9 feet or 10 feet, which, however, never impair the purity of the water. The nearest part of the lake is 71,581 feet from the reservoir at New Westminster by the pipe-line. The supply is practically unlimited in quantity.

There are two inflow-pipes, so as to guard against the results of an accident happening to one of them. These pipes deliver the water into a screen chamber, 3 feet in diameter and 18 feet high. This consists of eight castings, one of which is a heavy bed-plate; the rest being cylinders of 1-inch metal with spigot joints, and having suitable branches for connecting with the mains. The chamber contains vertical channel-iron guides for the screen-frames. The screens are of copper wire, 7 and 14 wires to the inch, in wooden frames about 34 inches square. A small wooden building above the screen chamber accommodates the caretaker or patrolman. The ground along the pipe-line was cleared to a width of 33 feet. For a considerable distance from the town, the line follows a previously existing public road; and for the remainder of the distance, a waggon road has been made and declared public. Along the old road the ground is of easy slope; but after leaving it, the line is generally along steep hillsides and across bluffs, with occasional stretches of swamp. There are numerous streams, some of which were underrun and others bridged. On the hillside ground, a bench was cut for the roadway, and the pipe-trench cut on the inner side of it.

Except at one point, where the line was carried over a high bluff to reduce the length, it was kept below an imaginary line of uniform gradient, drawn from the source to a certain point in the city. At any future time, therefore, by laying a link round the bluff in question, the pipe-line could be made available for supplying, at its full capacity, an additional reservoir at any point that might be chosen in the city. In locating the pipe-line, it was purposely carried over a number of points of considerable elevation and almost precipitous slope; thus dividing the line into a series of sections, any one of which could be discharged for repairs without emptying the others, and without the shock and strain arising from the use of stop-valves on the main.

In the streets, the pipes were laid at a mean depth of 5 feet; on highways, at about the same depth; in heavily-timbered forest land, at 5 to 6 feet; in light timber, at 4 to 5 feet; and on steep hillsides at 7 to 10 feet. The gradients vary between 1 in 100 and 87 in 100. Angles of less than 4 degrees were passed without special pipes. For larger angles, cast-iron bends were used, and changes of gradient were made to coincide with alterations of direction as far as possible, so as to economize in the number of bends used. The main is 14 inches diameter throughout.

The steel plate of which the main was constructed was manufactured under a specification requiring a tensile strength of 65,000 lbs. per square inch, and an elastic limit of 39,000 lbs. per square inch, with an extension of 20 per cent. on 10 inches. The plates and other material were supplied from Glasgow, and put together by the Contractors at shops established for the purpose in New Westminster. Each plate was bent in rolls, and lap-riveted with two rows of rivets. The circular joints were also lap-riveted with single riveting; the plates being sheared to such a size as to make an exact fit between the smaller and larger pipes. Four of the larger and three of the smaller pipes were riveted together to form a 25-feet length. Each length was then tested by hydraulic pressure, cleaned, and coated, and taken to the ground for laying. A thimble made from 5-inch strips, of the same thickness as the pipe, was riveted on the inside of one end of each length, projecting to fit into the end of the next length. A sleeve made from 5 in. by $\frac{3}{8}$ in. iron was passed over the joint, and set up with lead in the usual way. The pipes were of four classes; the thickness varying according to the pressure to which the pipe might be exposed. The four thicknesses were Nos. 9, 10, 11, and 12 B.W.G.—or 0·148, 0·134, 0·120, and 0·109 inch. The hydraulic tests with these plates corresponded to heads of 675, 625, 525, and 425 feet respectively. The corresponding rivets were $\frac{3}{4}$, $\frac{11}{16}$, $\frac{17}{32}$, and $\frac{15}{32}$ inch in diameter at a pitch of $1\frac{1}{16}$, $1\frac{1}{8}$, $\frac{29}{32}$, and $\frac{23}{32}$ inch respectively. Tight joints were obtained throughout the work. Trenching for the main commenced about Dec. 1, 1891, and laying about Dec. 14. The water was turned into it on Aug. 8, 1892.

The reservoir is on a ridge about a mile from the city, from which it is separated by a deep ravine. It is in good clay which formed excellent material for the banks. The reservoir was made by day labour under the author's direction; and the castings, valves, &c., were obtained from Victoria. The reservoir is rectangular, measuring 150 feet by 80 feet on the bottom, and with a depth of 15 feet; the capacity being about 280,000 cubic feet. The water-level is 400 feet above the city datum—404 feet above high-water mark. The outflow main from the reservoir is 22 inches in diameter, of steel plate, Nos. 9, 10, and 11 B.W.G., jointed and laid in the same way as the 14-inch main. A gate chamber, 6 feet by 8 feet inside, was formed over the valve at the outflow, built of 4-inch cedar plank. It also contains a 6-inch open-topped pipe, which serves instead of an air-valve. There is a 6-inch waste-pipe, from an overflow tank, delivering to a surface drain.

The 22-inch main has seven bends, five of which were of 90 degrees, and constructed for convenience in two lengths. There are four 4-inch air-valves, a 6-inch relief, and two 10-inch blow-off valves. The 22-inch main connects with the two 14-inch steel plate mains of the distribution system. On one of these is a relief tank, 20 feet in diameter and 6 feet deep, of brick laid in Portland cement mortar, rendered with $\frac{1}{2}$ inch of neat cement. By means of this tank, the pressure in the lower parts of the city is reduced; only the upper parts carrying the direct head of the reservoir. This was necessitated by the difference of level, amounting to 300 feet, between the upper and lower districts. In case of fire in the lower district, the full reservoir head can be made available; the two districts being cut off from each other by two 14-inch and two 6-inch valves. The service-mains are chiefly 6 inches in diameter, of which size 89,936 feet have been laid. There are 73 hydrants (of the Galvin pattern) established. The pipes were laid, as a rule, 15 feet from the street boundary, with a stop-valve 4 feet from each street intersection. Every summit and dead-end is provided with an air-valve; there are eleven 6-inch relief-valves on the system. Care was taken to have no summits except at intersections. The house connections are partly of lead and partly of ungalvanized wrought-iron piping. The trenches were 2·95 feet wide on the average, at the top, and 3·82 feet deep. The cost to the city for trenching and laying was 11·4d. per foot run for 6-inch pipe, and 10·7d. for 4-inch pipe.

The condition of the works since the opening has been satisfactory. During the winter of 1892-3 a trying ordeal of flood and frost was experienced without any interruption of the water supply. When the temperature of the air was 12° Fahr. below zero, that of the water in the reservoir was 37·5° Fahr. The 14-inch supply-main, where exposed for about 1000 feet, was carefully watched, and was always found to liquefy snow placed upon it.

The capacity of the supply-main at the mean head is about 110,000 cubic feet per day. The capacity of the 22-inch main below the reservoir is sufficient to meet a fire draught of 200 cubic feet per minute, besides the ordinary domestic wants of a population of 22,000. In consequence of the efficiency of the supply, insurance rates have been reduced in the city by an amount exceeding the water-rate.

The following table gives an abstract of the cost of the works up to December, 1892:—

Franchise		$22,033·27
Land, buildings, and materials in stock		13,765·47
Works—		
Screen chamber	$1,148·61	
Patrol-house	620·99	
Supply-main (including clearing)	184,023·14	
Service reservoir	17,921·29	
City mains	44,370·36	
Relief-tank	2,325·55	
Distribution system	110,614·16	
House-service	5,490·18	
Extensions not included in original designs	3,340·57	
		369,854·85
Total		$405,653·59
		or about £81,130.

In this abstract, the cost of engineering, law expenses, &c., has been distributed *pro ratâ* over the various items. The cost of engineering surveys was 4·24 per cent. of the total; and the general charges were 1·68 per cent.

The Gorton Sewage Works.—To mark the completion of the Gorton sewage scheme, a ceremony recently took place at which Dr. B. W. MacArthur, the Chairman of the Gorton Urban District Council, set the works in operation. An opportunity was afterwards given to visitors to view the process selected. Before the adoption of the scheme, the whole of the sewage of the township went into Gorton Brook and Gore Brook without having received any treatment at all. The Mersey and Irwell Joint Committee, however, served the Council with a notice requiring them to divert the whole of their sewage from the streams within a given time. A scheme was, therefore, prepared dealing with the entire township, and consisting of main concentrating and several tributary sewers. Application was then made to the Local Government Board for sanction to borrow the necessary money, which was estimated in round figures (and including the cost of the land) at about £40,000. An inquiry was held at which opposition to the scheme was made by the Manchester Corporation, on the ground that the effluent would drain into a stream (the Gore Brook) which flowed through the city. The Local Government Board, however, gave their approval to the plan, and sanctioned the loan which its adoption involved. A convenient plot of ground was secured; and the first sod was cut in 1893 by Mr. T. Matthews, the then Chairman of the Local Board. The Engineers were Messrs. Lomax and Lomax, of Manchester; and under their direction the work has been carried out by Mr. D. Eadie, of Stockport. There are two detritus tanks with a capacity of 110,000 gallons, and three large precipitating tanks with a combined capacity of 1,079,000 gallons. It is intended, in future, to deal with the sludge deposited in the tanks by means of filter-presses; but this is not yet included in the scheme. The outfall works have cost £17,000, and the concentrating sewers have involved an expenditure of £8000 more. Other important sewers are about to be carried out, and, when completed, the whole of the sewage from the township will be conveyed to the outfall purification works, and the pollution of the rivers, so far as Gorton is concerned, will be at an end.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Dunfermline Town Council held a special meeting on Monday; being the second meeting, in terms of the Burghs Gas Supply Act of 1876, to consider as to the adoption of that Act. Provost Walker, who presided, said that a remark was made to him the other day, which led him to see that there was a misconception on the part of a considerable number of the community on a very important matter. He was told that there was some opposition to the proposal, in consequence of a large number of people thinking that, if the town purchased the gas-works, it would mean an additional amount of taxation to the burgh. If he thought that was to be the case, he would never have brought forward the proposal. His object had been to lessen rather than increase the taxes of the burgh. In every case about which he had obtained information, the result had been satisfactory so far as money-making was concerned. He had taken pains to write to a goodly number of towns in which the electric light had been introduced. He took thirteen places where it had been in use for a considerable number of years, or where it had been lately introduced; and he had had twelve replies. The general outcome of the letters was that the financial results had been unsatisfactory. He had made a summary, which was as follows: Two years, a loss each year; six years, less than 1¼ per cent., or, deducting interest, £6000; bad financial results, a loss each year since commencing; large loss, several years, average 3¾ per cent., by charging 25 per cent. higher than Board of Trade unit, if at 6d., a loss last year of £1300; gross profit, £2000, net result not given; a loss for past year; considerable loss; loss of £1350; not hopeful financially; hope to make pay. He did not wish to infer from this anything against the electric light; but he did say that it was a luxury, and as a luxury had to be paid for. It was for that reason that he thought it would not be suitable for Dunfermline, and that it would be better to have the gas-works. There were hundreds of houses in Dunfermline into which one would not think of introducing the electric light, so that although they had this illuminant they would require the gas as well. The Provost put the subject very sensibly. A question was asked as to whether the adoption of the Act implied that the Corporation must proceed with the transfer, the answering of which appeared, unnecessarily, I think, to be difficult; but in the end it was authoritatively laid down that they would not be bound to proceed. The adoption was then agreed to unanimously; and the Town Clerk has issued the statutory notice calling for objections on the part of ratepayers. There would appear to be a feeling in the minds of some that they should not proceed with the transfer, but should hold the threat over the head of the Gas Company that, unless they give easy terms to the town, the Council would exercise their powers under the Act. I dare say such a threat would not do much harm; but if there be anything in it, the statute seems to give every facility for the use of it. No limit is placed to the time in which the powers under it may be put in force; and the threat might thus be a perpetual one. I trust that good sense will prevail; and that this state of matters will not arise.

The Aberdeen Town Council have re-appointed Mr. Johnston Convener of the Gas and Electric Lighting Committee. During election times many new ideas are put forward which are never heard of again. On this occasion, when the Council were on the subject of appointing Committees, Mr. J. Gray brought forward one of these suggestions, in the proposal that the Gas and Electric Lighting and the Water Committees should be conjoined. His notion was that if one Committee were in charge of all the works which require the streets to be opened, the scandal of one Committee opening a street and almost as soon as they had finished their work another following, would be got quit of; the result being that the thoroughfare is ruined and the residents are put to great inconvenience. Mr. Gray's proposal was well meant; but it was vetoed, the Lord Provost intimating that the officials said it would not work at all. That may or may not be the case; but where Mr. Gray's motion was weak was that it did not go far enough. It should have included the Roads and the Cleansing Committees, because these have to do with the paving of the streets and the laying of sewers. With those Committees added, there would practically have been the whole Council; and the scheme would certainly have been as unworkable as it is at present. The indiscriminate opening of streets is a crying scandal which exists in every town; and for it the officials are largely to blame, because they frequently do not work together. No remedy has yet been found, though attempts have been made to arrange for one Committee intimating to another their intention to open up a certain street. The solution of the difficulty would, of course, lie in the Roads Committee intimating that they proposed to pave a certain street, and then the other Committees putting their pipes in order before it was done; but then no Committee cares to spend money until it is absolutely required, and such a scheme would interfere with the estimates which they had adopted for the year. It would also make the Roads Committee the dominating one, which some Conveners would not tolerate; there being a certain jealousy between departments. That feeling ought to be overcome, in the public interest; and if a remedy is to be found, it should begin with the framing of the estimates for the year—that is to say, before the time for adopting these arrives, the Roads Committee should make up their minds which thoroughfares they are going to pave during the year, and communicate with the other Committees on the subject. These could then make provision, in their estimates, for overhauling their pipes. Such a scheme might involve outlay which was not immediately contemplated; but there would be a saving in the end, not to speak of the comfort that would be secured to the community, which should make some scheme of the kind workable.

For the filling up of the vacancy caused by the retirement of Mr. Thomas Whimster, Manager of the Perth Corporation Gas-Works, 43 applications have been received. The Commissioners met in private on Monday night; and out of the list, they selected the following nine as a short leet: Mr. Alexander Yuill, Corporation Gas-Works, Alloa; Mr. Andrew Wilson, Gas-Works, Carlisle; Mr. G. W. Anderson, Gas-Works, Whyteleaf, S.O., Surrey; Mr. David Easson, 13, Queen Street, Perth; Mr. George R. Love, Gas-Works, Dundalk, Ireland; Mr. James M'Cubbin, Gas-Works, Port Glasgow; Mr. W. S. M'Gregor, Gas-Works, Leslie; Mr. William M'Crae, Gas Commission, Dundee; Mr. Edward A. Harman, City Gas-Works, West Bromwich.

The inhabitants of Forfar are still in a state of agitation over the explosion in the gas-works a fortnight ago. One individual, who resides in the neighbourhood of the works, urges the Gas Corporation to have a searching inquiry by "a competent gas expert," whatever that may mean; otherwise there will be a general exodus from that district of the town. He considers that "to stay in a locality where there is a certain amount of danger is bad enough; but to remain hourly in expectation of being blown into eternity is still worse." Was ever such bunkum written? But for the fact that Mr Waddell was burned by it, the explosion was a small affair, but it is being made use of by some who are opposed to Mr. Waddell's policy to depreciate his work; and as, unfortunately, his opponents have a considerable footing in the Corporation, the effect is damaging. Apart from that, it is bad taste of anyone, while Mr. Waddell is not yet able to defend himself, to attack him in this covert way. It would be too glaring a piece of injustice to speak such sentiments at a public board; and, as a matter of fact, at a meeting of the Corporation on Monday night, the subject was passed over, on account of Mr. Waddell's condition of health. But an anonymous letter in a newspaper is a convenient method of hitting a man from behind; and it has been resorted to, I do not say by any member of the Corporation, but by someone in sympathy with the opposition. This is very shameful; and more particularly when Mr. Waddell is down, which at present he in reality is.

As to the meeting of the Corporation on Monday night, it is almost amusing to see the extraordinary interest which is taken in their doings at present. One local newspaper even goes the length of publishing a diagram showing where each member of the Corporation and the officials sat, which betokens an abnormal and unhealthy feeling in the community. The business was not particularly important. A Convener of the Committee had first to be appointed. The Provost moved that Mr. Craik, who has been a very capable Convener, should be re-appointed. A member thought that someone else should be elected, as Mr. Craik had been Convener for such a long time, and he lived too far from the works. Two names were proposed in succession; but neither of the gentlemen would accept the office, and in the end Mr. Craik was re-appointed. Mr. Christie then said he was to have moved that the power to dismiss workmen should be vested in the Gas Committee, instead of in the Manager; but he could scarcely go on with this motion at the present time, owing to the unfortunate position in which their Manager was placed. It was impossible to fully discuss this matter without introducing the name of the Gas Manager; and he asked that his motion be allowed to stand over to next meeting. This was agreed to. On account of a charge which was made by a member of the Corporation at a public meeting during the recent election, to the effect that there was cheating going on in the selling of coke, the Committee recommended that the coke be sold at the rate of 10s. for 33 bags, delivered in town; no coke being sold by weight in future. Mr. Craik said that the bags used at the gas-works had got less and less, until it required about 41 bags to weigh 18 cwt. They were to get a bushel measure; and the coke would then be sold by the bushel. Mr. Christie said he would certainly object to this method of selling coke, as he did not think the Corporation should encourage their officials to bolster up their finances in this manner. If a man purchased a ton of coke, he ought to get a ton. Mr. Craik said that they could not guarantee any weight when selling coke. If anybody was cheating, the whole Corporation were cheats. With this beautiful sentiment, the matter was allowed to drop; and the Corporation went into the subject of the sale of the residuals. The only other matter taken up was the explosion, regarding which Mr. Craik intimated that, as soon as Mr. Waddell had recovered and was able to attend, they intended to have an investigation by the whole Corporation. Mr. Christie asked if it was not necessary to report the occurrence to the Board of Trade. The Clerk replied that he had sent notice according to the statute, and had also reported the matter to the Factory Inspector. Mr. Christie thought it was necessary to ask the Board of Trade to send an Inspector to make an inquiry. They ought to have an inquiry, as it was the only way in which they could satisfy the public. The Provost said that Mr. Stirling, the Chief Constable, had made an inquiry, in case of any of the injuries proving fatal. The Clerk said that Mr. Stirling could take no action unless he found any malicious conduct in connection with the matter. Mr. Stirling said he had found nothing whatever of that nature. Mr. Christie said he did not want to press the matter; but he would insist upon its being gone into. Mr. Craik said that the damaged retort-bench would not be touched until Mr. Waddell was able to go about; and the Corporation would then be called, and they could get the Board of Trade or any other person to make an inquiry.

The small town of Fort William, which lies near the base of Ben Nevis, is unable to support a gas company; yet the Police Commissioners are arranging for the introduction of a supply of electricity for lighting. The gas supply has, on more than one occasion this year, almost entirely failed; the reason being, as Mr. Fullarton, the Manager of the works, explained at a public meeting, that the works are too small. The natural remedy would be to enlarge them; but the alternative course has been adopted of taking on electricity. The power for driving the machinery is to be derived from water, which will do well enough in summer, when the light is not wanted; but in winter, when it is required in a frosty region like Fort William, there may be difficulties. A reserve steam plant will then be needed; and the community will be in a worse position than now. They are, however, going into the business with their eyes open; and they will therefore have only themselves to blame if they have to pay sweetly for their folly.

Dorking Water Supply.—The Dorking District Council have resolved that new water-works are necessary, and that it will not be in the interests of the ratepayers to acquire the undertaking of the Dorking Water Company at the valuation likely to be put on the existing works. A Committee has been appointed to consider the details of a scheme for constructing the proposed works.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 23.

Sulphate of Ammonia.—Notwithstanding the quiet appearance of the market, there has been a considerable amount of business doing—any parcels offering being readily picked up. Although very little advance in prices has been realized, makers are firm; it being believed that large speculative contracts have yet to be covered. The closing quotations are £8 15s. to £8 16s. 3d. f.o.b. at the ports. In the forward position, speculators are again offering more freely; but it does not transpire whether much business has been done. It is reported that £9 5s. has been refused f.o.b. Leith, over spring months.

Nitrate of Soda is quiet at 7s. 9d. per cwt. on spot.

LONDON, *Nov.* 23

Tar Products.—Pitch is undoubtedly easier; but whether this arises from an effort on the part of buyers to reduce prices, or from natural causes, cannot at the moment be said. The fact remains that makers hold no stocks, and are invariably well sold forward. Carbolic acid is stronger; and the absence of stocks either in the hands of makers or users is likely to accentuate the value of this product in all its forms—crystals being quoted quite ½d. higher. Anthracene continues firm. Large business is reported; and very little is being offered—most makes outside the Committee having been bought up. Slightly higher prices are being asked for "B" quality. Benzol more than maintains the advance it obtained more than a week ago. No important new business is reported; but very few producers have any for sale for early delivery. Solvent naphtha is steady; and a good trade is being done in naphthalene. Business has been reported during the week at the following rates: Tar, 19s. 6d. to 23s. 6d. Pitch, 35s., west coast; 38s., east coast. Benzols, 90's, 1s. 8d.; 50's, 1s. 7d. Solvent naphtha, 1s. 3½d. Toluol, 1s. 9d. Crude, 30 per cent., naphtha, 5½d. Naphthalene, pressed, 50s.; drained, 30s. Cresylic acid, 1s. 2d.; crude, 9d. Carbolic acid, 60's, 1s. 8d.; 75's, 2s. 1d. Anthracene, "A," 1s.; "B," 10d. All these prices are subject to 2½ per cent. discount.

Sulphate of Ammonia, though in fairly good request, and being shipped in very considerable quantities, has not so far realized anticipations in respect to an improvement in price, although buyers are willing to pay 5s. in advance for forward delivery. Prices, however, are miserably low; and makers would be unwise to sell far forward at such rates. Transactions have been noted at prices ranging between £8 12s. 6d. and £8 15s., less 3½ per cent. at all ports. For forward delivery, 5s. is offered, and 10s. asked, in advance. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Only a slow, dragging sort of business continues to be reported generally throughout the coal trade, with a good many collieries not working full time, and supplies of all descriptions of fuel plentiful. For the better qualities of round coal, prices are maintained at about list rates, averaging 10s. 6d. per ton for best Wigan Arley; 9s. to 9s. 6d., for Pemberton four-feet and seconds Arley; and 7s. to 7s. 6d., for common house-fire coals. The lower qualities of round coal, for iron-making, steam, and general manufacturing purposes, continue more or less a drug upon the market; and notwithstanding increased activity in the iron-making, engineering, and other industries, requirements for consumption are still a long way below the output of the collieries, and excessively low figures are quoted to clear away surplus supplies in anything like quantities. At the pit mouth, common round coals can be bought from as low as 5s. 6d. per ton for special sales, with ordinary pit prices averaging 6s. to 6s. 6d. Engine classes of fuel are in fair demand so far as the better qualities of slack are concerned; but commoner sorts are a drug, and very low in price. At the pit, best slack fetches from 4s. 6d. up to 5s. per ton, with common sorts obtainable at from 3s. to 3s. 6d. The shipping trade still shows no improvement; and common steam coal can be readily bought at from 7s. to 7s. 6d. per ton delivered at the ports on the Mersey.

Northern Coal Trade.—Very great dulness has been felt in the steam coal trade of the North of England the last few days. The close of the Baltic season usually sees such dulness; but the strikes of last year and its two predecessors gave an alternative demand which does not show itself this year, so that work is short at most of the collieries, and prices are weak. Nominally, best Northumbrian steam coals are quoted at 8s. per ton f.o.b.; and one colliery, which has a command of some French markets, asks 8s. 3d. Much of the coal is, however, sold below the first-named price, either by discount or the acceptance of a slight reduction. Second-class steam coals are quoted at 7s. 3d. to 7s. 6d. per ton f.o.b.; and small steam coals vary from 3s. 9d. to 4s. There have been more contracts entered into for manufacturing coals, chiefly at prices similar to those expiring; but none of the locomotive coal contracts have yet been allotted, and in their cases lower prices than those now current will be taken for next year. Gas coals are now nearly at the height of their demand; and for odd cargoes the price may be said to be slightly higher—from 6s. 9d. to 7s. 3d. per ton being the general rate; but the bulk of the deliveries that are now being made are on contracts taken months ago, and probably generally ranging from 6s. to 6s. 3d. per ton f.o.b. Some of the best gas coal collieries have orders that will ensure full work for at least three months ahead. There is little alteration in the coke trade. The export demand for blast furnace coke is slightly less, owing to the close of the Baltic shipments, but there is a larger local consumption than has been known, and fair quantities are being sent to the north-western blast furnaces. The price for best Durham coke is 14s. 6d. to 15s. per ton f.o.b. With a large production of gas coke, the demand seems also good; so that there is not generally any large addition to the stocks in hand at the gas-works—at least to those near navigable waters.

Scotch Coal Trade.—While the engineers' dispute exists, the coal trade continues to drag. There is really no change to record, either in demand or prices. Supplies are very abundant; the men working all the time they can. The prices quoted are: Main, 5s. 9d. to 5s. 10d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 146,886 tons—a decrease on the preceding week of 14,880 tons, and as compared with the corresponding week of last year of 1217 tons. For the year to date, the total shipments have amounted to 6,575,688 tons—an increase over the corresponding period of last year of 2,071,381 tons, but a decrease as compared with 1893 of 541,209 tons.

Loans for the Merthyr New Water-Works.—At a special meeting of the Merthyr District Council on Monday last week, it was agreed to accept an offer from the Lords of the Admiralty of £132,300 for fifty years and £10,900 for thirty years, at 3¼ per cent., for water-works purposes; the money to be repaid on the annuity system half-yearly. It was proposed that the loans should be cleared off by the repayment of principal and interest; but this was rejected by a large majority.

Projected Sewage Disposal Works for Alton (Hants).—An inquiry on behalf of the Local Government Board was held at Alton, Hants, on the 19th inst., by Colonel Coke, M.Inst.C.E., for the purpose of considering an application from the Urban District Council for a loan of about £11,000 for sewage disposal works, the plans for which had been prepared by Messrs. R. B. Grantham and Son, of Northumberland Avenue. The Inspector first examined the land up to and upon which the sewage was to be pumped and distributed, and then held the inquiry. There was a good deal of opposition to the application.

New Joint-Stock Companies.—The Bedworth Gas and Coke Company, Limited, has been registered with a capital of £5000, in 456 £7 ordinary and 904 £2 preference shares, to acquire and carry on the undertaking of the Bedworth Gas and Coke Company. The Dedham Gas Company, Limited, with a capital of £2000, in £2 10s. shares, is to acquire and carry on the business of the Dedham Gaslight, Coke, and Coal Company, Limited. The Harpenden Water Company, Limited, with a capital of £9000, in £5 shares, is to supply the parish of Harpenden in Hertfordshire, and the neighbourhood, with water. The Hot Water Supply Syndicate, Limited, with a capital of £6000, in £1 shares, is to acquire a patent (No. 19,695, dated Oct. 19, 1895) granted to H. M. Robinson, for improvements in apparatus for supplying hot water in exchange for coins or otherwise.

The New Water Supply for Belper.—Messrs. G. and F. W. Hodson, of Loughborough, have prepared a new scheme of water supply for Belper; and their report has been considered by the District Council. The Engineers propose to provide a supply for the whole parish, with mains in all the populous parts, at an entire cost of £15,776. Some of the members of the Council thought the cost heavy, and the scheme too comprehensive. Mr. G. Hodson, however, assured them that they would not go on with any work until they had proved the water they were boring for; and he had no hesitation in advising that the boring be proceeded with. After this, tenders for the boring operations were opened. The lowest was that of Mr. J. F. Price, of Nottingham, at £3054 15s.; and this was accepted. It may be remembered that Mr. H. Strutt, the Chairman of the Council (whose father presented the town with the whole property of the Water Company), has placed at the disposal of the authority the necessary land for the borings, and guaranteed £4000 for carrying out the experiments.

The Gas Question in Liverpool.—The subject of the gas supply of Liverpool is still engaging the attention of the Corporation authorities. At the last meeting of the Lighting Committee of the Council, it was moved that the Council be recommended to rescind the following resolution of the 2nd of October last: "That, in view of the high price paid for coal, &c., used by the Liverpool United Gaslight Company, and the consequent high price of gas and coke, the Town Clerk be, and he is hereby, instructed to do all that is necessary to enable the Council to promote a Bill, in the forthcoming session of Parliament, to obtain powers to establish and maintain a competitive gas supply, and that Standing Order No. 61 be suspended accordingly." On a division, the motion was carried by 11 votes to 3. It was thereupon moved—"That a Special Sub-Committee of five be appointed to consider all matters connected with the supply of gas to Liverpool, and the candle power and charges for the same, with power to discuss the matter with the Gas Company, and to engage, if necessary, a gas expert to advise the Sub-Committee." On a division, nine voted for, and four against the motion. It was therefore carried. When the constitution of the Sub-Committee was under consideration, Alderman F. Smith was proposed as a member; but, on a division, the proposition was lost.

Explosions of Domestic Boilers.—The following circular letter, calling attention to the necessity for adopting precautions against the explosion of domestic boilers during periods of severe frost, has been addressed by the Board of Trade to the various water companies and the local authorities who undertake the supply of water: "The attention of the Board of Trade has from time to time been called to the large number of explosions which have occurred during periods of severe frost from boilers used for domestic purposes. As these boilers are exempt from the provisions of the Boiler Explosions Act, the Board are not in possession of precise information with regard to such casualties; but it is generally agreed that, in the great majority of cases, the explosions are due to the freezing of the water in some portion of the pipes connected with the boiler, and to the excessive pressure thereby caused. The Board are advised that most of these casualties might be prevented by the adoption of simple precautions either to prevent the freezing of the water in the pipes, or to relieve any excess of pressure which may arise in the event of the water becoming frozen. Seeing that many very serious, and a considerable number of fatal, accidents are occasioned by explosions from domestic boilers, and that the number of these casualties might be materially reduced if, before the approach of winter, householders were made aware of the precautions that should be taken, the Board of Trade desire to impress upon water companies and upon local authorities who have undertaken the water supply in their districts the expediency of calling the attention of their customers and ratepayers to the subject, and of placing before them a concise statement of the safeguards that should be adopted. The Board of Trade will be glad to know what steps you propose to take in the matter."

Chertsey Gas Company.—The shareholders of this Company have passed a resolution authorizing the increase of the capital by £4000, by the issue of 160 new ordinary shares of £25 each.

The Proposed Purchase of the Driffield Gas-Works by the District Council.—The members of the Driffield District Council had before them a short time ago an agreement, which had been drawn up conjointly by their own Solicitor and the Solicitor for the Gas Company, for the purchase of the gas-works. It was moved that the agreement should be approved, and the seal of the Council affixed thereto. Some of the members objected to such a serious step being taken, as neither the Council nor the ratepayers had had time to consider the agreement; but the motion was carried by five votes to four. It was resolved to forthwith apply for a Provisional Order.

The Cost of the East London Water Inquiry.—The total cost of the recent inquiry held by the Local Government Board regarding the water supply of East London, so far as the Vestries are concerned, amounts to £624. As is usual in such cases, there is considerable reluctance on the part of the various Boards to settle proportionately; for it is one thing to enter a fight, and another to accept the consequences. As it is, the Hackney Vestry have resolved to pay the whole of the expenses incurred, and have apportioned the same as follows on the several authorities interested in the inquiry: Hackney, £140; Bethnal Green, £88; Mile End, £75; St. George's-in-the-East, £30; Shoreditch, £84; Limehouse, £39; Poplar, £117; Whitechapel, £51.

The Wells City Council and the Gas-Works.—At a meeting of the Wells City Council last Tuesday, the Sanitary Committee reported, as the result of their negotiations with the Gas Company, that they had offered the works to the Council for £19,680, which they considered quite out of the question; and the Committee were prepared to recommend the Council to give a sum of £12,700, which they thought was the value of the undertaking. This the Company had declined to accept; and as they suggested no alternative, nor accepted the offer to light the city, negotiations, as far as the Committee were concerned, were at an end. It was then formally resolved to apply to the Board of Trade for a Provisional Order to light the city by electricity; a proposition to offer the Gas Company £15,000 for their concern being rejected.

Gas Exhibition at Derby.—An exhibition of gas-stoves, grates, and every kind of gas cooking appliances manufactured by Messrs. Richmond and Co., Limited, was opened by the Mayor of Derby (Mr. H. Boam, J.P.), at the Temperance Hall in that town last Tuesday afternoon. He said he was pleased he had been afforded the opportunity of opening the exhibition. Some people had expressed an opinion that gas would soon take a back place; but he had no fear of that. He was glad to say he was a considerable shareholder in the Derby Gas Company, and was not at all fearful of losing his interest. He thought electricity would make greater strides than it had done; and so also would gas, which would be as great a servant of the public in the future as it had been in the past. A vote of thanks to the Mayor having been proposed, Mr. E. W. T. Richmond supported it, saying that the success of the two exhibitions previously held in Derby had led his firm to hold this. He added that, during the exhibition instruction in the management of gas appliances would be given; as well as cookery lectures by Miss Richmond.

Water Scheme for Penrith.—After a controversy extending over four years, the Urban District Council of Penrith have, in Committee, agreed to a scheme for a new water supply to the town, which is expected to cost over £20,000. Local public opinion has been sharply divided from the first between securing a supply by gravitation from Cross Fell, in the neighbourhood of Melmerby, and retaining the present system of pumping from the River Eamont, which flows from Ullswater Lake. The Local Government Board some time ago intimated that, owing to the liability of the stream to pollution, no money would be lent for the improvement of the existing works. It is claimed for the Melmerby plan that the supply from one group of springs alone is three times as great as Penrith needs, although the Local Authority sell large quantities to the Railway Companies. Moreover, it is far beyond the range of cultivation or human habitation; and the analyses are excellent. The last Council election was fought on this question; and three members who then secured seats were not committed to any fixed policy until further investigations had been made. These have now declared for gravitation from Melmerby.

Lamp Explosions at the Salisbury Workhouse.—Owing to the frequency of explosions of the hand-lamps used in the Salisbury Workhouse, the Clerk to the Guardians communicated with the Gas Company, asking if the Directors would supply gas to the workhouse. He received an answer to the effect that, if the workhouse were within the limit of the Company's radius, they would do so. A subsequent letter from the Secretary, however, pointed out that the Company's Act did not extend to Britford, in which parish the workhouse is situated. The Directors, with a view to meeting the wishes of the Guardians, suggested that the difficulty might be got over by laying the mains so far as their limit, and placing a meter at that point, from which the Guardians could carry the pipes to the workhouse. The cost of laying the whole main, it was estimated, would amount to £100. The matter came before the Guardians at their meeting last Friday, when one of the members asked if the House Committee had not exceeded their instructions in going into the whole question of lighting by gas. Mr. Hammick, as Chairman of the Committee, explained that, owing to the explosion of several lamps, it was a question of urgency. The new lamps which were the cause of so much mischief had been purchased with the approval of a Poor Law Board Inspector, and superseded a set of glass lamps formerly in use, with which no mishap had occurred. They had also considered whether the old glass lamps should again be resorted to, or whether candles should be substituted for oil. After some discussion, in the course of which the idea of taking gas to the workhouse was abandoned, on the ground of its great expense (it being estimated that it would cost £400), the porter was called in, and stated that, out of the five dozen small lamps obtained a short time ago by the Guardians, no less than a dozen and a half had exploded. It was decided to dispense with the present kind of lamp; and the matter was left with the Committee.

Destructive Fire at Messrs. Crompton's Works.—Last Friday morning, shortly before nine o'clock, the large electrical plant works of Messrs. Crompton and Co., Limited, at Chelmsford, caught fire, and before noon the premises were almost entirely burnt to the ground. According to the *Suffolk Chronicle*, the first indication of anything amiss was smoke coming from the high-tension switch-board. Evidently the switch had become overheated, or at least some part of it, and thus caused the mischief. Before the alarm had barely been given, the flames seemed to have taken hold of the entire engine-room. The quickness with which they spread may be judged from the fact that the employees were unable to get their own hand hose into play. From the engine-room, the flames spread east and west; and in turn the store-room, the general offices, the drawing offices, and the main workshop were a mass of fire. In two hours this had nearly done its work; most of the buildings being completely gutted, and their contents destroyed. The damage is estimated at £100,000; and as the works contained the machinery for the electric lighting of the town, this will necessarily be interrupted.

Sales of Shares.—At the Mart, Tokenhouse Yard, last Wednesday, Messrs. Fox and Bousfield sold parts of freehold shares in the *New River Company* at the rates of £101,000, £108,000, and £119,000 per share; also new shares (£100) at £400 each.——On the previous day, Messrs. Edwards and Son sold £5000 of stock of the *Staffordshire Potteries Water Company* at prices ranging from £119 to £121 per £100 lot.——Last Wednesday, £1500 new "A" stock in the *Canterbury Gas and Water Company* was offered for public competition in 150 lots of £10 each, being part of an authorized issue of £36,000. The lots fetched an average of £23 2s. 3d. each.——Last Thursday, Messrs. Alexander, Daniel, Selfe, and Co. sold by auction, at Bristol, £15,000 of 7 per cent. maximum consolidated ordinary stock in the *Bristol Water-Works Company*. The total amount realized was £22,217 10s., or an average of £148 2s. 3d. per cent. There was a large attendance; and the bidding was spirited.——At the Mart, last Friday, Messrs. J. A. and W. Tharp sold 155 £5 and 107 £10 shares in the *West Ham Gas Company*. The former fetched from £11 15s. to £12 per share, realizing £1832; and the latter, £14 10s. to £15 per share, realizing £1592.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1080.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	23—24	+½	4 7 6
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	..	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	100	107—109	..	4 11 9
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¾—7¼†	−¼	4 9 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4 13 0
180,000	,,	,,	9	Do. New	100	205—210	..	4 5 8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	124—128	−1½	3 18 1
320,000	20	27 Sept.	11½	British	20	54⅞—55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4 17 10
51,510	10	,,	8½	Do. 7 p. c.	10	18½—19½	..	4 7 2
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	8—8½†	..	4 14 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	31—33	..	5 0 0
550,000	Stck.	26 Oct.	13½	Commercial, Old Stock	100	320—325	..	4 3 1
165,000	,,	,,	10½	Do. New do.	100	247—252	..	4 3 4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	278—283	..	4 11 10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	..	4 11 10
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4 0 9
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4 3 0
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100*	292—296	−½	4 6 2
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	284—288	..	3 9 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3 10 7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	135—140	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	147—152	..	2 19 2
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	235-240*	−2	5 0 0
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6—6½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4 6 2
541,920	20	14 Nov.	5	Monte Video, Limited	20	17—18*	..	5 11 2
150,000	5	24 May	8	Oriental, Limited	5	7½—8	..	5 0 0
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105—110	..	5 9 1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5 12 1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11—12	..	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4 2 8
1,350,000	,,	,,	12	Do. B do.	100	308—313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325—330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	295—300	..	3 6 8
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	218—223	−2	3 2 8
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	6½	Grand Junction	50	110—115	−7½	2 16 6
708,000	Stck.	29 Aug.	12	Kent	100	307—312	..	3 16 11
1,043,800	100	26 June	7½†	Lambeth, 10 p. c. max.	100	249—251	..	2 17 1
406,200	100	,,	7½†	Do. 7½ p. c. max.	100	208—213	..	3 8 1
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
500,000	100	14 Aug.	12⅞	New River, New Shares	100	380—390	..	3 3 7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	145—150	−1	2 13 4
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2 15 2
1,155,066	Stck.	12 June	10	West Middlesex	100	295—298 ex div	..	3 7 1

† Next dividend will be at this rate.

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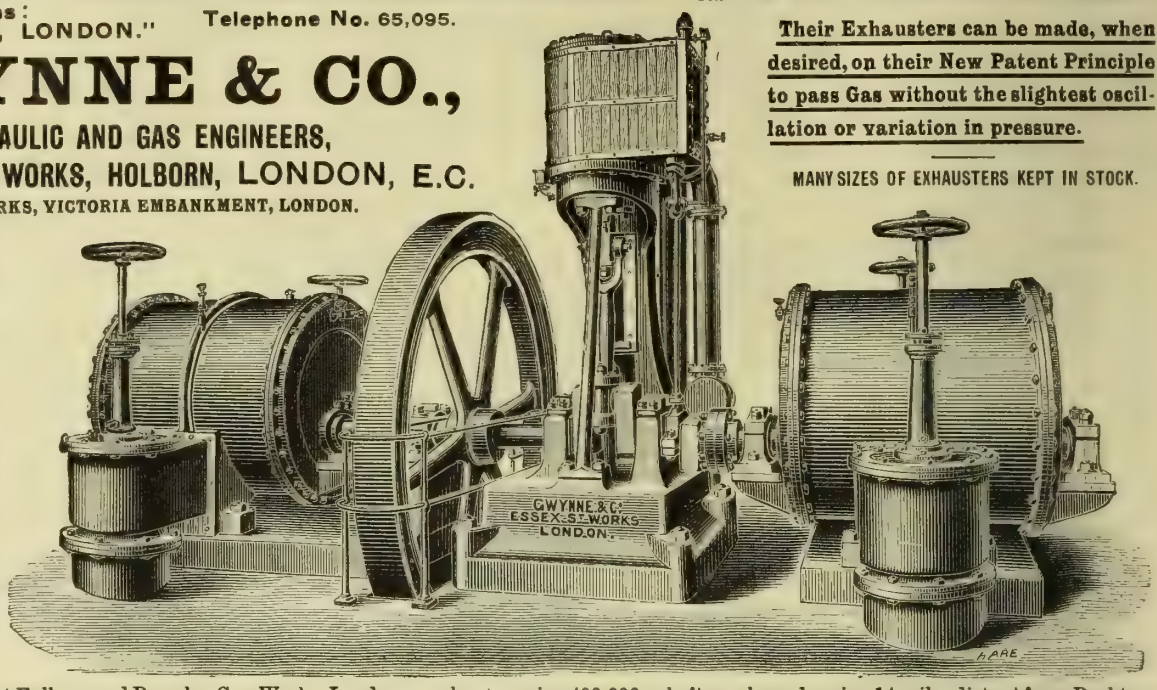

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

EDITORIAL NOTES.

The Parliamentary Notices.

THE most momentous topic in gas engineering circles at this season of the year is the prospects of the approaching parliamentary session. In the present issue, we are able to give this year's complete list of parliamentary notices relating to gas supply; and to this must be directed those of our readers who are interested to know who and what are "coming to Parliament" next session. The crop of notices is rather heavy, and contains some announcements of the first importance. We have already commented upon the South Metropolitan notice, and have nothing at present to add to our remarks upon this subject until the Bill appears. Meanwhile it may be mentioned that the Chairman of the Company, Mr. George Livesey, has been "interviewed" by a representative of the *Globe* newspaper; and his observations on this occasion are reproduced in another column. It was the indiscretion of some informant of that paper—notoriously the organ of the "stern, unbending Tories"—which caused the somewhat irregular disclosure of Mr. Livesey's workman-director proposal to the general meeting of the Company last February; and the *Globe* has been in opposition to the idea ever since. It prefaced the account of the interview, which appeared on Friday last, with the declaration that the "scheme is, to say the least, Utopian. "It is also premature," on the ground that nobody has asked for it. The notices of the two Cheltenham Gas Bills have been duly published by the Company and the Corporation respectively. The Company's Bill will include provisions for consolidating the capital into one class of stock bearing a uniform dividend. There is no news of the same kind from Derby, mentioned in these columns last week in conjunction with the Cheltenham transfer proposal. The Dublin Corporation's "omnibus" Bill will, as usual, contain some clauses to vary the conditions of gas supply in the Irish capital. The Corporation of Edinburgh have given notice of their intention to incorporate Leith and other adjacent districts within the boundaries of the city, which will entail the dissolution of the recently-constituted Gas Commission of the Edinburgh and Leith Corporations, the vesting of the powers and property of the Commission in the enlarged Corporation, and the acquisition of the undertaking of the Portobello Gas Company. The Huddersfield Corporation will seek to enlarge and vary their gas powers, and to absorb the undertaking of the Longwood Gas Company. The Guildford Gas Company propose to consolidate their capital and to improve their position in other respects. The Ilfracombe Gas Company, unlucky last session, are going to try their fortune again with what appears to be a somewhat similar Bill, which will include a capital consolidation scheme. The Leamington Corporation propose to acquire the undertaking of the Leamington Priors Gas Company, as already noticed in the JOURNAL. The Manchester Corporation are contemplating an extension of the municipal boundary. The Newcastle-upon-Tyne and Gateshead Gas Company will seek power to make extensions and raise additional capital. The Matlock Bath District Council wish to acquire the property of the local Gas Company; and the *imbroglio* at Sandwich is to be laid before Parliament. The Ystrad gas supply forms the subject of two notices, issued by the Local Authority and the Company respectively, and raising the usual questions. The Board of Trade will also be fairly busy with Gas Orders which will concern the districts of Chester-le-Street, Fort William, Laindon (Essex), Matlock Bath, Oswestry, and Settle. Three gas applications are to go before the Local Government Board, affecting the districts of Driffield, Sandwich, and South Molton—all of them contemplating the acquisition of Gas Companies' property. From these notifications it will be seen that the coming session bids fair to be a busy one in the annals of the statutory regulation of gas supply throughout the United Kingdom. All three capitals—London, Dublin, and Edinburgh—will have gas business in hand, and some of the principal English cities and towns will be similarly engaged; while in several instances small gas supply areas will be instrumental in raising important questions of gas administration and finance.

Meeting of the Manchester District Institution in Leeds.

THE members of the Manchester District Institution of Gas Engineers met on Saturday in Leeds, under the presidency of Mr. Isaac Carr, Vice-President, in the absence through indisposition of Mr. G. Smedley, of Buxton. A very satisfactory feature of the proceedings was the election of five new members, which argues well for the popularity of the Institution in the district which it serves so creditably. Two good papers were read at the meeting—by Mr. W. Newbigging and Mr. S. R. Ogden respectively—both of which will be found in another column. Mr. Newbigging's contribution dealt with a question of no small practical importance—the best arrangement of gas washing and scrubbing plant for meeting modern requirements in respect of ammonia purification. The author confesses to having a kindness for the tower scrubber. But he admits that the imperfections of the usual water-distributing arrangements are apt to render it an ineffective piece of apparatus at all times, while he gives up the problem of proper water distribution altogether in the case of towers more than 9 feet in diameter. It appears from the paper, however, that when the amount of gas washing to be done becomes a serious task, there is nothing for it but a washer-scrubber. This is to all intents and purposes the verdict of contemporary gas engineering practice. For small works, and indeed for works up to a very respectable size, the tower scrubber will answer every purpose, and is the proper appliance, more especially when in the hands of experts such as Mr. H. Green, of Preston. The output of a large works, however, cannot be washed in this way; hence the favour in which so-called washer-scrubbers are held by the managers of the largest works. It is whispered, however, that not even by their aid is ammonia purification always practicable to the mere "trace" that theory prescribes as readily attainable. Mr. Ogden's paper gave an account of the working at Blackburn of the carburetted water-gas plant erected for the Corporation by the Economical Gas Apparatus Construction Company, Limited, with recent carbonizing data of very great interest. It is a source of satisfaction to all parties concerned that this experiment has succeeded so well. Mr. Ogden's suggestion of a time when gas coal will be carbonized for its coke, the illuminating gas being produced by the cupola, is calculated to create the impression that a new epoch has indeed opened for the gas industry of the United Kingdom. The large attendance at the meeting and the interest taken in the proceedings amply justified the policy of holding such a gathering, of a purely business character, in Yorkshire. Mr. Isaac Carr has been elected President for 1896.

Humphreys on Photometry.

THE carefully-compiled paper by Mr. Alex. C. Humphreys, of New York, upon the "Commercial Value of Photo-"metry," which was read by the author at the recent meeting of the American Gaslight Association, and has been reproduced in the last three issues of the JOURNAL, is, on the whole, a trustworthy summary of the existing stock of information concerning the methods and results of photometry as practised in connection with gas supply. It is unquestionably a paper that reflects much credit upon the author; and it forms a valuable constituent of the transactions of the technical society which was instrumental in placing it before the gas engineering profession at large. If we understand the author's object rightly, it is that of defending photometry as a valid means of ascertaining and defining the illuminating value of a light-source, irrespective of any question of "diffusive power" or other considerations extraneous to strict photometrical investigation. If Mr. Humphreys has not succeeded in adding much that is new to the amount of information already available in respect of these matters, it is because there is little fresh knowledge to be gathered in the fields where he has so industriously searched for it. He evidently thinks he has disposed of the question of "diffusibility "*versus* photometrical reading" by his Twenty-First Street laboratory experiment. The practical issue, however, appears to lie in the consideration of what, for lack of a better term, may be called the "key-note" of an example of artificial lighting. The electricians are aware of this consideration; and whenever they have the opportunity, they endeavour to persuade their patrons that 8 candle lamps are capable of answering every purpose of interior lighting. The moment a 16 candle lamp appears upon such a scene, the whole aspect of the interior is changed, and the lower scale of lighting is perceived to be dull. Change the "key" to the 16-candle pitch, and the same result is produced, only to be upset again with the advent of a 20-candle lamp. So we might go on until the rising standard of brilliant lighting is hardly satisfied with an installation of full-sized arc lamps spaced a few feet apart. Where, then, is the line to be drawn? Nobody we ever heard of denies that what the photometer calls a 20-candle light is more brilliant than the light which the same instrument rates at 16 candles; but it by no means follows from this that the former is more suitable for use as a unit of lighting than the latter. The responsibility of the lighting expert begins where the work of the photometrist ends. It is true, as Mr. Humphreys admits in the concluding paragraph of his paper, that "the intensity of illumination, either of an "open or of an enclosed space, cannot be made uniform "by the employment of any artificial light-source;" and we are disposed to agree with M. Blondel [*vide* last week's JOURNAL] that uniformity would not always be desirable if it could be attained. But it is certain that the more intense the light-sources that are to be employed, the more difficult it becomes to make effective, agreeable, and at the same time economical use of them.

The Strike in the Engineering Trade.

DURING the middle of last week, hopes were raised of a speedy settlement of the dispute in the engineering trade. Though by Saturday these aspirations were again clouded over, they can hardly be said to have completely died away. No specific grounds were named for these anticipations; but the expectation seemed to have been formed, by many people who ought to know how matters were shaping, that before long the masters and the men would agree to meet in conference under a neutral Chairman. It was, indeed, announced by a news agency that such a meeting had been arranged for. Meanwhile, it is so far satisfactory to observe that a good deal of the rancorous, one-sided "fustian" vented in regard to the employers' action by the "popular" newspapers has given place to acquiescence—sullen, of course, but still acquiescence—in the proposition that combined action is as proper for one side as the other. Some of the newspapers which began by clamouring for Government interference with the employers' arrangements have been fain to confess that, after all, Government has no more power to compel private engineering works to be thrown open than to drive unwilling men into them. The fact of the matter is that hitherto workmen and their flatterers on the platform and in the press have been accustomed to think of combination as a panacea of their own devising, and reserved for their own use. It is stated in the preface to the rules of the Amalgamated Society of Engineers that "organization gives to men a special "character, and is a source of strength. It keeps them "compact, and concentrates their efforts towards one end; "whilst without it they are both weak and ineffectual, "exercising no influence or control over their own future "condition." It never seems to have occurred to those who preached and insisted upon the practice of this dogma of Trade Unionism that two parties could adopt and act upon it, as in the present instance.

A weighty utterance upon the crisis which this action has brought about in the engineering trade has been offered by Colonel Saunderson, M.P., in a letter to *The Times* of the 27th ult. The writer perceives that this is now a struggle between two really powerful organizations, and, in the circumstances, he thinks that either Mr. Balfour or Mr. Chamberlain should offer, on the part of the Government, "to consider the whole question of the strike, and arbitrate "on the merits of the case." More than this it is not suggested that anybody could do. Colonel Saunderson also declares with reason that what is wanted most urgently in connection with industrial disputes of this character is some reliable means of ascertaining and putting the public in possession of the rights of the case. We have heard enough about Boards of Conciliation and Arbitration for the settlement of trade disputes; but it has been an insurmountable obstacle to the acceptance of any such devices that they would have no power for enforcing their decrees. The case for a Board of Investigation, however, stands upon a different footing; and the only complaint we have to make against Colonel Saunderson's letter is that he fails to distinguish sufficiently between the cases and prejudices what he appears to be desirous of recom-

mending by confounding it with an old and discredited suggestion. On the other hand, it might be objected that almost as much goodwill on both sides would be needed to render an inquiry fruitful as would go to a composure of the difference. Still, if there was an authority established for the express purpose of investigating the causes and sources of disputes, and any interested persons refused to supply information which it was known to be in their power to give, it would look bad for their case. The ultimate power behind both investigation and arbitration is public opinion. But whereas it might be possible for the award of a Board of Arbitration to fail to satisfy public opinion, this force would be free to satisfy itself with reference to the results of investigation. We have in this favoured land a Government Department which, if it were good for anything, might undertake this duty of investigation. But, unhappily, it is pretty well understood by this time that the Labour Department of the Board of Trade does nothing of consequence to anybody besides finding offices for a mere handful of lucky ex-agitators. The sooner this expensive failure is cleared away the better.

Mechanical Road Carriages.

The offer of a handsome prize by our contemporary the *Engineer* for the encouragement of the application of mechanical power to road carriages (already noticed in these columns), has now taken definite form. The competition is to be international, and the competing vehicles are to be entered in four classes. For full particulars, reference should be made to the *Engineer* itself. So far as our interest in the competition is concerned, it is hardly necessary to say that this is limited to the prospect of coal gas being selected by some competitors to furnish the motive power. It is impossible to predict that such a selection will be made; but it is certain that coal gas is not precluded by the conditions, which state upon this head that "any "method of propulsion other than muscular power may be "employed, provided it be contained in the vehicle." Combustible liquids or spirits below ·8 specific gravity or a flashing-point under 73° Fahr. (Abel's test) are expressly excluded. In this matter, as well as in the limitation of the normal speed of the vehicles to ten miles an hour, we find confirmation of views of our own expressed in our earliest notice of the proposed competition. The first trials can hardly take place before next October; and meanwhile there is reasonable hope that the existing statutory disabilities of mechanical road carriages will be modified or removed.

An interesting paper on the subject of "Locomotive "Carriages for Common Roads" was read before the Society of Arts on the 27th ult., by Mr. H. H. Cunynghame, which gave a summary of what has been attempted in this respect. Naturally, the historical steam carriage of Murdoch came in for mention. The circumstance of their great prototype having laboured in this branch of mechanics should of itself be a sufficient reason for gas engineers to take an interest in its modern revival. Mr. Cunynghame thinks, however, that Murdoch's steam carriage was "not carried beyond the experimental stage;" and certainly it is not for his part in this as yet unrealized endeavour that the grand old Scotch millwright is chiefly remembered. It seems clear that in Murdoch's time the problem of applying mechanical power to road carriages was a more popular study among mechanicians of every degree than it has been since rail and tramways came to put the road in a second place to the rail. It is only with the modern rehabilitation of the road as a means of travel, through the "cycle," that the idea of reviving the problem has taken form as a question of the day. With the cycle in this agency must be associated the steam and cable tram and the electric "light" railway. Indeed, there is a well-defined movement afoot in these modern days for the elimination, as far as is possible, of animal power from the conduct of street traffic, for several reasons which need not be gone into here. Mr. Cunynghame warned his hearers that the prospect of the application of electric power to road carriages is at present very slight. It would be as much as a battery of accumulators could do to drive a car capable of carrying their own weight. It is a little remarkable that until the last year or two mechanically driven road carriages have hardly been heard of, even in countries where their use has not been forbidden. But it would not be fair to argue from this that mechanically driven carriages are not likely to come into general use.

WATER AND SANITARY AFFAIRS.

We made mention last week of the several Water Bills affecting the Metropolis—pointing out, in the course of our remarks, the chief features of the scheme for the establishment of extensive reservoirs at Staines. We also referred to the Bill by which the New River Company propose a series of additional works, involving a large expenditure, for purposes of construction and improvement. Mention was made of the Bill of the Southwark and Vauxhall Company, and the project for the creation of a Kent Water Board. The Bill for this last-named object it appears is not to be proceeded with unless the London County Council revive their scheme of purchase. The Southwark and Vauxhall Bill comprehends new works of considerable magnitude; including four new reservoirs, each having a water area of 250,000 square yards. Perhaps the size of these reservoirs will be most readily appreciated by a good many persons, as being equal, in each case, to an area measuring 500 yards in length and breadth. The reservoirs are all to be situated at Walton-on-Thames, in Surrey. There are also to be two separate wells and pumping-stations at Harefield, in Middlesex. The East London Water Bill is, as we mentioned recently, a measure to be brought forward by the County Council, requiring the East London Company to maintain a constant supply of water at such a pressure as to force it to the top of the highest houses in their district. In the case of failure, the County Council are to have power to sue for penalties. This Bill was kept in abeyance until the transfer scheme broke down. Had the prospect of buying up the present Metropolitan Water Supply been maintained, the Council would have disdained any such obligation as they propose to lay upon the East London Company. The situation is thus a very critical one for London in respect to the water supply question in the next session of Parliament. Five out of the eight Metropolitan Water Companies propose new and extensive works, involving a very large outlay of capital; and if these schemes are sanctioned, the County Council project for bringing a supply of water from Wales, at the cost of many millions, may as well be at once abandoned.

The Bills affecting water supply outside the range of London and its suburbs are somewhat numerous. The East Surrey Water Company seek authority to purchase the undertakings of the Reigate and Kenley Water Companies. The Corporation of Brighton intend applying for sanction for the transfer to them of the undertaking of the Shoreham and District Water Company. The Birmingham Corporation, among other things, are desirous to alter the line of the aqueduct sanctioned by their Water Act of 1892. At Sheffield, the Corporation propose the construction of new reservoirs, and the execution of various works in connection with the water supply. Power is further sought to divert and use the waters of the Little Don or Porter River and its tributaries; as also to supply water to the Corporations of Barnsley, Rotherham, and Doncaster. The Bill, altogether, is one of considerable importance. The Portsmouth Water Company contemplate certain extensions, and the acquisition of additional lands and springs. The Corporation of Chester have a Bill giving them power to construct a weir across the River Dee, and to prevent the pollution of the river higher up. Contributions are to be made towards the expenses by the Chester Water Company, and by landowners whom the works will benefit. The Derby Corporation desire to obtain, by agreement or compulsion, all or part of the undertaking of the Meerbrook Sough Company, and to construct certain works. On the South Coast, there are two Bills relative to Eastbourne. The Corporation of that town are going to apply for an Act by which they shall be empowered to introduce a new supply of water. Power is sought to purchase the undertaking of the Eastbourne Water Company, by compulsion or agreement. In addition, the Eastbourne Water Company give notice of a Bill to extend their limits of supply, and to authorize the construction of new works, with power to enter into agreement with the Local Authorities as to the supply of water in bulk. There is a scheme in South Wales, by which the Urban District Council of Ystradyfodwg seek power to purchase the undertaking of the local Water Company, and to construct new works. There is to be an arbitration clause in which power will be given to the

arbitrator to make deductions from any compensation claimed by the Company, such deductions having reference, among other points, to the probable necessity for the future introduction of a new source of supply. Though not going quite so far, the clause bears a singular likeness to the famous arbitration clause in the Transfer Bills of the London County Council.

Across the Tweed, Edinburgh gives notice of a Bill for various purposes, including an absorption of the District Water Trust. In Ireland, the Dublin Corporation have a scheme for supplying water, under certain conditions as to quantity, to the Commissioners of nine different townships. Throughout the various projects which are to come before Parliament in the coming session, there are frequent provisions for an extension of the area of supply, and necessarily for the raising of fresh capital. Though a little outside our province, we might call attention to a Bill for power to form a Company in order to bring a supply of sea water to London—the head works to be at Lancing, in Sussex. The idea is by no means new; and we question whether it contains the faintest germ of a dividend, even supposing Parliament can ever be induced to sanction such an enterprise.

The Brighton Corporation and the Shoreham Water-Works.—At an extraordinary meeting of the Shoreham and District Water-Works Company held on Monday last week, assent was given to the sale of the undertaking to the Brighton Corporation for the sum of £37,257, in 3½ per cent. stock of the Corporation, redeemable in 1946; and the Directors were authorized to carry out the sale.

Memorial to the Late Mr. H. F. Willey.—A memorial to the late Mr. Henry Frederick Willey has been placed in St. John's Hospital School, Exeter. It has been erected by past scholars of the school, and consists of a brass tablet, mounted on marble, and bearing an inscription which states that Mr. Willey was "educated in the school, and was successively Sheriff, Alderman, and Mayor of this his native city." It also gives the date of his death—Feb. 27, 1894. The memorial was unveiled last Tuesday by the Town Clerk (Mr. G. R. Shorts), and was accepted by Mr. E. A. Sanders on behalf of the Governors. Both Mr. Shorts and Mr. Sanders spoke highly of Mr. Willey, not only as a business man and a citizen, but in his private life; the Town Clerk remarking that he was one who, in the language of Scripture, "feared God, loved the brotherhood of his fellow-men, and honoured the King."

Personal.—Mr. A. Graham Dow, who has resigned the managership of the King's Lynn Gas-Works after being thirty-six years in the Company's service, was recently presented by the workmen with a silver tea service, accompanied by a framed illuminated address, as a mark of their esteem, and in recognition of his unfailing kindness to them.——Mr. C. Lucas, who has been Chairman of the Newbury Corporation Gas Committee for the past fourteen years, recently signified to his colleagues his desire to relinquish the position. The Committee have passed resolutions recording their best thanks for the able services of Mr. Lucas, and electing Mr. B. Smith to succeed him.——The gross value of the will of the late Mr. F. O. T. Delmar, a Director of the San Paulo Gas Company, has been put at £185,699, of which £100,000 is to be set aside for the establishment of the Delmar Charitable Trust, the income from which is to be divisible among various public institutions.

Mr. Harrison Veevers and his Appointment at Dukinfield.—Last Saturday's *Ashton-under-Lyne Reporter* said: "We have some startling news to record with regard to the administration of our local affairs. It is well known that Mr. Harrison Veevers has for many years held the dual appointments of Surveyor and Gas Engineer; and the arrangement has, so far as we know, worked satisfactorily. However, a change is about to be made. A special meeting of the General Purposes Committee was held on Thursday evening; and it was decided to sever the two offices, and advertise for a Surveyor at £120 a year. Mr. Veevers is to devote all his time to the management of the gas-works at £250 per annum. Why this drastic change should be made, the Committee have not yet vouchsafed a reason to the public, and not even to the gentleman immediately concerned. In the year 1880, Mr. Veevers was appointed Surveyor and Gas Manager; and he retained the appointment for three years. He then relinquished the office in consequence of the great demand upon his services at the Denton Gas-Works, which then belonged to Dukinfield. Five years afterwards, the Local Board asked him to take the dual control again; and he has held them ever since at a salary of £320 a year. Now the majority in the Council has changed its mind. The component parts of this public body are of a different calibre to those who ruled the affairs of the township some 15 or 20 years ago; and we know not what a day may bring forth. We are sure the majority of fair and impartial people will consider the General Purposes Committee, or rather those who were in favour of the resolution to bring about this change, are treating Mr. Veevers in a very shabby manner."

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1159.)

Last week brought about a wonderful change on the Stock Exchange; and to an extent that must have been far beyond all anticipation. From the opening, a cheerful influence prevailed; and it was soon found that the outlook for the settlement was unexpectedly favourable. As the incubus which had pressed so heavily was lightened, the recovery became more pronounced. To supplement this tendency, came intelligence from the East of a more agreeable character; and, though this was somewhat modified before the close by later news not quite so happy, yet, on the whole, the week has accomplished a remarkable recovery. As a natural consequence, prices have risen smartly, and the reinstatement extends to every department. Perhaps all difficulties arising from the overbuying of recent months are not yet smoothed away; and a few awkward hitches may attend the further disentanglement of the coil. But the worst is over; and the end is in sight. The requirements of the settlement were not sufficient to do much for the Money Market, and rates were light, and money is easy. Business in the Gas Market was quieter on the whole than in the preceding week; and movements were a little irregular. Changes in quotation were few in number, and very slight in degree; and on a balance there was rather more retrogression than advancement. Gaslight "A" was moderately active only. It opened steady at good middle figures; and then on Tuesday the quotation was put down. But, in spite of this, prices came out rather better, so that on Friday the quotation had to be restored, and with half a point to the good. Gaslight secured issues were in capital demand, especially the 10 per cent. preferences, which changed hands at big figures. South Metropolitans were quiet and rather dull. The "B" dropped a point; but the "A," on the other hand, commanded top price. There was nothing particular to note in Commercials. The Suburban and Provincial division were even more than usually inactive; and no change of any sort occurred in their prices. Among the Continentals, business was entirely confined to Imperial, which opened flat, and had a further fall; but the price then appearing attractive some rather smart buying came in, and gave a better tendency. Cagliari receded a point. Among the remoter undertakings, Monte Video had a slight relapse; but Oriental advanced in response to the favourable report and accounts for the year. Water was unsettled; and the tendency, on the whole, was adverse—East London and Southwark being more especially weak. Chelsea, on the other hand, improved.

The daily operations were: Business in Gas was not particularly active on the opening day; and prices for the most part were only moderate. Imperial Continental fell 2. Water was steadier; and Chelsea advanced 2. Transactions in Gas on Tuesday were still quieter; and the tendency was easier. Gaslight "A" receded 1½; and South Metropolitan "B," 1. Water was weak—East London falling 1; and Southwark, 2. On Wednesday, Gas continued quiet; and the only move was a fall of ½ in Monte Video. East London Water dropped 2 more. Thursday was more active; and prices were a little better. Oriental rose ¼. In Water, Southwark fell 3; and Lambeth tens, 2; but ditto 7½ per cents. moved up 2. The tendency in Gas on Friday was favourable; and Gaslight "A" rose 2. Southwark Water fell 2 more. Saturday was very quiet. Gaslight 4 per cent. debenture rose 2.

ELECTRIC LIGHTING MEMORANDA.

The Lesson of Fareham—The Hardship of the Fareham Case—The Responsibility of Members of Local Authorities to their Constituents.

A sharp lesson to local authorities inclined to be a "law unto themselves," and to fancy they can play fast-and-loose with their engagements, was administered by the Lord Chief Justice last week in disposing of an action brought by the Fareham Electric Light Company, Limited, against the Fareham Urban District Council. The facts of the case were not in dispute. It was shown that the old Fareham Local Board entered into an agreement with the plaintiffs to purchase their electric lighting undertaking as a going concern, at a price to be awarded by two arbitrators—the purchase and transfer to be completed within two months after the award, and after approval and sanction by the Board of Trade and the Local Government Board; and the defendants further agreed to use their best endeavours to obtain from the Local Government Board the necessary sanction for the transfer and for the borrowing of the money required for the transaction. Matters took their regular course for a time; the price of the property being determined at the sum of £4866, and the consent of the Board of Trade being duly obtained by the Company. The Local Board also set the Local Government Board in motion; and a local inquiry was held. Between the time when all the preliminaries were completed and the issue of the Local Government Board's reply upon the project, the Parish Councils Act came into operation; and the new local authority elected under the Act

contained a majority averse to going on with the scheme. Consequently, the application was abandoned. Thereupon the Company took proceedings against the local authority for breach of the agreement entered into by their predecessors. The law of the matter was clear enough. There was an agreement, and it had been violated by the local authority, who were, of course, bound to fulfil the obligations of their predecessors in office. Judgment accordingly was given for the Company—damages, £3800.

The law and the strict justice of the case having been thus vindicated, it is possible to admit that, on the merits of the affair, ratepayers of the locality affected have been caused to suffer undeservedly at the hands of those to whom their interests were formerly committed. It seems to have been a conspicuous example of a state of things unhappily not peculiar to this particular district. The local Gas Company had somehow become unpopular; and an Electric Lighting Company was formed to light the place under the benevolent auspices of the Local Board. Again, there is nothing unusual in the results of this adventure. The light was voted a success; but the Company who supplied it were not equally fortunate financially. In their extremity, the Company sought for relief from their embarrassed circumstances in a sale of their undertaking to their good friends, the Local Board; and they did not seek in vain. In the meantime, however, the inhabitants of the district awoke to a sense of what was going on between their representatives and the electric lighting speculators. The public might not have liked the Gas Company, and might not have been unwilling to see the electric light enter the field as a competitor with gas. But when it was known that the Local Board meant to saddle the district with the new light, and devote public money to the support of what had turned out to be a commercial failure in the hands of its original promoters, the impression was created that here was going to be a case of "jumping out of the frying-pan into the fire," in the matter of the pubic lighting. So the elections to the new authority which was to supersede the old one, turned upon the electric light question; and in the event the consenters to the bargain with the Company were sent packing. There seems to be no more question concerning this order of facts than about those of the agreement and the award, and the failure to go on with the application to the Local Government Board. The old Local Board—out of touch with public opinion on the matter—had agreed to a course of action which their successors had an express mandate from the electors to reverse. Unfortunately for the ratepayers, however, the old Board had acted strictly within their powers in this regard; and consequently the only way out of the miserable business is by paying.

It is not so easy to see how the plaintiff Company can have been so injured by the dropping of the transfer scheme as to be fairly entitled to the substantial damages awarded by the Court. It would doubtless have been a splendid thing for them to have got back from the Fareham Local Board all the capital, to within a few pounds, represented by their unprofitable venture. But if their property was honestly worth the price which the arbitrators would have made the local authority pay for it, there cannot be much hardship, the ordinary man would be disposed to think, in their being constrained to keep it. We do not desire to enlarge upon this aspect of the case, which is of very great importance to the lighting industries as well as to local authorities. But it can easily be understood that there is a strong public feeling in Fareham with regard to the manner in which the public interest has been dealt with. The affair should be a warning to all members of local authorities who may be in danger of allowing their predilections for a system of lighting or any other outside interest to carry them into courses not approved of by those whose wishes, as well as interests, it is their first duty to follow and subserve. In the ordinary transactions of the duly appointed authorities for any local government district, there is nothing to specially interest (much less to excite) the non-official public who pay for all, in the ordinary way. So it sometimes comes about that the well-meaning, busy gentlemen who undertake to do the public business for their fellow-ratepayers, forget that they are let alone in doing it mainly because it is generally felt that they are to be trusted in all routine matters, and cannot in any case do much harm. And if they should vary their monotonous official occupations by a quarrel with the local gas company, the public will rather enjoy the squabble than complain about it—so long as little or no money is spent in law costs. But whatever may be their strict legal rights in such a matter, no prudent, self-respecting member of a local authority will take the responsibility of placing himself, and those whose interests he is bound to protect, in such a position as that now occupied by Fareham. There are, indeed, very few occasions in the history of a local government district where the governing body can exhibit statesmanship or the opposite quality. There is the drainage; there may be a question of water supply, of tramways, of street improvements, or of public lighting. Besides these, there is hardly anything over which a local authority for a small district or moderate sized town can distinguish itself, or make a mess of. Why, in the name of all that is reasonable, should a chairman or other member of a local board, "dressed in a little brief authority," go out of his way to get into hot water? What is there in electric lighting that the members of any District Council should strive to force it down the throats of an unwilling populace, laying themselves open by so doing to all sorts of injurious imputations of motive? Lastly, must there not be something wrong about our system of local government, and its supposed control by head-quarters, when an Urban District Council, by merely dropping an application to proceed with a scheme for the purchase of a property, can involve the ratepayers in such loss as that now visited upon Fareham? There is a parade of protecting the ratepayers by the system of local inquiries into the desirability of doing certain things, and certain other things cannot be done without the supposed safeguards of advertisement and the holding of public meetings. Yet here is a case of victimizing ratepayers merely by civil process. It may be quite right and proper; but, from the ordinary unofficial ratepayers' point of view, the subject would appear to call for further investigation. Execution in the Fareham case has been stayed until Jan. 15; so the end is not yet.

DENNY LANE.

It is with sincere regret that we have to record the death of Mr. Denny Lane, the Secretary of the Cork Gas Company, which took place last Friday evening, at his residence, South Mall, Cork. He was taken ill about three weeks ago; and though hopes were entertained of his recovery, he had a relapse, and passed away peacefully surrounded by his family.

Mr. Lane was born on the 7th of December, 1818; and he was the only child of Maurice Lane, the owner of the Clintown Distillery, Riverstown, and one of the members of the first reformed Corporation in Cork. He was educated at a well-known school in the city at that time—Hamblin and Porter's—and received there the groundwork of a sound education. Even at an early age, he showed an aptitude for learning, and a literary and inquiring taste far above that of youths of his class. At the age of 18, he graduated at Trinity College, Dublin, where he took his M.A. degree. He afterwards went to London, and attended lectures at the Inner Temple, and took his B.L. degree, and was called to the Bar about the year 1842. His mother had died when he was only four years of age; and his father's death occurred while he was prosecuting his studies in London. He became heir to a very large property; but he rapidly lost much of his estate through endeavouring, as he said himself, to promote local industries, and engaging labour that did not pay. Some of his schemes were, however, successful. Mr. Lane, as he grew to middle age, began to take an interest in the political movements of the day; and, associated with the men of 1848, formed a fast friendship for Smith O'Brien, Meagher, Mitchell, Davis, and other leaders of the Young Ireland Party. The result of his connection with this movement was that in 1848, during the suspension of the Habeas Corpus Act, he was confined in Cork Prison for four months. But he was never actually brought to trial. Mr. Lane was possessed of exceptional prudence and foresight. On two occasions he impressed upon the leaders of the movement that they would not get the support they expected from the country; and he counselled a more prudent course. But the leaders believed they had gone too far to withdraw. After Mr. Lane's liberation, he took a more or less prominent part in politics up till a comparatively late period. In 1876, on the death of "Joe" Ronayne, he contested the city in the Home Rule interest; but he was opposed by John Daly, also a Home Ruler, and Mr. W. Goulding. The latter was successful—Mr. Lane being at the bottom of the poll. Defeat seemed to discourage him somewhat, and though he did not afterwards take so active a part in political life, he never concealed his opinions of men and things around him.

To speak of the many enterprises with which Mr. Lane was associated, or the societies, learned and commercial, which he adorned, would occupy much space. He was connected in 1868 with the starting of the Cork Gas Consumers' Company, which took the place of the old Gaslight Company; and this connection lasted till the day of his death. He promoted the Cork and Macroom Railway Company in association with the late John Francis Maguire, Timothy Mahony, and Joe Ronayne, and he occupied for a long series of years the position of Vice-Chairman of the line. He was a Director of the Passage Railway, a member of the Cork Harbour Board, and President of the Cork Literary and Scientific Society for the years 1884 and 1885. On several occasions he addressed the art students of Cork in speeches whose value may be judged from the fact that two or three of them have been reprinted in magazines. Equally strong was his interest in science. He was Chairman of the School of Science; and he devoted a great deal of his time to the subject, as connected with gas, steam, and electricity. Everyone connected with the gas industry will remember the circumstances of Mr. Lane's first election as President of The Gas Institute, the able address he delivered at the Institution of Civil Engineers, and the tact and geniality with which he conducted the proceedings of the meeting. Fresh in their recollection also will be his second election to the office, and the various incidents of the meeting in Belfast in 1893. Nor will anyone present at the banquet at the Crystal Palace on the occasion of the visit of French gas engineers to London, readily forget how Mr. Lane addressed to them, in their own language, some felicitous

allusions to the old alliance between their countrymen and the Irish. Mr. Lane was a welcome contributor to the Transactions of The Gas Institute; and in 1886 he was awarded the first premium and the President's Medal for his paper on the "Gas-Engine," read the previous year at Manchester.

The foregoing is but an outline of a career full of activity, and full of usefulness to the city and country of which he was proud—a career, too, in which self-sacrifice was a prominent feature. Mr. Lane was a cultured Irish gentleman; and, while a patriot, he had the broad-mindedness of every well-read man. He could speak readily on a great variety of topics; and his remarks were always instinct with learning and shrewd observation, enlivened by an Irishman's characteristic wit.

Mr. Lane leaves a widow and two daughters, to whom, in their great bereavement, the sympathy not only of his colleagues and fellow-citizens, but of the larger circle of friends and admirers in the world of science, will, we are confident, be freely extended.

REVERSAL IN INVENTION.

The phenomenon of invention is something that powerfully attracts and interests practical, work-a-day humanity. The fact that every now and again somebody is found to suggest an improvement upon, or an addition to, the multitudinous appliances employed by civilized men with the object of increasing the comforts, reducing the inconveniences, or cheapening the cost of living, is an unfailing cause of admiration for the multitude who never think of attempting anything of the kind. Small wonder is it, therefore, that, in the estimation of the populace, the faculty of the successful inventor is held to be a "gift," which must be a birthright of its possessor, and cannot be compassed by study and effort. On the other hand, those whose calling brings them often and intimately into contact with persons of an "inventive turn," as it is significantly termed, are apt to take an altogether different, and much lower, view of the mental quality in question. There is a wide divergence between the estimate of the inventive faculty entertained by those who regard inventors—whether commercially successful or otherwise in their self-imposed efforts—as an order of superior beings deserving of public recognition and support, and that commonly held by the hard-headed individuals who perceive in every inventor first and foremost a person who is aiming at a short cut to fame and fortune. Both views might be supported by many illustrative examples taken from the life; but in this, as in most other matters of opinion, the truth lies, as a rule, somewhere between these extremes. As we have taken more than one occasion for showing in these columns, no more pernicious counsel can be given to those who have their living to get, and whose inclinations or circumstances impel them to seek it in engineering and mechanical branches of industry, than to urge them to try and "invent something," with the object of being able to live happily without work ever after. It would nevertheless be almost as great an error to attempt to belittle or ignore the great part which true invention plays in the development of all industries, not the least that with which the Journal is specially identified.

The riotousness of the spirit of inventiveness in certain communities—as, for example, that of the United States—has created in some observers a revulsion of opinion against the popular idea which takes it for granted that invention exists as an entirely separate product of the industrial mind. Thus an American engineering writer has actually argued that what is usually called invention is nothing more than the rearrangement of certain factors which are common property to subserve a particular purpose. From this point of view, every new piece of work not wholly done by a self-acting machine is a product of invention, inasmuch as the makers must have used their tools, and applied their skill, to novel ends before it could have taken its final shape. There is something in this view, of course, although it is not the whole truth. When a handicraftsman hits upon a novel way of doing any part of his work, or when the product is so far a novelty as to have required in its fabrication fresh methods of manipulating materials or using tools, the result is in its degree as fairly entitled to be called an invention as is the outcome of a fresh application of the enormous mental and other resources of a Siemens, a Bessemer, or a Maxim. It is difficult to say in regard to the enormous output of a truly great inventor, as he would be popularly called, what is originated by himself and what might be traced to his mastery of the means and methods of his particular speciality. There is invention everywhere, or it is nowhere. Never was a piece of work worthy of the name of engineering construction done in the world but demanded for its proper execution more or less ingenuity, which was as truly invention as anything for which a patent has ever been granted. Every engineer who has had the supervision of large works has had occasion to note how that resourcefulness of the workman, which is indistinguishable from inventiveness, never fails to meet day by day and hour by hour those little difficulties of detail which no superior foresight could have prevented; so that the quickness of execution, and even the quality of the work done, exhibit advances as it goes on towards the appointed end. Remembering this fact, it is impossible to wholly withhold agreement from the assertion that the inventive quality has no distinct existence, but is only a phase of aptitude.

Following up this line of argument, it can be used to demolish the pretension, advanced by some other engineering writers, that there exists a "science of invention." For example, a Mr. Edward P. Thompson has been amusing the members of the Franklin Institute of America with a lecture in which there occurs the sentence: "Invention as a science has not received the same attention as physics"—a statement which is absolutely nonsensical. There is not, nor indeed can there be, a science of invention so long as the two words "science" and "invention" retain their ordinary and accepted meanings. It is true that there is a systematic as well as an unsystematic way in invention; but this is a very different idea to that of ascribing system, or science, to invention. Mr. Thompson may be pardoned, perhaps, because his whole lecture is a terrible example of imperfect expression. We take notice of it, however, for the sake of the very suggestive idea in regard to inventions which it is meant to convey. It is the lecturer's object to set forth the important part played in the history of mechanical inventions by what he calls "the principle of reversal;" and it so happens that practical gas engineering supplies us with several very good examples of this so-called principle which Mr. Thompson does not mention.

Of course, there is nothing new in the discovery that many a new process or machine is only an old one turned "the other way about." Mr. Thompson evidently flatters himself that it was reserved for him to "first make positive once for all the principle of reversal, and secondly to emphasize the importance of its systematic application to all inventions, past, present, or future, especially all leading inventions." It is hardly necessary to state that there is no more familiar type of inventor than the genius who is persuaded of the possibility of doing great things by turning somebody else's device upside down or inside out—making the product the producer, and so forth. Yet it is undeniable that the reversal of some processes and mechanisms has taken a long time to bring about. The example of the dynamo and the electric motor is made a great deal of by Mr. Thompson. But in this leading case the operation of reversal was not delayed after the guiding principles of dynamo construction on the large scale were understood and applied satisfactorily in practice. It does not at all follow that mere acquaintance with the principle of reversal will enable anyone to work a process or a machine backwards. It is necessary as a preliminary to this operation that the thing shall be susceptible of action in two opposite senses, and that both uses shall be called for.

One of the best examples of the application of the principle of reversal supplied in gas engineering is the rotary exhauster, which was originally intended for a rotary steam-engine, in which capacity it was a lamentable failure. It is therefore to be included in the category of those reversed machines which are in reality only good for the contrary purpose to that contemplated by their designers, and consequently supply, from one point of view, examples of the fatuity of human plans, or, from another, good illustrations of the indomitable spirit that induces men to make the best of a bad job. A perfect example of the other class of machines—those which work equally well for their intended purpose or reversed—is the well-known but old-fashioned Jones exhauster, which was nothing more nor less than a vertical steam-engine converted for use as a gas-pump. The wet gas-meter, again, is normally a kind of gas-and-water wheel turned by gas. It is quite possible, however, to make it drive the gas instead of being driven by it; and although such motive-power meters, as they are called, are but rarely used now in connection with the supply of gas to consumers, yet the principle is not without utility in connection with the addition of carburetting vapour or oxygen to coal gas in process of manufacture. The station governor acts by virtue of a reversal of the habit of gasholders; and if the coin-controlled consumer's meter is not exactly a "reversal" arrangement except in the point of getting in the money before the gas is burnt, it is at any rate a notable "revival" of an idea which is as old as written history.

This observation suggests another, on the subject of this so-called principle of "reversal" in invention. It can never be other than a second-hand style of advancing mechanical science, so long as it is deliberately chosen as the inventor's guide. In order to successfully reverse anything, the thing must previously exist in fact or upon paper, and he is but a poor sort of inventor who would be content to seek for this road to fame and fortune. Moreover, although there is something rather fascinating about the notion that there may exist many a process and apparatus which has hitherto escaped profitable reversal, because nobody before Mr. Edward P. Thompson has had the luminous idea of formulating "a true solid principle of reversal, and not a theory" whereby men might be laid upon the right track in this regard, there is small hope, we fear, that the kind of inventors who have lacked such guidance will be able to do much with it now they have had it placed at their disposal. Mr. Thompson's key is one that only fits an open door. It is one thing to survey the whole field of physics and mechanical science, and see in some things a reversal of others; and quite another thing to see where reversal would be possible or advantageous. This is one reason why, although the trick of turning things "the other way about" is so obvious, many apparently obvious reversals have been long in the doing. The most striking case in point is the reversal by Dr. Linde—for the

production of intense cold—of the recuperative principle introduced by Mr. Frederick Siemens for the production of intense heat. This remarkable application is only a few months old; while the Siemens furnace was invented nearly forty years ago. Why has this result been so long upon the road? Whoever could answer this question would be very near to understanding what genius is, and would have a better insight into the ways of things in general than is vouchsafed to most people. Again, we all know the trouble of the gas-engine—how it wastes 40 per cent. of its fuel because it cannot make a proper use of the heat which is evolved when the potential energy of the gaseous mixture is converted in the cylinder into dynamic energy. Why, then, we may very well ask, does not somebody "reverse" this state of things, if this principle is truly a key to a real mystery?

These considerations may serve to convince us that Mr. E. P. Thompson was not relinquishing sole rights in a grand secret when he formulated his "principle of reversal," which was in his estimation too "solid" to be a "theory." As a contribution to the armoury of the engineering critic, the suggestion of the lecturer is not to be despised. As an aid to the inventor it is worthless; for where it is anything more than a grandiloquent designation of an old trick of the copyist who would be original, it indicates an operation calling for the same genius to perform successfully as goes to the accomplishment of any original invention.

The Managership of the Perth Gas-Works.—As mentioned by our Scotch correspondent last week, the list of applicants (43 in all) for the position of Manager of the Perth Corporation Gas-Works, rendered vacant by the resignation of Mr. Thomas Whimster, was reduced to nine. At a special meeting of the Gas Commission in Committee on Monday last week, the number was further brought down to three; and eventually the choice fell upon Mr. Andrew Wilson, of Carlisle. As will be seen from our "Notes from Scotland," the selection was confirmed by the Corporation last Thursday. The successful candidate is a son of Mr. Thomas Wilson, of Coatbridge, whose assistant he was before he obtained an appointment under Mr. Hepworth. Although young, he has had varied experience; and, under two such managers as his father and the former Gas and Water Engineer at Carlisle, it must have been of a very excellent character. Moreover, his "record," if we may be pardoned the expression, has been exceptionally good; and therefore we think the Perth Gas Commission will find they have entrusted to the right man the practical supervision of their important undertaking.

Bacteriology and the Quality of Water.—For several years the American Public Health Association have had a Special Committee on the Pollution of Water Supplies. At the meeting of the Association in Montreal, this Committee recommended that a co-operative investigation should be instituted with regard to the bacteriology of water supplies; and, as an outcome of this proposal, a convention was held in New York, in June last, to consider methods, and elaborate a standard scheme of work which would secure some sort of uniformity in the differentiation of species of bacteria. We learn from *Nature* that the subjects considered relate almost exclusively to certain technical matters which required elucidation before a satisfactory scheme of work could be drawn up. Among the questions was the grouping of water bacteria, and the influence of variations in the composition of nutrient gelatine upon their development. No decision was reached on any of the subjects discussed; but they were all referred to a Committee, with the understanding that the convention would accept the decision come to, and that the members would modify their laboratory methods in accordance therewith.

Gas v. Electricity for Traction.—The proposal to construct an electric tramroad between Brighton and Rottingdean does not advance much in public favour; and the Brighton Town Council have given in a very half-hearted fashion their consent to the erection of posts on the seashore. Though the application was originally made for an electric tramroad, it does not seem as if the Company had yet made up their minds as to the system of driving to be employed; and, at the meeting of the Brighton Town Council last Thursday, Mr. Stafford asked Mr. Dawson (the Company's Consulting Electrical Engineer) if he did not think that a gas motor would be cheaper than the trolley system. Mr. Dawson replied emphatically that it would be impracticable. Mr. Stafford put the same question to Mr. A. Wright (the Electrical Engineer in charge of the Company's works). Mr. Wright said there was no doubt a difficulty; but he considered that the use of a gas motor would be the cheapest solution of the difficulty. Such a motor could be worked much more economically than an electric one; and, according to Professor Kennedy, the vibration produced would not be noticeable, and he did not consider that there would be any danger from explosion. He saw no difficulty in applying the system on the scale necessary for the purpose of the Rottingdean railway; and he thought that gas traction would give it a better chance of paying than would be the case with electricity. He must admit, however, that the use of a gas-engine on such a line would be in the nature of an experiment. The point was then left; and, in the end, the Town Council agreed to the scheme for a tramroad.

NOTES.

Proposed Sugar Beet Cultivation in England.

Depression in the agricultural and artificial manure industries is naturally to some extent action and reaction. Among other recent contributions to the discussion of the present deplorable condition of British agriculture may be noticed, on account of its possible bearing upon the demand for sulphate of ammonia, a paper read at the Imperial Institute by Mr. J. Kersley Fowler on the sugar beet, with special reference to its cultivation in the United Kingdom. Mr. Fowler began by showing that it is high time some new departure was taken with the object of making farming profitable. More than twenty-five years ago, Mr. J. Duncan, a sugar refiner, tried the experiment of establishing at Lavenham, in Suffolk, a factory for making sugar from beetroots. The factory was a failure, because the farmers of the neighbourhood could not be induced to grow and deliver enough roots to keep it going. Wheat was then selling for 60s. per quarter, as compared with the present price of 24s. per quarter; and it did not pay to grow sugar beet at £1 per ton. It has been asserted that English climatic conditions are not favourable to the growth of the sugar beet; but this has been disproved by direct experiment and analysis by Dr. Schack-Sommer, of Liverpool. The cost of growing and delivering an acre of sugar beet is about £9 5s.; and as 15 tons per acre could be produced, and the price at present is 17s. per ton, the crop shows a fair profit of £2 10s. per acre. An immense improvement in the quality of the roots has taken place of late years; reducing the weight required to yield a ton of sugar from 12½ to 8½ tons. Co-operation of various interests is needed to establish the industry in the derelict English corn lands.

Discussions upon Argon.

Chemists and physicists everywhere continue to investigate the nature and properties of argon. Signor R. Nasini declares himself to be of the opinion that the monatomic character of argon, as deduced from the kinetic theory of gases, cannot yet be regarded as irrefragably established. In presence of the discrepancy between the conclusions in this regard drawn from the kinetic theory of gases and the periodic system, and so long as more cogent evidences cannot be brought forward, Signor Nasini says he cannot believe that 40 represents the true atomic weight of argon. M. Schlœsing, jun., has confirmed the experimental results that were obtained by Lord Rayleigh and Professor Ramsay, which go to show that argon is not appreciably absorbed by copper or by cupric oxide. Testing for argon in air taken in Paris at a height of about 10 metres above the ground, in air taken in Normandy on the top of a hill about 1000 feet high, again in air collected at a height of 300 metres on the Eiffel Tower, and at the bottom of an iron mine, Schlœsing finds that the proportion of this constituent of the atmosphere varies only to a degree scarcely perceptible on analysis. Argon occurs in air extracted from arable land at different depths in a slightly smaller quantity than in normal air. This is partially explicable by the solvent action of water upon it; always supposing that the rain reaches the soil before it has taken up from the air all the argon which it is capable of dissolving.

Measurement of High Temperatures.

The *Chemiker Zeitung* gives some extracts from a paper on this subject by Herr L. Holborn and Herr W. Wien (*Wied. Ann. Phys. Chem.*, 1895, LVI., 360). There are three methods by which high temperatures may be measured. The first uses an air thermometer of refractory material; the second depends on the change in the resistance of a platinum wire with change in temperature; and the third is based on the employment of a thermocouple of difficultly fusible metals. The air thermometer method was valueless until recently, as suitable vessels could not be made. But now they are produced from some refractory clays, and permit of measurements of temperatures up to 1500° C. (2732° Fahr.). The results are, however, vitiated by the effects of capillarity in the interior of the vessel. The resistance method has some great disadvantages. At high temperatures, the absolute resistance generally increases constantly; but the coefficient of the temperature diminishes very irregularly. The presence of free hydrogen also affects the resistance; and the wire must, therefore, at least be calibrated before and after use. The third or thermopile method has proved the best. The most favourable circuit consists of platinum, and an alloy of platinum with 10 per cent. of rhodium. The increase in the electromotive force of such an element is exactly proportional to the temperature. No substance except carbon affects the constancy of the couple; and temperatures up to 1600° C. (2912° Fahr.) can be measured by it.

Successful Concrete Monolith Construction.

The method of construction of some successful portland cement concrete piers for a lofty railway viaduct has been described by Mr. G. R. Tuska before the American Society of Civil Engineers. The whole of the work was done by men who had never made concrete before. It was composed of one part of cement, two parts of river sand, and five parts of broken limestone, mixed by hand; the barrel of cement being taken as the unit of measure. In the mixing, two barrels of sand were laid out evenly in the mortar-box, and a barrel of cement

spread over it. After having been thoroughly mixed dry, about 12 gallons of water were added; the quantity varying with the freshness of the cement and the temperature. The broken stone was laid down beside the mortar-box in a bed 4 feet wide and 6 inches thick, wetted, and the cement mortar thrown upon it. After being turned over with shovels twice, the concrete was wheeled to the moulds. Here it was laid down in beds 8 to 10 inches thick. By passing the blade of a shovel between the mould and the concrete, a small portion of the mortar was forced against the mould; thereby giving the work a smooth finish with no stones showing at the surface. The concrete was rammed as laid with rammers weighing from 30 lbs. to 40 lbs. Too much ramming is to be avoided. Two days after completion of the pier, the moulds were removed; the new concrete being protected by brushwood from direct rays of the sun, and watered twice every day for a week after the removal of the moulds. This process was found to benefit it greatly. Before commencing work each day, the surface of the old work was roughened with a pick, then cleaned and well wetted, and a layer of cement mortar laid over it to receive the new concrete. One abutment so made contains 321 cubic yards of concrete, and the work has stood perfectly the vicissitudes of hot sunshine and sharp frost. Stone and sand concrete thus made is almost completely waterproof.

The Temperature of Flames.

Professor Hartley has recently been engaged investigating the spectroscopic phenomena presented by flames at high temperatures, with reference to the use of the spectrum as an index of temperature. His observations were made up on the flame of the Bessemer converter, which has been calculated to be above the melting-point of gold, and below that of platinum. When a simple spectrum changes to one of a more complex character, the alteration is due to an increase of temperature, other things being equal. Similarly, when a spectrum extends through the visible rays into the ultra-violet region, and an increase is observed in the number and intensity of the ultra-violet rays, nothing but a rise in temperature will serve to account for the change in the spectrum. Professor Hartley admits the difficulty of ascertaining the maximum temperature of any flame, as such temperature may exist over but a small area; and he observes that Le Chatelier's recent measurements of the temperature of furnaces appear for this reason to have given numbers considerably lower than those usually accepted. Professor Hartley thinks the temperature of the Bessemer flame must in any case nearly approach that of the oxy-hydrogen flame, if it does not generally exceed it. It is curious to remark that, though the temperature of the material in incandescent gas-burners must be high, no spectroscopic observations of these light-sources have yet been published.

COMMUNICATED ARTICLE.

NOTES ON CURRENT TOPICS.

By "Veritas."

Much has been written on the question of incandescent lighting; but there is one special detail which has not been prominently noticed—viz., the amount of material available for the preparation of the "mantles." In cases where comparatively rare elements are used for a specific purpose and some commercial application demands an increased supply, the increased demand is frequently accompanied by a large rise in price. This has been recently exemplified in the case of platinum, the price of which rapidly increased with its extended employment for electrical purposes. In the case of the incandescent burner, the light is to a large extent dependent on the durability of the mantles. These mantles are prepared in a special way from elements which, a few years back, were so rare as to be almost regarded as simply chemical curiosities. In recent years, a practical demand has arisen for these special materials; and the practical application of that which was previously regarded as scarce and rare, has stimulated the discovery of new sources of supply.

With special reference to the production of mantles necessary for the incandescent system of lighting, a publication in the JOURNAL for Oct. 29, giving a *résumé* of a paper read by Dr. Bunte, of Carlsruhe, affords most important details with regard to the supply and cost of the necessary raw materials. It appears that great quantities of a mineral known as monazite—containing from 2 to 4 per cent. of thorium—have been recently discovered in the United States, Brazil, the Ural, and Australia; the amount being so large that an Amsterdam firm undertakes to deliver no less than 20,000 tons on rail at 9 cents per pound. Dr. Bunte estimates that the raw material contains about 3 per cent. of valuable constituents, and that, taking the amount necessary for the preparation of an ordinary mantle at about half a gram, the actual value of the material necessary for the preparation of each mantle is less than one halfpenny. In this estimate, the cost of preparation, and the high professional skill necessary, are ignored; but the fact remains that, with an available commercial supply of 20,000 tons per annum (containing some 600 tons of thorium oxide) and on the basis of each mantle only requiring half a gram of the pure material, we have available a sufficiency of the raw product to produce an annual supply of no less than 1200 million mantles. Dr. Bunte also points out that the system of the employment of a mantle for the development of light need not necessarily be confined to coal gas; and that the method is available for portable lamps burning methylated spirits, benzene, or naphtha. He even goes to the extent of expressing an opinion that the incandescent spirit-lamp will, when improved, undoubtedly come to be a severe competitor with petroleum lamps which are used in country places where ordinary gas is not available.

Dr. Bunte also makes reference to the possible use of acetylene as an illuminating agent. He states that the chemical works at Neuhausen and Bitterfeld have taken up the manufacture of calcium carbide, with the result that the material can now be purchased at 2¾d. per pound. At this price, and considering the high value of acetylene as an illuminant, calcium carbide should in the immediate future take its place as a serious competitor with other sources of light. But the cost of carriage has to be taken into account; and it would possibly be more expedient to supply a compressed or liquefied gas in preference to the raw material. Should acetylene ever be used as an adjunct to existing illuminants, the suggestion which has already been made might be of value—viz., that in cases where dynamos are employed for electric lighting, the surplus power of the machinery, when not devoted to the supply of electricity, might well be used for the production of calcium carbide. Of course, the suggestion is at present outside the domain of practical politics, as there has been as yet no attempt to introduce acetylene on a practical scale for commercial purposes. In ordinary houses supplied by coal gas, and with the possibilities of light capable of development by modern appliances, there seems little need for deserting ordinary gas in favour of acetylene. With regard, however, to remote country districts, where private houses have no public gas supply, and where in some extreme cases some special plant for the production of gas is on the premises, the advent of compressed acetylene as a possible illuminant would be welcomed. The cost and difficulty of gas manufacture, with its attendant retorts, labour, and gasholders, would be dispensed with. The alternative of the use of paraffin lamps, with their inherent dangers, would also be dispensed with. This is, of course, for the present simply ideal, but not without the region of what may be a possibility within a few years' time.

Turning from the question of lighting to that of heating, there is no doubt that one of the most important developments of the use of gas in recent years has been that of its employment for heating purposes. The public are still ignorant of the best means of using gas for this purpose; and it rests in the hands of the gas companies to give the proper directions. Gas is useful in affording a cleanly and efficient source of heat; but it is very unfortunate that there are still firms in existence who advertise stoves which they claim can be used for heating purposes in an ordinary room without a chimney flue. Any material used for heating purposes—whether solid or gaseous—gives off, on combustion, products which are more or less injurious to health, and which ought not to be allowed to escape into the atmosphere of an ordinary room, but should have their natural outlet by the usual chimney. Stoves which are advertised to work without this arrangement act prejudicially to the use of gas for heating purposes. There is a popular misconception that, simply because gas-stoves do not produce visible smoke, the products of combustion are innocuous. This is a very great mistake, as the combustion products from gas, although not accompanied by the obvious smoke produced from an ordinary fire, are more or less injurious. In addition to this, it has to be considered that, although fuel is consumed mainly for heating purposes, whether gaseous or solid, it performs another function, which is too often overlooked—that is the question of ventilation.

Gas burnt in a room simply vitiates the air, but a gas-stove connected to a chimney affords radiant heat and at the same time creates a current of hot air up the chimney—producing a corresponding influx of pure air. The function of the heat of combustion *quoad* ventilation is, in fact, too often neglected; but, of course, in the question of the use of gas as an illuminant, where it is consumed at a comparatively high elevation near the ceiling of the room, the heat developed by combustion could not be used for ventilating purposes without material alterations in existing architectural details. The provision of pipes to act as outlets for combustion products, and consequently as ventilators, would necessitate careful provision so as to prevent dangerous results from over-heating, with the additional disadvantage that outlets of communication to the external air situated at a comparatively high level will frequently, under varying conditions, act in a reverse manner. This is the question which the modern science of ventilation has not completely solved; and yet it is one which in principle is apparently simple. Given a gas-burner at the upper portion of a room, provided with an orifice communicating with the external air, through which the heated products of combustion could escape—admitting also that there is a free inlet for fresh air—we have an ideal system of ventilation acting automatically. The gas, however, is not alight throughout the day, whereas the domestic fire may be actively at work; and in this case a strong current of heated air passes up the chimney, and requiring a corresponding volume of fresh air, enters the room by the channel of least

resistance. In ordinary cases, the fresh air obtains entrance by chinks of doors and windows, but mainly as a cold substratum which, starting from the under surface of the door of the apartment, makes itself painfully evident to the feet of the occupiers of the room, who are frequently seated between the door and the fire, and are thus in the main line of the draught. In the case of gas-ventilated apartments on the lines briefly sketched out, the air-tube provided as an outlet for the heated products of combustion from the gas would—in the event of the gas not being alight, but the fire in use—act as the channel of least resistance for the inlet of cold air; thus reversing the conditions for which it was intended. This has happened in public halls, where a powerful system of central lighting has been adopted with a corresponding system of ventilation.

In considering the use of gas-stoves for heating rooms, the advisability in all cases of ensuring the exit of combustion products by a chimney has been strongly recommended. The ordinary combustion products from gas are carbonic acid, water vapour, and sulphurous oxide; the amount of the latter being dependent on the proportion of sulphur present in the original gas. Whether the gas is used for heating purposes in a stove unattached to a chimney, or whether it is used for pure purposes of illumination, the air of the apartment must be correspondingly vitiated. There is, however, a great difference between the two cases, inasmuch as the proportion of gas used for heating would, as a rule, be much in excess of that required for lighting. Further, gas used for heating purposes is necessarily consumed at a comparatively low level; and therefore the combustion products would tend to vitiate the air at a lower level than when burnt for illuminating purposes closer to the ceiling. It is obvious that, in the former case, the deleterious action on the occupiers of the room would be far greater than in the latter.

When speaking of the products of the combustion of gas, the possibility of the formation of incomplete combustion products has been omitted as on this detail there has not been sufficiently trustworthy evidence to deserve serious comment. At the same time, as a criticism of the whole question as to the possible evolution of incomplete combustion products from ordinary burners, whether of the luminous or non-luminous type, the paper communicated to the JOURNAL for Nov. 19, by Mr. Lewis T. Wright, bearing the title "On the Alleged Escape of Carbonic Oxide and Unconsumed Carbon from Coal Gas Flames," is well worth careful study. Mr. Wright shows that, in spite of allegations to the contrary, the consumption of gas in all forms of ordinary burners is practically perfect—that is to say, that incomplete combustion products, which if present would be markedly deleterious to health, are not formed. Mr. Wright very truly points out (alluding to the methods of investigation which have been adopted by those who allege that unconsumed gas or incomplete combustion products normally pass from ordinary burners) that corresponding tests have not been made of impurities present in the air of the apartment. The suggestion, and a very probable one, is that the results obtained on analysis, and which were credited to unconsumed combustion products, were really and actually due to impurities in the air. Mr. Wright appears to have made a most careful series of experiments with the view of detecting the presence of the incomplete combustion products of gas consumed by the ordinary methods; and, to use his own words: "The results were in all cases negative." He further adds that he does not believe that an instance of imperfect combustion has ever been substantiated against lighting burners, nor even against heating burners of good class when employed under their normal working condition. This is a very satisfactory statement; and it proves that, in the use of gas (whether in the domain of heating or lighting), with a full knowledge of the products of complete combustion, we have learned the worst, and that we need not take alarmist views as to the possibility of the formation of any other substances more deleterious to health.

Obituary.—In the last number of the JOURNAL we had to record the death, on the previous Wednesday, of Mr. W. Thorman, the Engineer of the Lea Bridge District Gas Company. We regret to have to announce to-day another loss in the family. Just a week after the event above alluded to, Mr. John Thorman, brother of the deceased, and the Engineer of the West Ham Gas Company, died after a few hours' illness, in his 49th year. Mr. J. Thorman entered the Company's service in 1868, and was subsequently appointed Assistant-Manager. In 1891, he succeeded his father, the late Mr. E. H. Thorman, in the position now rendered vacant under such peculiarly sad circumstances. The Directors of the Company, many of whom had known Mr. Thorman from boyhood, and who regarded him in the light of a personal friend, held a special meeting last Thursday evening, for the purpose of recording their sense of the loss the Company sustains in his premature decease, and their deep sympathy with Mrs. Thorman and her family in their great bereavement. ——Mr. George Gascoyne, of Derby, who had attained the venerable age of 81 years, died last Wednesday. His name will be familiar to many of our readers in connection with the chairmanship of the Derby Gas Company, which office he held for many years, and only resigned it at a comparatively recent date on account of failing health. He was also Chairman of the old Derby Water Company until the undertaking passed into the hands of the Corporation.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

Quarterly Meeting in Leeds.

The Quarterly Meeting of the Institution was held last Saturday, at the Great Northern Hotel, Leeds. In the absence, through ill-health, of the President (Mr. George Smedley, of Buxton), the chair was occupied by Mr. ISAAC CARR, of Widnes, the Senior Vice-President. There was a very large attendance of members.

The CHAIRMAN said he was sorry to have to open the meeting with an announcement that the President (Mr. Smedley) was not able to attend on account of ill-health. Unfortunately, for some time past, he had been ailing; and the Committee were afraid he might not be able to be present. That morning, they had received a letter to confirm this; and he supposed, by virtue of being Senior Vice-President, he would have to act in Mr. Smedley's stead that day. He could only say he hoped that Mr. Smedley would soon be restored to health; and that he would be able to attend at the next meeting, and fill his place at the finishing up of his year of office, before the chair was taken by the succeeding President. He (the Chairman) was very pleased to meet the members at Leeds, and to see such an excellent gathering. Another gratifying feature of the meeting was to see so many strangers from many parts of the country, which only showed how happy the Committee had been in selecting Leeds for the meeting. He hoped that this was a good augury for future meetings in the city. As a rule, the Committee had arranged for one meeting in some part of Yorkshire; but he could not remember coming to Leeds before, although he had been connected with the Institution for a great number of years. He was quite sure that, after such a gathering as this, they would not be very long before they again visited Leeds.

CONFIRMATION OF MINUTES.

The HON. SECRETARY (Mr. S. S. Mellor, of Northwich) read the minutes of the meeting held at Buxton in August last; and they were confirmed.

NEW MEMBERS.

The following gentlemen were elected members of the Institution; Mr. W. Higginson, of Sandbach; Mr. J. Nicholson, of Castleford; Mr. E. O. Watson, of Rawmarsh; Mr. R. H. Nuttall, of Milnrow; and Mr. A. H. Smith, of Darwen.

ELECTION OF PRESIDENT FOR 1896.

Mr. C. A. CRAVEN (Dewsbury) said, before moving the resolution which had been confided to him, he would remark that, as a Yorkshire member of the Institution, and particularly as a Yorkshireman, he hailed with satisfaction the advent of the Institution to the busy city of Leeds. He was only sorry that they had not a good "figure-head" in the city. They could then have rallied round the Institution, and given the members a good reception. But the officials in Leeds were sadly split up. He was not going to offer any opinion on this point—whether it was for the good of the city or otherwise. However, all the Yorkshire members were very pleased to meet their fellow-members, and to extend to them the "right hand of fellowship" on this occasion. In moving his resolution, he was going to place before the members the name of Mr. Isaac Carr as President for 1896. He thought the suggestion of the Committee was certainly a very happy one. His recollection of Mr. Carr dated back to 1876 or 1877, since which time he had mounted up, and made his mark. He had always taken an original view of matters; and he (Mr. Craven) thought that, on the whole, he had come out in an extremely satisfactory way from the things that some people were inclined to carp at. He had great satisfaction in moving his election.

Mr. J. F. BROMLEY (Batley) remarked that in Mr. Carr the Institution would have a President who had not only a considerable amount of natural, but much acquired ability; and he had great pleasure in seconding his nomination.

The motion was heartily agreed to.

The CHAIRMAN said he was exceedingly obliged to the members for the honour they had conferred upon him in electing him to be their President for the coming year. He should do his best to forward the interests of the Institution, as he had ever done since he became a member thirteen years ago. But a President could do very little himself. He might be enthusiastic, and might work hard; but unless he had the cordial support of the members, there was little hope for the welfare and success of the Institution. The papers and discussions had not, to his mind, been of late up to the standard that they used to be; and he urged upon the members to come forward, and take a deeper interest in the work.

Mr. WILLIAM NEWBIGGING then read the following paper:—

TOWER SCRUBBERS AND HORIZONTAL OR WASHER-SCRUBBERS.

One of the tendencies of recent years among gas managers is that of dispensing entirely with the tower scrubber, and placing reliance on one or other of the various forms of horizontal or washer-scrubbers for eliminating the ammonia

impurity from the gas. The objection raised against the tower scrubber is that it fails in its primary duty—viz., that of the removal of the ammonia impurity. It is with a feeling of regret that I am forced to the conclusion that in many cases the charge is true. Of all the apparatus on a gas-works, the tower scrubber has, perhaps, the most pleasing, or at least imposing, appearance; but if it has still to retain its place among modern gas-works appliances, good reasons must be forthcoming for its retention—efficiency before appearance being the cry, and rightly so.

The usual and proper custom in gas-works where tower scrubbers are erected in pairs, is to put weak ammoniacal liquor from the hydraulic main and the condensers through the first, and clean water through the second vessel. The weak liquor, having a strong affinity for carbonic acid and sulphuretted hydrogen, materially lessens the work of the purifiers by extracting a proportion of these impurities, in addition to bringing the liquor up to the requisite commercial strength. The second scrubber, through which clean water passes, removes the last traces of ammonia remaining in the gas.

This is the view we have always had of the action that takes place; and theoretically it is correct. But as practical men, we know well that an apparatus that will so effectually distribute the liquor, or the water, as the case may be, in such a manner that the whole of the surfaces exposed to the gas in its passage shall be evenly wetted, has yet to be invented. The water often finds its way into one channel, while the gas is passing round and about it, but untouched by the falling water. Especially is this the case where tower scrubbers are filled with coke. The wood boards, though far from perfect, were a step in the right direction, as also are the canvas screens; but whether coke, or wood, or canvas screens, in a scrubber which exceeds 9 feet in diameter it is impossible to ensure efficient and equal water distribution. This is, of course, as much due to imperfections in the distributor as in the filling material; and so the ammonia passes forward, to the injury of the consumers' fittings, and a consequently smaller amount standing in the books to the credit of the liquor. More especially is this the case where reliance is placed on a single tower scrubber.

Now, while deprecating the entire abolition of the tower scrubber, the advent of the washer-scrubber has necessitated an alteration in the usual arrangement and functions of the tower. When erecting a new plant, I would recommend that one tower scrubber only be provided, to be worked in conjunction with a washer-scrubber. The arrangement would be as shown in the following diagram:—

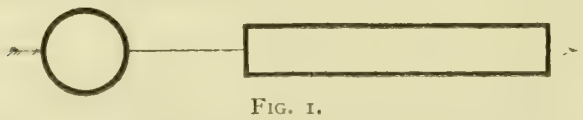


Fig. 1.

Weak ammoniacal liquor is passed through the tower scrubber and clean water through the washer-scrubber. The tower scrubber will remove a large proportion of the ammonia and other impurities, and is useful for the purpose of working up the liquor to the requisite strength; while the washer-scrubber will remove the last vestige of the ammonia from the crude gas.

Where there are already two tower scrubbers in existence, I should arrange them as shown in the second diagram; passing weak liquor through the tower scrubbers, and clean water through the washer-scrubber:—

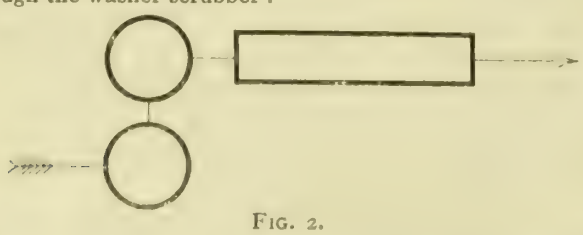


Fig. 2.

When the make of gas has increased to such an extent that still further scrubbing power is required, a second washer-scrubber should be added; and the arrangement would then be as shown in Diagram No. 3.

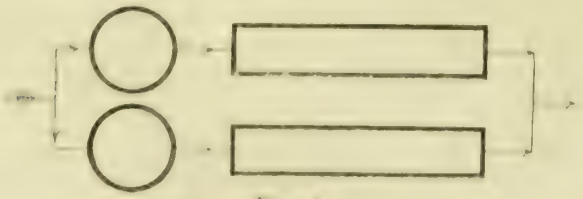


Fig. 3.

Whichever of the two forms of apparatus be used, it is indispensable for their efficient action that the tar should be removed from the gas previous to its entering same. However efficient a condenser may be, it leaves much of the lighter tars untouched; and these go forward, to the detriment of the efficient working of the scrubbers, and also to the injury of the gas. Take an extreme case: Assume the scrubber to be largely impregnated with tar, and the gas passed through it in the ordinary way, the illuminating power of the gas would suffer materially. For that reason, a tar-extractor should be fixed at the bottom of every tower scrubber to do this work, which more often than not is left to the scrubbers themselves—a duty which they were not constructed to fulfil.

There are various forms of washer-scrubbers in the market and many managers are in doubt which to adopt. Each maker naturally claims his own as the best; and only actual and varied experience under different conditions will determine that point. The persuasive eloquence of a good traveller has found a place for apparatus in many a gas-works, which, for all the use it is, might as well never have been fixed. On the other hand, there are machines by various makers which work steadily the 24 hours round, requiring little attention, and removing all traces of the ammonia impurity. As regards cost, there is not much difference between the tower scrubber and the washer-scrubber. The latter is more easily protected than the former against the frost and snow in winter and the rain and sun in summer, as a light shed can be erected over it; whereas a tower scrubber is exposed to all weathers, and consequent wide variations in temperature. Being nearer to the ground, a washer-scrubber is also more under the control of the foreman, who, if an elderly man, or one possessed of weak nerves, hesitates to climb to the top of a tower. The manager, also, can more easily ascertain whether the apparatus is fulfilling its functions. He arranges the flow of water in such a way that he always has several of the compartments clean; knowing thereby how much power he has in reserve.

In conclusion, I would say that experience has taught me that a combination of the two forms of apparatus, in the way I have shown, is the best.

Discussion.

The Chairman said a feature of Mr. Newbigging's paper was that he took a different line from the one usually followed, in recommending that the tower scrubber should take the second place to the purifying-machine, or mechanical washer-scrubber, in the order of the flow of the gas. He did not agree with the conclusions that Mr. Newbigging came to, inasmuch as, at the present time, he was working two large tower scrubbers, and should have a mechanical scrubber for sale very shortly (laughter). His object in working tower scrubbers in preference to mechanical washers was that it was essential, in purifying gas from ammonia, that the flow of gas through the vessel should be as slow as possible; it afforded facilities for doing something else besides extracting the whole of the ammonia. Of course, the gas contained a good deal of ammonia, in the form of cyanogen, that was never recovered; and in tower scrubbers it was possible to decompose the cyanogen. By putting in a little alkali with the water over the scrubber, the alkali combined with the cyanides, and broke them up; and the nitrogen of the cyanides combined with the nascent hydrogen in the gas, and formed ammonia, thus increasing its yield. This was a thing he could not speak upon with any special data at the present moment. But it was a reaction that did absolutely take place in the tower scrubber; and besides it was one that could only be obtained by giving prolonged contact between the gas and the water or the soda solution. Whether at present the decomposition of these cyanides paid for the cost of the soda, he was not yet prepared to say; but he believed it did. At all events, there was a great deal to be hoped for in the way of increasing the yield of ammonia from the gas. With coal containing 1½ per cent. of nitrogen—that was, calculating it out, equal to 140 lbs. of sulphate of ammonia per ton of coal—they considered they were getting a large yield if they obtained 27 or 28 lbs. of sulphate. All this nitrogen went away in some manner. Some was broken up in the retort, and some went down as ammonia; but a large quantity went away as cyanide. He considered that a large tower scrubber was the most suitable apparatus for the recovery of the cyanides; and if they were to be got and sold commercially, it could not be done by rapid contact through a purifying-machine. This was the reason he was discarding his mechanical washers, and going back to the old tower scrubbers of large capacity.

Mr. William Carr (Altrincham) felt very much disappointed with the paper. He thought that they should have had some statement or some argument put before them, either that the tower scrubber or the washer-scrubber was the best. Here they were fronting "north by south"—a combination of both was best. However, he was much obliged to Mr. Newbigging for having brought forward the paper. It reminded him of the one read by the late Mr. Ogden at one of the Institution meetings in Manchester, on which occasion he thought the best discussion was heard that had ever taken place on the question of scrubbing and washing. The matter was then fairly threshed out, as they thought. They came to the conclusion most decidedly that the tower scrubber possessed advantages which the washer or horizontal scrubber did not. Mr. Newbigging had pointed out some objection to the tower scrubber, as to its height and the difficulty of protecting it, and also the fact that, in consequence of being filled with improper material, it was very frequently inefficient, and passed gas without taking out the ammonia. This, to his (Mr. Carr's) mind, all came from the want of intelligent use of the tower scrubber. Mr. Newbigging said the filling of the scrubbers with boards was a step in the right direction; and

he agreed with him that it had only been a step—not because the boards were defective in any shape or form, but because gas engineers had never attempted to solve the question as to how near or how far apart the boards should be. Of course, in the past—say, fifteen years ago—there were not so many gas managers who were also sulphate makers; and it was then an important consideration to sell liquor of high strength. In those days, the liquor in the North of England was sold under Twaddel's hydrometer; and the more carbonic acid and sulphuretted hydrogen they could cram into the liquor, the more they realized for it—they were really selling carbonic acid and sulphuretted hydrogen for ammonia. In some places, when high tower scrubbers were first adopted—he remembered notably the case of Elland, where they had two high towers, which were very much in excess of the requirements of the works—they sold a large amount of liquor in comparison with other works. To a gas manager of that time it must have been a desirable thing to do. As so many purchased liquor by the Twaddel hydrometer, the more stuff gas managers could put into it, to get the hydrometer well up in the liquor, the better it was for them. The people who bought the liquor got alive to this, and commenced to buy it by the ounce and by the distillation test. Then came the process of gas-works putting down sulphate plants of their own. There was no particular advantage in then loading the liquor up, because they had to deal with the sulphuretted hydrogen themselves after it left the liquor; and so the question had grown a little complicated since that time—the advantages of the tower scrubber being lessened thereby. They had had long discussions in that and other Institutions as to the desirability of the purification of gas in closed vessels; and many attempts had been made to purify gas with the liquor, and to absolutely do away altogether with the need of purification by lime or oxide. To his mind, this had always been a possibility; and he still thought it was possible that such a thing might be done. Mr. Livesey, under his purifying liquor process, had accomplished a great deal in the tower scrubber in removing large quantities of impurities from the gas. The celebrated Claus process came next; and it bid fair to get them out of all their difficulties. He remembered when his brother and himself went to Birmingham to see the experimental Claus plant there, which was working in a most efficient way, so they were told by the Engineer who had it in charge and by the representative of Mr. Claus. They had the privilege of testing the gas that was being worked by it; and, so far as they could ascertain, the gas was absolutely purified. Why the process never got beyond the experimental stage at the Windsor Street gas-works at Birmingham, he was never able to see. But since that time there had been a trial on a large scale at Belfast; and it had been given up there. He remembered the discussion that took place at The Gas Institute on this question, on which occasion he said that the only difficulty he could see in the way of such a process was the mechanical appliances that were necessary to work the liquor over the different towers. It was then proposed by Mr. Claus that duplicate pumps should be obtained, so that one could always be ready in case the other went wrong. But he suggested that one might go wrong; and on the other being put to work, that also might go wrong before the first one was again ready for work. Mr. C. E. Jones had ridiculed him at that meeting, and said it was not the habit of gas engineers to let their plant get into such a condition that the moment it was started it broke down. Still, he (Mr. Carr) did not know the reason for the failure of the process. It all pointed to the fact that there was the possibility of more being done with the scrubber or scrubbers than was being accomplished now. They were at present satisfied to take out the free ammonia wherever scrubbers were at work; but he believed that some attempt had been made by Messrs. Davis and Belton to try to split up the cyanides as his brother (the Chairman) had suggested. What would be the result of this process he was not in a position to say; but he would press upon all managers who had to deal with the question that the scrubbing and washing of gas was about the least interesting of any part of gas manufacture at the present time. It was the subject that had received least attention, and yet it was one of the most important in connection with the gas industry. With regard to the filling of tower scrubbers—and therein was the secret—coke, boulder stones, and screens had been used. He had been in a gas-works where he had seen a man splitting up old packing-cases with which to fill the scrubber. The packing-case had come over the Atlantic Ocean, and the boards of which it was composed were an inch thick. The man was using strips of these boards to keep them apart; and so in his scrubber he was having inch interstices between the boards. A man doing this showed his absolute want of knowledge in regard to the real principles of scrubbing. As his brother had already intimated, what they wanted was length of contact, and to ensure contact. Notwithstanding the fact that the gas might be a long time passing through the scrubber, if it did not come in contact with the interfilling material, it might as well go through a plain pipe or an empty scrubber. Gentlemen who had given any attention to the subject of the flow of gas would know that it was fastest away from the surface or where there was no friction. If they had boards that were one inch apart, it would be found that about seven-eighths of the gas passed up the centre of the aperture; whereas only one-eighth dragged along the surface. An ideal scrubber would be one in which they had sufficient area in diameter, and in which they had boards ⅛ inch apart. With a scrubber containing boards ⅛ inch in thickness and ⅛ inch apart, they would require nothing more than a good distributing apparatus at the top. This, he agreed with Mr. Newbigging, was a thing that was very difficult to get, particularly for large diameter scrubbers. Of course, if they were only going to use ammoniacal liquor for the scrubber, they could have a splash-plate, and send the gas at great force through the plate. Then the difficulty arose of getting an equal distribution for a scrubber that was something like 9 or 12 feet in diameter. His personal experience was that he had found as much difficulty in getting the distribution of the water in a mechanical or horizontal washer as he had in a tower scrubber. He was bound to say, although he had been able to get the gas clean with mechanical washers, that he had never been able to do much more than take out the free ammonia. With a washer 15 feet long, filled half way up to the centre, and with the upper surface curved and filled with machinery, the gas could not be very long in its passage through. Consequently, the usefulness of the apparatus was very greatly mitigated by that circumstance. In the case of the tower scrubber, if they would only take out the tar, he thought they could get far more efficiency with one scrubber than with half-a-dozen washers. If they had length of contact, the two articles or substances—the water and the gas—came together for such a long time, in the slow passage of the water down the boards (if they had sufficient boards near together), that the gas might be washed to an extent that had been scarcely dreamt of up to the present time. He did not know all efforts for using purified liquor had been given up. He believed a new patent had been taken out lately, and probably they would hear something more of it. There was one point with reference to the tar that Mr. Newbigging had mentioned—as to reducing the illuminating power of the gas. It reminded him of a circumstance that came under his notice in his early days as a gas manufacturer, where a number of tower scrubbers were ranged together, and where the liquor was pumped over in the form he had mentioned—namely, by a splash-plate. One of the foremen, when he found that the illuminating power of the gas was getting too low, used to lower the suction-pipe down into the tar, and pump tar over the scrubbers, with the effect that the illuminating power was increased as much as 1½ candles. The mechanical action of driving the tar against the splash-plate must have had the effect of vaporizing some of the tar; he could only explain it in that way. But the fact was certainly correct, that it did increase the illuminating power by 1½ candles. It was only in cases of passing gas through tar of great density that there was any considerable reduction of illuminating power. He did not know what kind of tar Mr. Newbigging alluded to; but he (Mr. Carr) did not think any tar that reached the scrubbers would have the effect he stated. Although he had spoken on the paper rather against its tenor, at the same time he was much obliged to Mr. Newbigging for having read it; and he hoped it would lead to the further consideration of the scrubbing question by the members.

Mr. W. W. Hutchinson (Barnsley) said there was one point that Mr. Newbigging had omitted in his paper. He might have said something as to the advantage of dealing with the tower scrubbers with a liquor of a certain density in one, so as to get a high strength of liquor, and a liquor of lower quality in the others. He fancied this was one way in which great advantage might be derived. For the reason that it had not been convenient yet, he had not done much in this way himself. But he had, in times past, heard of members who had been working in this direction; and he should like to have their experience. He had himself found some difficulty with tower scrubbers in keeping the illuminating power in good order in their new works at Barnsley. Frequently, in the winter, he had to shut off one or two of them, on account of the extreme cold prevailing having a detrimental effect on the illuminating power. He really rose for the purpose of asking for information with regard to using a separate tank and a separate pump for liquor of varying densities for each tower scrubber.

Mr. T. Bower (West Hartlepool) said at one part of his career he was very much in favour of tower scrubbers; but some seven or eight years ago, he veered round rather towards mechanical scrubbers. At the works with which he was now connected, he put in a mechanical scrubber in addition to two tower scrubbers, 45 feet high by 10 feet in diameter. He did not get the advantage that he hoped to do from the introduction of mechanical scrubbing. Shortly after, when he was considering the rearrangement of some of the plant, he made up his mind that it was desirable to get another tower scrubber. He put up one of the same size and capacity as the two he had previously, with the result that he procured considerable relief. He was not in a position to say that it increased his illuminating power to any great extent; but, on the other hand, it did increase the quantity of sulphate of ammonia he obtained per ton of coal carbonized. There was another point in which he found they were materially helped; and this had been referred to by Mr. Carr. He pointed out that in former days it was not so necessary for gas managers to consider the extraction of sulphuretted hydrogen by their scrubbers as it was now, when chemical manufacturers looked very minutely into the percentage of the ammonia contained in the liquor. In his own case, this did not apply, because the more

sulphuretted hydrogen he could extract by the tower scrubber, in addition to the extra quantity of ammonia, was really a double advantage, inasmuch as he manufactured his own sulphate. In connection with the sulphate plant, he had the Claus plant. So that, if he could extract a large amount of sulphuretted hydrogen in the scrubber, he relieved the purifier of that duty; and in carrying the sulphuretted hydrogen forward to his sulphate plant, he could extract the sulphur in a commercial form, whereas otherwise it would be lost. So far as the financial view was concerned, in this respect he found tower scrubbers to be a great advantage; and if he were called upon now to design an entirely new works, he certainly should lean towards an excess of scrubbing power rather than mechanical horizontal washers. When he was in Lancashire, he had a somewhat similar experience with regard to tower scrubbers. On the introduction of an additional tower scrubber there, he immediately found he had a considerably greater quantity of liquor than before. In Durham, they were not accustomed to get by any means the proportion of sulphate per ton of coal used that gas managers in Lancashire did. They were satisfied with 23, 24, and 25 lbs. of sulphate per ton of coal; and they thought these were excellent results. He mentioned this because, in making comparisons between gas-works in Lancashire and Durham, those in the latter county were often placed at a disadvantage. Anyone who had had experience of Durham, Lancashire, and Yorkshire coal would know that Lancashire and Yorkshire coal contained a larger proportion of ammonia than Durham coal.

Mr. C. A. Craven (Dewsbury) agreed very much with the author of the paper. He had had a tower scrubber, which was quite large enough to deal with all the gas they made up to a certain point; but he never found the scrubber to completely free the gas from ammonia. He was always able to get an ammonia test even in the summer time, when the make of gas was only a quarter (and even less) what it was in the winter. Some years ago, they put up a mechanical scrubber; and he could speak very favourably as to the results. They had no difficulty at all in clearing the gas from all traces of ammonia. That was his experience. He took exception to one remark made by Mr. William Carr. He seemed to think that, when boards were placed in scrubbers, they were put in in a vertical way, so that the gas could follow the same current from the bottom to the top. That was not the way he (Mr. Craven) had been in the habit of having them arranged. The boards he used were 7½ inches deep and ½ inch in thickness. These were crossed, so that the gas was bound to be broken up; and the breaking up caused it to impinge on the sides of the wetted boards. With regard to the quantity of ammonia, he did not think he had much ground for grumbling. He obtained and sold, on the average, 30 lbs. of sulphate per ton of coal.

Mr. William Carr said he did not dream anybody would misunderstand him in the way Mr. Craven had done in regard to the placing of the boards. He assumed it was one of the elementary principles of filling scrubbers that the boards should be crossed. But if they had boards 1 inch apart, and they were crossed by others 1 inch apart, they would have a vertical column of 1 inch; if they were ¼ inch apart, they would have a vertical column of ¼ inch.

Mr. C. E. Jones (Chesterfield) agreed with Mr. Carr that inch boards for scrubbers were a mistake, and crossing them at right angles was also a mistake. The practice of filling scrubbers had been a very varying one. In the olden days, some 23 or 25 years ago, the finishing scrubber was packed with broken pots, earthenware, pieces of brick, and other unconsidered trifles of that description. Many years ago, he was an advocate for drain-pipes, which were a great improvement over the rubbish that was put in formerly. Eventually, he adopted this plan in the finishing scrubber: He had boards ⅜ inch in thickness, and 7 inches deep; and he distanced them a little less than ⅜ inch. After the first layer was put in, the next layer was crossed—not at right angles, but at angles of something like 45°. The layers were crossed in the same fashion right to the top of the scrubber; so the gas in passing through would describe a spiral motion, would get broken up, and the bulk of it, in some part of its journey, would come in contact with the wetted surfaces of the boards. This scrubber had been most efficient and effective ever since it was constructed; and, except for painting, it had never cost anything for repair. The distribution was effected by means of a brush distributor. The water supply was conveyed into a tank with a ball tap, which fed another tank; and the filtration was effected by means of sponges, so that if the water contained anything likely to stop the pipes, the obstruction would be arrested. As to the question of maintaining the efficiency of the scrubber in cold weather, he had a coil of steam-pipes passing round inside the scrubber boxes. This was an advantage in the winter, as they never had any deterioration or lowering of the illuminating power, because the temperature of the scrubber could be actually increased to a greater degree than it was at the inlet or the outlet. Mr. Newbigging had shown the importance of removing the tar before it entered the finishing scrubber. He (Mr. Jones) agreed that this was most essential; but he did not agree that the washing of the gas with tar had no ill effect on the illuminating power of very rich gas. He had an opinion that it would be to the advantage of the gas industry if every tower scrubber were doubled in diameter, so that the gas would pass through them at a slower velocity. It would expand itself—it would be in a very attenuated form; and it would be in a condition more favourable for being acted upon by the liquor, whether weak or strong ammoniacal liquor, or water. This additional increase of diameter he considered far more important than an increase in height. No doubt, from the purely chemical point of view, it was a long continuous contact with every particle of gas possible that they had to aim at. When they could effect this, he thought they would have brought tower scrubbers to a perfect condition. He had no ammonia in his gas at the outlet of the scrubber either in summer and winter; and he therefore concluded that the machine he had adopted for the removal of the ammonia was an efficient one. There was one other point that might be considered—that the rougher the board or material that created the scrubbing action, the better would be the efficiency of the machine. He had heard it suggested that smooth iron should be used in place of boards; but this would be a mistake, because the gas would slide so easily over the smooth surface, which it could not do over the rougher surface of the boards. If he were to re-charge the scrubber to which he had referred, he should feel disposed to put in thinner boards, and also to narrow the apertures to such an extent as to avoid any indication of back-pressure. He would strongly recommend those managers who had not adopted boards to do so. Like everything else in a gas-works, they could not scrub and purify gas by chance. The old rule-of-thumb days had passed away; and they must ensure constant and personal attention in order to remove the ammonia from the gas.

The Chairman said Mr. Ford, of Stockton-on-Tees, had honoured them with his presence that day. He had no tower scrubbers on his works; but if he were to tell his experience of working without them, they would be much obliged.

Mr. W. Ford, in complying, said his experience of washers for the last twenty years, with the absence of tower scrubbers, had not been without some amount of trouble and anxiety. He must say this, that mechanical washers, where they had a man equal to a chemist to attend to them, were most perfect mechanical appliances; without such observation and knowledge, he must say that washers were more likely to contaminate than do good to the purification of the gas. In the event of frost, by simply closing up the dampers in the condensers they could very easily regulate the temperature of the gas. He should not like to follow Mr. Jones in his introduction of the steam-pipe. His experience had been that, when ammoniacal liquor was heated up, it caused it to evolve, and so waste, ammonia. After a very long series of experiments and practical experience with washers, he had come to the conclusion that the only way to obtain satisfactory results was by either one or two mechanical washers and afterwards a tower scrubber—reversing the order of the method Mr. Newbigging had adopted.

Mr. Newbigging, in reply, said he was indebted to the various speakers for their contributions to the matter under discussion. The Chairman, in his speech, rather gave the impression that he (Mr. Newbigging) was holding a brief entirely on behalf of the washer-scrubber. He would refer him to the first portion of his paper, in which he stated that one of the tendencies of recent years was to put in washer-scrubbers, and to dispense altogether with tower scrubbers. He read the paper with a view to showing that he considered it better to combine the two appliances in the order shown. Mr. Carr's experience with washer-scrubbers, seeing that he was going to remove one, must have been very unfavourable indeed; and he must have made an unfortunate choice when adopting the machine. If he remembered rightly, at the Widnes Gas-Works they had only a Livesey washer or a tar-extractor. (Mr. Carr: A purifying-machine.) Then he could only repeat that, according to his own showing, he must have made an unfortunate choice. Mr. William Carr had remarked that no portion of the apparatus of a gas-works was so little known as the scrubber. He agreed with him. There was a great difference between the duty which could be obtained from an apparatus that was carefully watched and its actions tested, and an apparatus that was allowed to pursue "the even tenor of its way," without anyone troubling to see what it was doing. To obtain the maximum duty from any apparatus well repaid a manager for the time and trouble it necessarily required. Mr. Carr also claimed that the tower scrubber was more effective than the washer-scrubber in removing other impurities than ammonia. On that point there was much room for difference of opinion. He did not think that anything had been said to alter the opinion he had expressed in the paper. Given a gas free from tar, a copious supply of liquor through the tower scrubber, a measured quantity of clean water through the washer-scrubber, and proper attention to the apparatus, and the best results would be attained.

Mr. S. R. Ogden (Blackburn) next read a paper upon

THE INSTALLATION OF CARBURETTED WATER GAS AT BLACKBURN.

Having been requested by the Committee to read a paper at this meeting, I have with some misgivings decided to give you an account of our installation of carburetted water gas at Blackburn. I cannot, however, go forward without first recalling the very able, interesting, and instructive paper read before our parent Institute some eighteen months ago by Mr. Stelfox,

of Belfast, which gave gas engineers generally an insight into the workings of a carburetted water-gas plant, and of its utility in connection with gas manufacture. To those placed in a similar position to Mr. Stelfox, however, the paper was doubly acceptable; and the manner in which the subject has been taken up, and the number of engineers who have followed his example, will not only be gratifying, but will also repay him for the trouble he took in preparing that paper, and thus bringing the subject forward.

The works at Blackburn were at that time run very much beyond their normal capacity. It had been found necessary to apply to the Local Government Board for sanction to build new works in another part of the town; and a grant of £150,000 had been obtained for the purpose. My Committee were, however, very much averse to increase our already large capital account, if it could be in any way avoided. The advent of the above paper was, therefore, most opportune to us. On approaching my Chairman and Committee upon the matter, it was decided, after further information had been obtained and considered, to put down a plant; and an order was placed with the Economical Gas Apparatus Construction Company, Limited, for two sets of plant on their Merrifield-Westcott-Pearson style of setting.

The question of where to erect the plant was the next point to be decided. After due consideration of the plant and its necessities, it was decided to erect same in an old retort-house on our No. 2 works which contained 112 small retorts capable of producing about half a million cubic feet of gas per day, this house being in close proximity to our coke-store.

The agreement made with the Contractors was, in effect, that the two plants should be capable of producing together not less than 1,250,000 cubic feet of gas per 24 hours, and that 1000 cubic feet of 22-candle power gas should be produced with not more than 50 lbs. of coke nor more than 4 gallons of oil—the quantity to be taken, after purification, by a station meter provided, and the quality tested on a bar photometer. They were also required to provide security for the due completion of the above conditions, the terms of which were very stringent.

The plant to be erected by the Contractors consisted of duplicate generators, carburettors and superheaters combined, washers, engines and blowers, and oil-feed pumps, together with scrubber, condensers, oil-meters, gauges, steam-pipes, steam and water valves, large water-cooled valves, oil superheaters, and all other pipes necessary for the completion of the plant. Also an iron stage or working floor with a hydraulic lift for elevating the coke, &c. The Corporation provided all the buildings and foundations, the boiler, exhauster, meter, purifiers, relief holder, and the storage and service oil-tanks, together with all mains required for the plant. The Contractors were also under a heavy penalty for its due completion ready for working on or before Sept. 1, 1895.

The work was commenced by the Corporation on our works on the 1st of March; and so energetically did the Contractors work to fulfil their part of the contract, that we were enabled to complete the whole, and make the first run of gas, on the 1st of August. It is to their credit that we have not had a single cause for stoppage since the plant was finished. You will have noticed that the above plant differs from that previously described to you, in that the carburettor and superheater are combined in one vessel one above the other—an arrangement claimed by the Contractors to have greater efficiency.

Having given a rough outline of the installation, I have thought it superfluous to attempt any further details either of the plant or of the method of working; and I propose now to put before you some of the working trials and results. The oil used is that known as the Russian "Solar distillate," having a specific gravity of ·875, and a flashing-point of 170° Fahr. After working about three weeks in short runs of a few hours per day when circumstances would allow, it was decided to make a full two days' run, and test the machine for its capabilities. The results were as follows:—

Commenced gas making at 8.30 a.m., Aug. 22, 1895.
Concluded " " 8.30 a.m., " 24 "
Duration of run, 48 hours.

Gas made	1,352,000 cub. ft.
Oil used	4,938 gallons.
" per 1000 cubic feet of gas made	3·65 "
Coke used in generators	39,015 lbs.
" " per 1000 cubic feet	28·85 "
" boilers	14,560 "
" " per 1000 cubic feet	10·76 "
Water used	100,000 gallons.
" per 1000 cubic feet	73·90 "
Illuminating power	21·45 candles.
" per gallon of oil used	5·87 "

Cost of Manufacture.

Oil used, 4938 gallons, at 3⅝d. per gallon	£74 11 8¼
Coke used, 23 tons 11 cwt. 1 qr., at 6s. 8d. per ton	7 19 5
Labour (manufacture)	3 13 4
Total	£86 4 5¼
Cost per 1000 cubic feet made	1s. 3·30d.
Water	0 0·44
Purification (estimated)	0 0·25
Oil, waste, wear and tear (estimated)	0 0·25
Total	1s. 4·24d.

This test was made to ascertain the conditions under which the machine was working, as, having only run such short times, it had been impossible to find out the proper heat by which to thoroughly "crack" the oil to produce the best results. It will, however, be gathered from the results shown that there would be no difficulty in the Contractors fulfilling their agreement.

Owing to the small consumption of gas at that season of the year, it was again necessary to make only short runs each day, so that storage room could be obtained for another test. This was eventually made, as follows:—

Commenced working plant at 8 a.m., Aug. 27.
Stopped " " 8 a.m., " 28.
Duration of run, 24 hours.

Gas made	637,000 cub. ft.
Oil used	2,375 gallons.
" per 1000 cubic feet	3·72 "
Coke used in generators	21,252 lbs.
" " per 1000 cubic feet	33·3 "
Illuminating power	19·1 candles.
" per gallon of oil used	5·13 "

This run was also made for a similar purpose to the previous one, and not with the expectation of any better results. As will be seen, they were much inferior. From this time forward, we were able to run a few hours longer each day; and the progress made was much more satisfactory.

The third and last test made before the expiration of the six weeks required by the agreement with the Contractors to work the plant and instruct the Corporation servants how to control it, was on Sept. 30; and it resulted as follows:—

Commenced gas making at 8.30 a.m., Sept. 30.
Concluded " " 8.30 a.m., Oct. 1.
Duration of run, 24 hours.

Gas made	821,000 cub. ft.
Oil used	2,734 gallons.
" per 1000 cubic feet	3·33 "
Coke used in generators	25,312 lbs.
" " per 1000 cubic feet	30·8 "
" boilers	5,040 "
" " per 1000 cubic feet	6·1 "
Water used	59,000 gallons.
Illuminating power	23·31 candles.
" per gallon of oil used	7·00 "

Cost of Manufacture.

Oil used, 2734 gallons, at 3⅝d. per gallon	£41 5 10¾
Coke used, 13 tons 11 cwt., at 6s. 8d. per ton	4 10 4
Labour (manufacture)	1 16 8
Total	£47 12 10¾
Cost per 1000 cubic feet made	1s. 1·92d.
Water	0 0·43
Purification (estimated)	0 0·25
Oil, waste, wear and tear (estimated)	0 0·50
Total	1s. 3·10d.

The result of this trial was considered sufficiently good; and the Contractors having carried out the whole of the conditions enumerated in their agreement, a certificate was given to this effect, and they were duly released of their bond of security, and the Corporation took over the plant. This has been kept working, as necessity required, since that time. These results, I am pleased to say, have been kept up; and, for the purpose of substantiation, I append records of three recent weeks' work—the first and third being part weeks, and the second a full week's working. They are as follows:—

I.—*From Oct. 23 to and including Oct. 30.*

Gas made	4,680,000 cub. ft.
Oil used	15,364 gallons.
" per 1000 cubic feet	3·28 "
Coke used (generators and boilers)	170,268 lbs.
" " " " per 1000 c.f.	36·38 "
Water used	204,000 gallons.
Illuminating power	22·90 candles.

Cost of Manufacture.

Oil used, 15,364 gallons, at 3⅝d. per gallon	£232 1 2½
Coke used, 76 tons 0 cwt. 1 qr., at 6s. 8d. per ton	25 6 9
Water used, 204,000 gallons, at 6d. per 1000 gallons	5 2 0
Wages (manufacture and purification)	16 7 9
Wear and tear, oil, waste, &c. (estimated)	9 15 0
Total	£288 12 8½
Cost of oil per 1000 cubic feet	11·90d.
" coke " "	1·29
" water " "	0·26
" wages " "	0·84
" wear and tear " "	0·50
Total	1s. 2·79d.

II.—*From Oct. 30 to and including Nov. 6.*

Gas made	5,886,000 cub. ft.
Oil used	19,260 gallons.
" per 1000 cubic feet	3·27 "
Coke used (generators and boilers)	213,612 lbs.
" " " " per 1000 c.f.	36·29 "
Illuminating power	23·15 candles.

Cost of Manufacture.

Oil used, 19,268 gallons at 3⅝d. per gallon .	£291	0	6½
Coke used, 95 tons 17 cwt. 1 qr., at 6s. 8d. per ton	31	15	9
Water used, 472,000 gallons at 6d. per 1000 gallons	11	16	0
Wages (manufacture and purification) . .	17	19	9
Wear and tear, oil, waste, &c., estimated .	12	5	3
Total	£364	17	3½

Cost of oil per 1000 cubic feet.	11·86d.
,, coke ,, ,, ...	1·29
,, water ,, ,, ...	0·48
,, wages ,, ,, ...	0·73
,, wear and tear ,, ...	0·50
Total	1s. 2·86d.

III.—*From Nov. 6 to and including Nov. 13.*

Gas made	4,821,000 cub. ft.
Oil used	15,696 gallons.
,, per 1000 cubic feet	3·25 ,,
Coke used (generators and boilers) . . .	180,460 lbs.
,, ,, ,, per 100 c.f.	37·43 ,,
Water used	327,000 gallons.
Illuminating power	23·06 candles.

Cost of Manufacture.

Oil used, 15,696 gallons at 3⅝d. per gallon .	£237	1	6
Coke used, 80 tons 11 cwt. 1 qr., at 6s. 8d. per ton	26	17	1
Water, 327,000 gallons, at 6d. per 1000 galls.	8	3	6
Wages (manufacture and purification) . .	14	19	1
Wear and tear, oil, waste, &c. (estimated) .	10	0	10½
Total	£297	2	0½

Cost of oil per 1000 cubic feet.	11·81d
,, coke ,, ,, ...	1·33
,, water ,, ,, ...	0·40
,, wages ,, ,, ...	0·74
,, wear and tear ,, ...	0·50
Total	1s. 2·78d.

The figures above require little explanation, as I think they speak for themselves. There is only a very slight difference in the cost of oil, accounted for by the difference in the quantity used, and also in the amount of water, also due to the quantity required for keeping cool the valves and for condensation. The amount for wages also depends on the quantity of gas produced. It will be noticed that I have not taken into account the tar, amounting to about 10 per cent. of the oil used, which up to the present time we have burnt under the boilers. I have, however, had an offer of 15s. per ton, which will slightly reduce the figures for the cost of production.

In comparing these figures with your own to find the probable cost to yourselves, it will be necessary to ascertain the cost of the oil, which is the chief item. We had unfortunately to purchase a cargo of 1760 tons during the oil boom; hence the cost of 3⅝d. per gallon. I have, however, evidence that oil will be forthcoming of a similar quality at 3d. per gallon; and I trust before long to see it even below that figure. The price at which the coke is charged is that paid by private consumers. The other charges are purely local matters.

I now come to some of the advantages accruing from the use of such a plant. It will be observed that the intention, purely and simply, in adopting this plant by the Corporation was that of production; but the advantages likely to accrue from it were not overlooked. When it is found that plant with all the accessories, for the manufacture and purification of 1½ million cubic feet of gas, can be put up in the space required by 112 retorts, with the necessary coal-stores, giving a production of half a million, and that the capital charges necessary are so very small, I think you will agree that these two items show in themselves distinct advantages.

But we have also in the same plant a means of enriching our product to anything that we may desire; and the necessity for fuel in the shape of coke, where it is a drug in the market as with us, enables me not only to use up part of the surplus, but also reduces the production on the works, and brings up the market value. I may say that we have no room for the storage of coke; and in past winters we have had to sacrifice a large quantity at a low price in order to have it removed.

One or two other advantages may be claimed; that of the cost of gas per 1000 cubic feet being not the least. Given a supply of oil at anything from 2½d. to 3d. per gallon, gas can easily be put in the holders at or about 1s. per 1000 cubic feet, and of 23-candle power. Another advantage is the smaller quantity of tar and liquor to be disposed of. At the present low prices, this is not to be lost sight of; and should these plants be extensively used, it would have a tendency to increase the value of these commodities.

Having given you some of the advantages of this system, I should like to mention one or two small disadvantages. The specific gravity of the gas being lighter than that of ordinary gas requires increased pressure for the purpose of distribution. For heating and motive power purposes, we are unfortunately not sufficiently forward in the use of this mixture for our manufacturers of gas stoves and engines to have experimented. But, owing to this lighter specific gravity, in a mixture of one-third of water gas to two-thirds of ordinary gas, it is necessary to alter the quantity of air supplied—less being required. In one case of complaint of gas-engines not doing their duty, this matter was explained to the maker, and then the difficulty was soon overcome. This also applies to gas heating and cooking stoves; and when properly understood it will cause no difficulty. The disadvantages you will see are of no moment.

A question will no doubt be asked as to what extent this gas can be supplied. To my mind, and from what little experience I have had, I find the mixture given above to be about the best. But eventually, as we get more used to the gas, and our appliances are made to suit the requirements, we shall be able to produce as much gas as we can provide coke for from an ordinary gas-making plant; and the conditions may probably be that we shall erect a plant principally for the production of coke, and not, as now, for the production of gas.

This question of carburetted water gas is one that demands attention from all gas engineers as a ready means of fighting our various opponents. In these times of calls for cheap and good gas, when we all look forward to increased consumption as a means of augmenting our production, we have now ready at our very doors, a system at once effective and cheap, and one by means of which large capitals may be brought nearer in relation to the quantity of gas consumed, and small capitals disappear. And I make bold to say that all will be lacking in their duty if they do not fully consider this system when opportunity for so doing shall arise.

Discussion.

The Chairman, having referred to the value that the paper would be to gas managers considering the question of adopting water gas, said the primary point in connection with it was the cost. He saw that the lowest cost per 1000 cubic feet was 1s. 2·7d. With this in view, Mr. Ogden went on to state that there were other advantages arising from the process—such as getting rid of the coke, which he would otherwise be unable to dispose of. That would be a factor in the matter, and would prove to be of great value, and a sufficient inducement for the introduction of such a process. But, to his (the Chairman's) mind, 1s. 2d. as the cost of making and putting 1000 cubic feet of gas into the holder was a very heavy price. Taking the cost of ordinary 18-candle coal gas—that was the cost of making only, without the repairs to the apparatus, it came close to 5d. per 1000 cubic feet; and, taking the cost into the holder and repairs and renewals, it worked out to 7d. Then reckoning every other consideration—that was, distribution, rates and taxes, and management charges—the cost came to 1s. 3d. per 1000 feet. What the figure for water gas would assume when all the charges properly belonging to a gas-works were added, he could not say but it was by no means a cheaper method of making gas than many works were manufacturing at in the ordinary way. Another point that would have to be seriously considered in connection with the supply of water gas was that of the calorific value. Where gas was used for heat energy, the calorific value of uncarburetted water gas was only one-half that of coal gas. When it was carburetted, of course it varied according to the quality to which it was increased. As supplied at the present time to the consumer, he believed the calorific value was from 10 to 15 per cent. less than ordinary coal gas. When they remembered that there were tens of thousands of pounds worth of gas used for heat energy apart from illuminating purposes altogether, they had to consider, from the consumers' point of view, what the 10 per cent. less in heat energy would mean to those consumers. The consumers would, he thought, have good cause of complaint if such gas were substituted in lieu of the coal gas which they had previously been using. If he were a gas consumer, and burnt a large quantity of gas for heating purposes, he should certainly have something to say about it; and he thought he would have a very good case indeed. This was a point that must not be lost sight of in considering the question—that they must look to the heat energy as well as the illuminating power.

Mr. Hutchinson, speaking with regard to the cost of the gas, said that in some respects he agreed with the Chairman that the cost of the finished gas was higher than that produced by the present system; but he could quite see there were many cases in which the possession of a carburetted water-gas plant would be very useful. He had in his mind an occurrence of a few years ago at Barnsley, and also in Leeds, when such a plant would have been very acceptable (laughter). As far as he could see, Mr. Ogden had not given them the capital cost of the installation. He stated that the Corporation provided part of the work, and the Contractors a certain part. What he should like to know was the total cost, so that they could compare the capital charges of this system with those of the ordinary method. He could readily understand that the capital charges might not be so heavy for a carburetted water-gas plant as those for the plant required for working on the usual system. A point in favour of water-gas plant—and this was a distinct advantage—was that it could be put to work and let down quicker than an ordinary plant.

Mr. C. E. Jones said the paper bristled with statistical information which one would like to digest and compare with results elsewhere. He agreed with the Chairman that the cost of the gas in the holder was somewhat heavy, particularly as it did not compare value for value with that obtained from bituminous coal. If the cost of the oil was reduced (as Mr. Ogden said he hoped

it would be) by one-half, of course the cost of production would be correspondingly lessened. The special feature, however, which he wished to refer to was the independence it gave gas managers when considering the extortionate demands of the colliers and coal merchants. An apparatus of this kind which placed them, in times of emergency, to a large extent independent of the coal producer, would have been of exceptional value to them during the troublous times they had to pass through in 1893. At a meeting of a kindred Association about that time, he took the opportunity of cautioning the coal producers against squeezing the gas industry unduly. On that occasion, he briefly alluded to other means of providing illuminating gas; and this was one of them. He suggested that the paper was of sufficient importance for the discussion to be adjourned to the next meeting, when the members could take it up with a more comprehensive knowledge of its excellencies, and consequently do it greater justice.

Mr. William Carr congratulated Mr. Ogden upon two things —first, that he had not claimed for this process that it threw a number of men out of work; and, secondly, that he said: "I should like to mention one or two small disadvantages." This was the first time he had heard from a reader of a paper on this subject anything about "disadvantages;" so that Mr. Ogden had struck out a new line in this respect. He would also compliment him upon the fact that he had the best apparatus of the kind, so far as he (Mr. Carr) knew, that had yet been brought before the public in this country. He meant that his results were (speaking from memory) the best of any that had so far been published. Mr. Ogden had made out a good case for adopting the plant; and any gas engineer, placed in similar circumstances, would have followed the same course. Personally, he should have done so had he been fixed as Mr. Ogden was. The paper did not give them the capital charges, so that they could work out the cost per ton, or the management charges. Therefore he (Mr. Carr) was obliged to agree with the Chairman that the cost of manufacture was not low. One question he should like to ask was as to the carbonic oxide in this gas—whether Mr. Ogden had had any analysis of it. Also whether he had taken any note of condensation—as to whether, when the gas had been stored for (say) 48 hours, there was any difference in the illuminating power since the time he had first tested it. He was not an alarmist, and he did not want to put any weapons in the hands of people who were already too much prejudiced against gas in any form. But, in his opinion, the important question as to the quantity of carbonic oxide in water gas was one that would some day prove of great trouble to gas makers. So far as he knew, there was no corporation or company that had parliamentary powers to produce water gas in this country; and water gas did contain a large quantity of carbonic oxide, which, he need not tell gas managers, was of an exceedingly poisonous character. It might some time be the cause of death, and give rise to numerous legal inquiries, and probably be an excuse for calling some suppliers of gas "over the coals." Whether he was an evil prophet or not, it struck him that this was what might happen some of these days; and without parliamentary power, he was not quite sure what position a company or corporation who supplied this gas would be in if it was formally brought home that the result of any such fatality was an excessive quantity of carbonic oxide in the gas. But that was a point for Mr. Ogden and others who had tried the gas to consider.

Mr. W. R. Herring (Huddersfield) said the manufacture of water gas was, to his mind, a peculiarly interesting one, because he fancied there might be a time in the near future when illuminating gas would be given up altogether. There was no doubt that the incandescent gas-burner would play a very important part indeed in the future of the gas industry; and he thought their millennium would come when they had to give up illumination altogether (laughter). It would, he was sure, be a happy time for gas managers. But at present they had to put illuminating matter into the gas; and it was important as to how this should be obtained. His own opinion was that they could not make gas of high illuminating power so cheaply by the water-gas plant as by the ordinary methods at their command. Its chief advantage was, no doubt, the means of quick production. Many of them would have felt the benefit of such a plant during the foggy days of the past week, when they were running a neck-and-neck race with their gasholders. From a practical point of view, he thought this was its chief and only advantage. With regard to cost, he was not at all satisfied. He could produce 23-candle gas at a less price than the figures shown in the paper. At his works, he had allotted a space for a water-gas plant so soon as he could see his way clear to put one up with advantage; but he had not yet arrived at that point.

Mr. Ogden, in replying upon the discussion, dealt first with the Chairman's question as to the calorific value of water gas. He said he was informed that the calorific value of 23-candle water gas was equal to 18-candle ordinary coal gas; and from the experience they had had up to now of supplying gas of these qualities mixed (it showed 21 candles when sent out), they did not find the difference between the calorific value of the mixture and the ordinary gas to be at all appreciable. As to the cost, he did not want to put this forward as a cheap method of producing gas. It would be seen that, if the oil could be bought for 2½d. instead of 3⅝d. per gallon, the cost into the holder would be very materially reduced, and that, at 23-candle power, there would be very much difference between the price of producing ordinary gas and water gas. Mr. Hutchinson asked a question as to the cost of the installation. Roughly speaking, it was £15,000; but that was exclusive of the relief holder. They utilized a holder they had at the time in use.

Mr. Hutchinson: Is that the total for the Corporation and the Contractors?

Mr. Ogden: The total cost to the Corporation and Contractors, and everything connected with the installation.

Mr. Jones: Does it include the buildings?

Mr. Ogden said they utilized an old retort-house; so they had the skeleton building and the relief holder. The £15,000 covered the entire plant, excepting those. The capital charges he had not gone into in the paper; but the management charges he thought were complete, with the exception, perhaps, of his own little "mite." The figures included purification. The water gas was treated entirely by itself until it was put into the gasholder. It was dealt with in its own purifiers; and the charges for purification included all that was spent on the gas in the week.

Mr. Hutchinson: But not the interest on the purification capital?

Mr. Ogden said the 0·5d. per 1000 cubic feet that he had allowed for wear and tear as a matter of fact more than covered wear and tear, and would, practically speaking, cover interest and sinking fund on the whole £15,000. The purifiers were included in the £15,000. Mr. Carr had mentioned the question of carbonic oxide. In the crude gas, it amounted to about 28 or 29 per cent.; but this was, as they used the gas now—one-third water gas to two-thirds coal gas—materially reduced in the general quantity. He had not yet had a chance of trying what the loss of the quality was in the storage holder. He had left that for a time, as he had not thought the weather fit for a test. The worst conditions under which they expected to work at any time should be taken into account.

The Chairman, referring to Mr. Jones's remark as to continuing the discussion at the next meeting, said that Mr. Ogden had intimated that he hoped to get some further statistical information shortly respecting the working of the process; and if he could at the next meeting introduce the subject by a supplementary paper upon the results, the Institution would be still further indebted to him.

Votes of Thanks.

On the proposition of Mr. R. Porter (Elland), seconded by Mr. J. Braddock (Radcliffe), a vote of thanks was passed to the readers of the papers.

Mr. Ogden, in replying, promised that if he could get the necessary statistics prepared in time for the next meeting, he should be delighted to submit a supplementary paper on the same subject; and he also expressed the pleasure he would have in meeting any of the members at his works to view the water-gas plant.

The Chairman having been heartily thanked for presiding,

On the suggestion of Mr. Jones, it was agreed that a telegram should be sent to the President, expressing the sympathy of the members with him in his illness.

This concluded the business; and shortly afterwards the members, with a number of friends, had tea together.

Electric Lighting of Trains.—A new system of electric lighting for railway carriages, the invention of Mr. Gill, has been carried out by Messrs. Stone and Co., of Deptford, on the London, Tilbury, and Southend Railway. Each carriage has its own dynamo attached beneath it, which is driven by a pulley and belt off the axle; and the current from it is sent into a battery of secondary cells, weighing about 3 cwt. There are several ingenious details which surmount the difficulties hitherto met with in this method of lighting.

Damp-Courses and Concrete Layers in Buildings.—In the course of a paper on "The Municipal Control of Buildings," read by Dr. G. B. Longstaff, the Chairman of the Building Act Committee of the London County Council, at the meeting of the Architectural Association on the 22nd ult., he called attention to a curious fact in connection with foundations and damp-courses in London. These are at present regulated by an old bye-law under section 16 of the Metropolitan Management and Building Act Amendment Act, 1878. A great part of this Act, including the section mentioned, has been repealed; but the bye-law continues in force under section 216 of the Act of 1894. The main reason for its existence is that, while speculative builders do not, as a rule, see the necessity for damp-courses, layers of concrete, and so forth, after a wall has once been erected a damp-course can only be put in at the expense of much labour. It has been pointed out that, in so far as a layer of concrete beneath a building is designed to exclude emanations from the earth, it is more necessary in the case of a gravelly soil than in any other; yet the bye-law specially exempts gravelly sites. Dr. Longstaff pointed out that the danger, which is a very real one, has been proved on more than one occasion by explosions of coal gas in houses, traceable to leaks from the mains under the impervious soil of the street pavements outside. A notable instance of this has been recently furnished by the fatality in the Strand.

AMERICAN GASLIGHT ASSOCIATION.

Annual Meeting at Philadelphia.

(*Concluded from p.* 1086.)

A paper on the "Ventilation of Gas-Lighted Rooms" was read by Mr. Irvin Butterworth, of Columbus (Ohio). The author admitted that the electric light man's strongest point against coal gas was the fact that its use was attended with more or less generation of heat and vitiation of the air; but he also thought that the problem of ventilating gas-lighted rooms might be attacked, with excellent chances of securing good practical results that would aid in increasing the popularity of gas lighting. Although an admitted need, the subject had been neglected; and American gas engineers seemed inclined to pass it over in silence as a "weak spot." But he preferred to study and discuss it boldly, as there was room for much improvement; and many popular delusions respecting it would be dispelled, to the great advantage of gas. The first move in this direction, which was made more than 60 years ago, was to provide a cap or hood over each individual burner, to take the products of combustion directly away. But it soon became evident that these devices were expensive, unsightly, troublesome, easily affected by draught, and after all did not greatly assist the ventilation of the room. They led to the introduction of the sun-burner, and of ventilating regenerator lamps; and there was no question but that rooms could be well lighted and ventilated by these means. M. Bandsept, Professor Lewes, and Mr. Simmance had conclusively proved that the same gas which would adequately light a room, could be made at the same time to properly ventilate it, and that both lighting and ventilating were better than was possible with electricity. Bearing these facts in mind, it was surprising that the ventilating gas-lamp was so little used; and the explanation was that the installation is both costly and troublesome, and generally not adaptable in ordinary dwelling-rooms, while the public were not yet educated to an appreciation of its advantages. A simpler and more easily applied system was required. The author proceeded to expose the fallacy of supposing electric lighting to be more healthful than gas lighting, and that the proportion of carbonic acid in a gas-lighted room was the measure of the impurity of the air. It was not true that the products of combustion from properly purified gas were exceedingly injurious; or that under ordinary circumstances they accumulated in a room in sufficient quantity to render the atmosphere unwholesome. A room in which the air could be sensibly affected in this manner, was not fit for habitation for any length of time. Gas lights created currents of air, which electric lights failed to do; and as regards absence of heat with the electric light, it did not follow that cold air was necessarily purer than warm air. He then showed that the really harmful impurities in the air are not products of combustion, but products of respiration and exhalations from the skin of living bodies. Although electricians and theorists had made much of the alleged insalubrity of coal gas, it was probable that the *heat* produced was a far more popular objection in practice; and that if this could be removed, there would be no other complaint. With the aid of a diagram, this point was fully discussed; and the author insisted on the need for removing the products of combustion at the ceiling level, and preferably independently of the chimney. He was not speaking from theory only, but from actual results gained in practice; and he concluded with a suggestion that the Association should appoint a Committee to prepare simple but detailed rules for the ventilation of gas-lighted rooms. [The Research Committee are to undertake this work.]

The President said the paper dealt with an important and interesting question, which was worthy a full discussion. Mr. Egner suggested that not only had gas engineers neglected the subject, but had sometimes made too light of it. He knew instances of gas consumers being told that gas heating-stoves could be used without special provision for taking away the products of combustion. Mr. M'Ilhenny heartily approved the suggestion at the close of the paper; and instanced the hall of the Franklin Institute, and the English Houses of Parliament, as good examples of gas lighting and ventilation. Mr. Littlehales agreed, and he added the Masonic Hall, Hamilton, Canada, to the examples quoted. Mr. Ramsdell said that ventilation by means of gas was largely adopted in France. Mr. Langford had successfully ventilated a stuffy room in his own house on the lines suggested in the paper. Other speakers strongly supported the conclusions arrived at by the author.

The Question-Box was then opened. In discussing the question of the average error of dry meters, it appeared that, with proper precautions, there need be no important error at all. The average of the official tests at Columbus, was under ½ per cent. slow; and Mr. M'Ilhenny knew of 3000 meters that were tested after five years' average use, when the average result was only ¼ per cent. slow. In reply to another inquiry, Mr. Pratt gave the production of tar from a Lowe water-gas apparatus as one-eighth of the oil used. He mixed it with breeze, and used it under the boilers. There was a long discussion on the loss of value suffered by gas coals in store, from which it appeared that some sorts were practically unaffected, while others materially depreciated, and that small or soft coal was the worst to stack. Mr. M'Millin referred to some tables on the subject submitted to the Ohio Association about ten years ago by General Hickenlooper.

PHOTOMETRY IN GERMANY.

The Commission appointed by the German Association of Gas and Water Engineers to investigate photometry as applied to the testing of gas have recently published the provisional report on their labours, which was presented at the last meeting of the Association. The report is signed on behalf of the Commission by the late Herr S. Schiele. The following summary of it is made from the *Journal für Gasbeleuchtung*, the official organ of the Association.

A number of experiments with the Lummer-Brodhun photometer have been made; and the mean variation with several modifications determined. The report states that the improved Lummer-Brodhun photometers of the Imperial Physico-Technical Institute of Frankfort, and one by Krüss, in which the line of observation is in the axis of the photometer, are especially convenient for general use. The standard light should be at a fixed distance from the screen, and moveable with it. For the Hefner unit, the distance should be 30 cm. (11·8 inches), to correspond with the candle at 14 inches; and the photometer table may be 250 cm. (98·4 inches) in length. The gas-burner and Hefner unit or candle must be brought to the proper height with the screen, by a screw adjustment. There should be two scales—one for a fixed position of the unit of light, and the other for use when the unit and screen are moved together. The carrier is to be arranged so that the Hefner unit can be clamped at one end of the table, or fixed at a certain distance from the screen and moved with it. The prisms and mirrors should be protected from dust by the interposition of glass in the openings through which the light travels; and the photometer should be arranged so that the Bunsen disc may be used if desired.

The report proceeds to a brief review of the report of the Dutch Committee on Photometry,* and to a critical study of the ether-benzene standard lamp and the system of photometry proposed for adoption in Holland. It is surmised that an international unit of light is improbable in the near future. The Commission are engaged in testing a number of hollow-top flat-flame burners, in order to find the most suitable for a consumption of 4 to 6½ cubic feet of gas per hour; but the experiments are not yet completed.

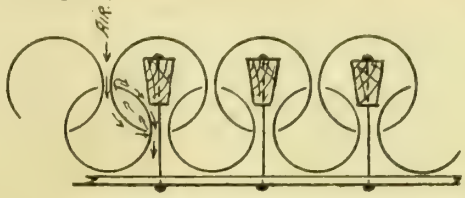
The Antiquity of Cast Iron.—Cast iron was not in commercial use before the year 1700, when Abraham Darby, an intelligent mechanic, who had brought some Dutch workmen to establish a brass foundry at Bristol, conceived the idea that iron might be substituted for brass. This his workmen did not succeed in effecting; being too much prejudiced in favour of the metal with which they were best acquainted. A Welsh shepherd-boy named John Thomas had, some little time previous to this, been received by Darby into his workshop. While looking on during the experiment of the Dutch workmen, he told Darby he thought he saw where they had missed it. He begged to be allowed to try; so he and Darby remained alone in the workshop all night, struggling with the refractory metal and imperfect moulds. They eventually succeeded in casting an iron pot complete. The boy entered into an agreement with Darby to serve him and keep the secret; and for more than a hundred years the process was practised at Colebrook Dale with plugged keyholes and barred doors.

Calorimetry by the "Method of Mixtures."—An improved calorimeter, for the application of the method of mixtures in determining specific heats, has been described by Mr. F. A. Waterman in the *Philosophical Magazine*. Mr. Hesehus's ingenious suggestion is acted upon, to maintain the calorimeter, after the introduction of the heated body, at a constant temperature by means of cold water, instead of measuring the rise of temperature of the calorimeter. This arrangement gets rid of the radiation error, and eliminates the "water equivalent" of the vessel. By dropping the cold water in, stirring is also made unnecessary. The method has been placed by Mr. Waterman upon a footing of equality at least with other systems; but his success may be partly due to other improvements. The body experimented upon is heated by a coil of wire conveying a current, and surrounded by ice. The initial temperature of the body may thus be regulated by simply maintaining the current at a certain strength; and this temperature can be kept constant for five or six hours together to within 0·1° C. The body is then plunged into a silver calorimeter surrounded by the bulb of a delicate air thermometer indicating a difference of temperature of 0·01° C. The cold water is contained in a copper vessel having the shape of an inverted cone surrounded by ice. In this manner, the ice cannot melt away and leave a free space round the vessel. The water-dropping arrangement and the electric heater are mounted on vertical axes in such a manner that they can be quickly swung into position just over the calorimeter. After the heated solid or liquid has been dropped in, the water-dropper is set to work—at first rapidly, and then slowly until the body has assumed the original temperature of the calorimeter. For bodies of the same weight and the same initial temperature, the specific heat is simply measured by the amount of ice-cold water necessary to cool them to the temperature of the room.

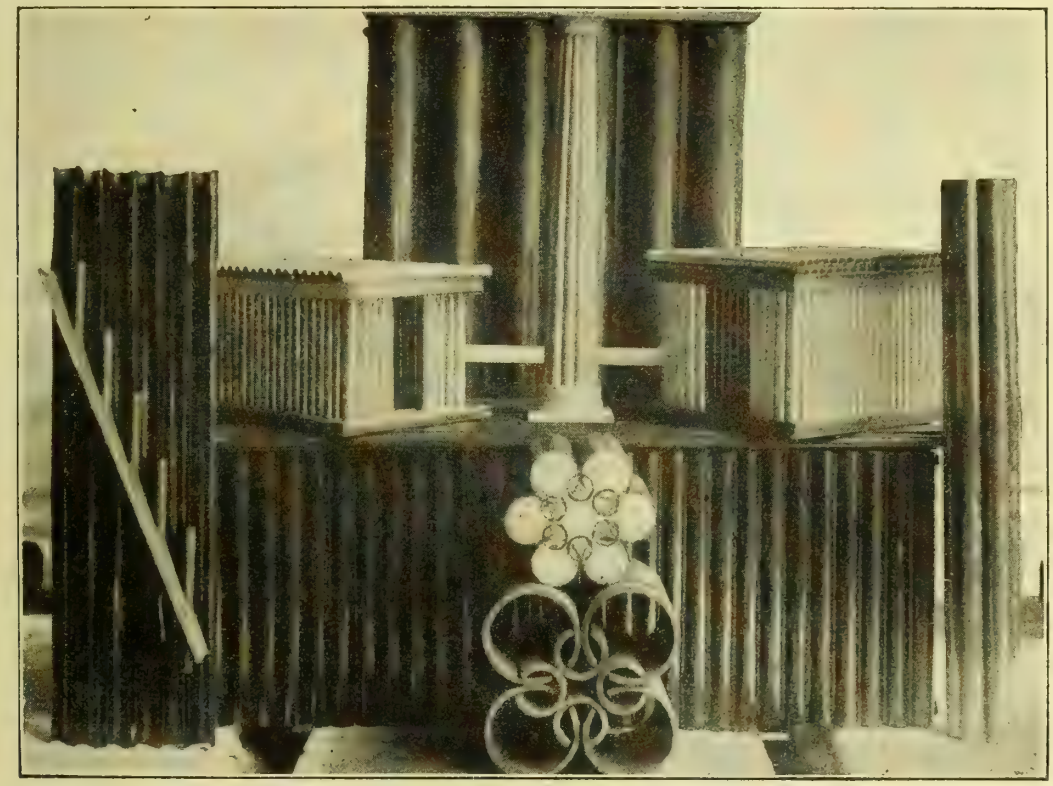
* JOURNAL, Vol. LXIV., pp. 1161, 1209.

PEASE'S TUBULAR METALLIC BUILDING CONSTRUCTION.

The accompanying illustration represents some of the forms in which Mr. E. Lloyd Pease (of the firm of Ashmore, Benson, Pease and Co., Limited) is now making his patented tubular metal and concrete construction for columns, partitions, and roofs. The system appears to be one of the greatest advances made in the direction of rapid, strong, fireproof, and economical building since the introduction for this purpose of corrugated iron sheeting. Corrugated ironwork construction was a great advance upon everything that had gone before it, for many obvious applications. But since its first appearance and instantaneous growth in popularity, invention in this regard seems to have stood still. Mr. Pease's system was noticed in the JOURNAL upon its first public manifestation; and we mention it again now to make our readers acquainted with what is being done to extend i s applications. The illustration is reproduced from a photograph of a group of model forms. In the centre, at the back, is a tubular ventilator, the construction of which is further shown by the accompanying small section figure. This device is susceptible of several modifications; but it will be perceived how the interlocking of the two rows of tubes effectually prevents the admission of rain with the air, whether the appliance is fixed horizontally or on edge. The amount of air admission in this example is regulated by wooden strips, which are just visible between the tubes, and are hinged at the top. When these are drawn forward by means of the connecting bar, the ventilator is closed. The merits of the device are its simplicity and its quality of being weatherproof, and the ease with which it can be carried out over a large area—such as the roof of a large building, as a public hall, hospital, and so forth.



In front of the ventilator is placed a taper reeded column and in the foreground appear sections of columns as made up with thick and thin metal, which can be done in lengths of 30 feet without a joint, and in a great number of designs. From these and the model pavilions, it can be seen how this system of construction—unlike other ironwork—lends itself in the hands of a skilful architect to the production of a naturally decorative effect. The two pavilions are different; the one on the right being made up of equal sized tubes of the thinnest sheets obtainable. Without any extra cost for material, these walls may be made 3 inches to 9 inches thick, and may be filled with dry earth, peat, moss, or other non-conducting substance. The thicker walls are the cheaper, because the number of tubes in them is less. The system is naturally more expensive than corrugated iron sheeting; but the buildings are heat and cold proof, and are made without bolts or nails. One of the pavilions is even more portable than the other, since the walls and roof will roll up. The construction provides an excellent key for plaster if required. On the left hand side of



the illustration is shown a piece of flooring with a stiffening bar running diagonally across a wide span. These floors are very strong, and need no ceiling. The column on the opposite side is composed of polished brass tubes. The modifications and developments of this system of building construction seem to be almost endless.

Institution of Junior Engineers.—At the meeting of this Institution next Friday, a paper is to be read by Mr. J. Julian, of the Borough Engineer's Office, Cambridge, on "Water, Gas, and Electric Mains, &c., in Connection with the Formation of Urban Roads and Footways."

Private Bill Legislation.—The time allowed by the Standing Orders of Parliament within which to give notice for the introduction of Private Bills for the ensuing session expired last Wednesday. From the official notices published in the *London Gazette*, it is found that the total number of Bills in course of preparation is 170—precisely the same as the number actually deposited last session. A general analysis of these Bills shows that 62 relate to railways, including electrical and light railways; 24 refer to gas and water undertakings; 37 are promoted by Corporations, District Councils, and other public bodies; 11 deal with tramway undertakings, including tramroads; and the rest to piers, harbours, docks, and miscellaneous matters. Of the total number of Bills, not more than 23 may be classed as affecting London and the suburbs. This is considerably below the average. These Bills include five promoted by the London County Council, and three by the London Water Companies.

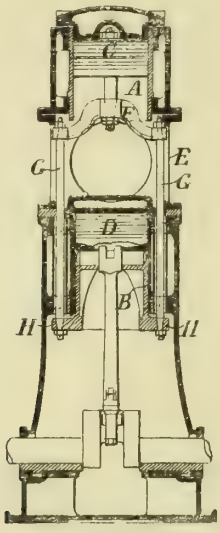
Abandonment of the Coal Boring in Suffolk.—The Directors of the Eastern Counties Coal-Boring Association have decided to discontinue the boring at Stutton, which has been proceeding for about a year in the hope of finding coal. The boring was carried to a depth of 1525 feet; the strata passed through being as follows: Drift (river gravel), 16 feet; London clay and Reading beds, 54 feet; upper and middle chalk, 729 feet; lower chalk, 154 ft. 6 in.; gault, 49 ft. 6 in.; and Palæozoic rock, 531 ft. It is possible another trial will be made at Bramford, which lies to the north of Stutton.

The Expansion and Contraction of Concrete.—In an article published in the *Annales des Ponts et Chaussées*, M. Dutoit remarks that the expansion and contraction of the concrete in large reservoirs, due to the changes of temperature, are so great as to cause cracks which open in the winter and close in the summer. If these are filled up, fresh ones open near them, so that it is useless to repair them. The new covered reservoirs at Paris are built of a silicious stone; and were it not for these fissures, it would have been set in concrete, so as to form one homogeneous mass sufficient to have proportioned the walls for stability and to set them on solid earth. The foundation is, however, on a bed of gypsum and marl, and its soundness would be affected were water to reach these beds. To prevent this, drainage tunnels of elliptical section were formed on the floor of the reservoir, which intercept any leakage, so that it can be carried clear of the foundations. The walls of the reservoirs below ground are similarly surrounded with broken stone placed in a trench, the bottom of which is plastered and sloped, so as to lead off any water getting through the walls into the drains.

REGISTER OF PATENTS.

Gas-Engines.—Robinson, M. H., of Thames Ditton. No. 23,028; Nov. 27, 1894.

In order to obtain pressure constantly in the same direction upon the brasses of an engine working upon the "Otto" cycle, the patentee proposes to use two single-acting cylinders placed tandem-wise, or one beyond the other in the same axial line, upon the same side of the crank, and with the working end of each cylinder placed farthest from the crank. In order to avoid the use of a piston-rod passing through the working end of one cylinder, each piston or plunger is connected to a crosshead, and both crossheads are fixed rigidly together by rods or bars passing outside the cylinder nearest to the crank. Explosion is arranged to occur in each cylinder alternately. Thus, if the engine is vertical, with the cylinders above the crank, then upon every upstroke one or other of the pistons will be engaged in compressing a charge for explosion upon the following downstroke, with the effect of cushioning, upon each upstroke, the whole system of pistons and rods—in other words, they are held in constant thrust against the crank-pin upon every non-effective stroke.



The illustration is a vertical section of an engine arranged, as described, to keep the parts in constant thrust. A and B are the two cylinders in which explosions occur alternately; and C and D are their respective pistons. The two cylinders are placed tandem-wise, and are separated by a distance-piece E. The upper piston C is shown with a piston-rod and crosshead F; while the lower piston D is formed as a trunk piston. It is obvious, however, that it might (if desired) be also fitted with a crosshead, similar to C. The two pistons are rigidly connected together by side rods G, which are bolted to the crosshead F, and to lugs H upon the trunk piston D. These side rods G pass outside the lower cylinder B, the cover of which is solid.

Utilizing Heat from Gas and other Lamps for Warming Carriages, Rooms, or other Enclosed Places, and for Ventilating Same.—Sykes, T., of Lingards, near Huddersfield. No. 23,142; Nov. 29, 1894.

This invention has reference to railway carriages, rooms, or other enclosed places, wherein the light for illuminating same is closed from the interior or otherwise protected by a shield or cover; the object being to warm the carriages or enclosed place by the heated products of combustion, or by atmospheric air conducted through the lamp and heated therein, and also to ventilate or withdraw the vitiated air from the interiors of the compartments or rooms. In carrying out this arrangement, the patentee proposes to form two series of openings, one above the roof or ceiling, or communicating with the atmosphere, and the other below, or communicating with the interior of the carriage or room; and in conjunction with the openings to provide moveable grates or slides adapted to close or expose the openings at will, but so arranged that when one series is closed the other is open or exposed.

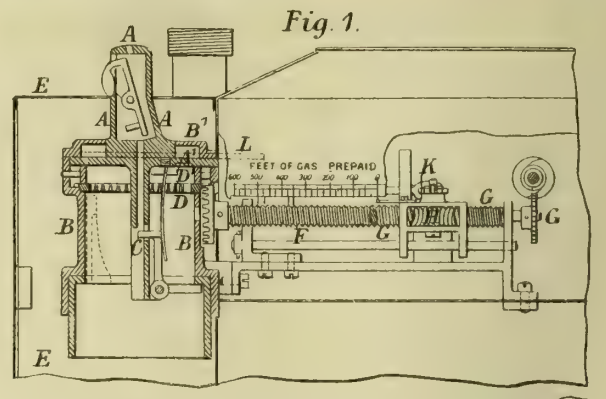
Mounting Incandescent and other Gas-Burners in Street-Lamps.—Redman, T., of Bradford. No. 23,715; Dec. 6, 1894.

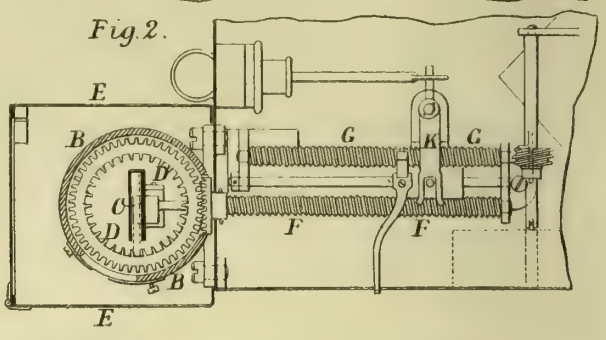
To prevent the fracture of incandescent mantles when used in street-lamps, the patentee proposes to lead the gas-supply pipe to within a suitable distance of the gas-burner in the usual manner. At the termination of the pipe, a tap is coupled by a flexible tube to the metallic connection to which the gas-burner is fitted. The burner is suspended by an arrangement of springs or elastic connections, coupled to some convenient portion of the lamp or other fixture, or it may be supported by an elastic or spring-cushioned chair. In either style of mounting, should the lamp receive a shock, the vibration to the burner and delicate attachment is prevented (or greatly reduced) by the intervening spring or elastic mounting.

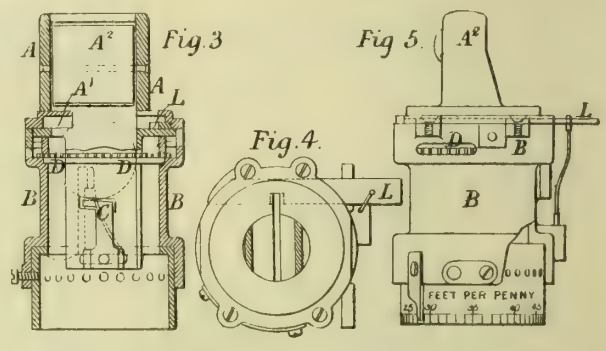
Prepayment Gas-Meters.—Peebles, D. B., of Edinburgh. No. 24,231; Dec. 13, 1894.

This invention has for its object "to construct and combine parts in an improved manner to form simple, compact, fraud resisting, and otherwise satisfactory mechanism, to secure the delivery of gas through a meter in proportion to prepayment by coins inserted in a slot or coin-inlet."

Fig. 1 is a sectional elevation, and fig. 2 is a sectional plan of the meter. Fig. 3 is a vertical section at right angles to part of fig. 1; fig. 4 is a sectional plan showing some parts not seen in fig. 2; and fig. 5 is a sectional elevation showing parts not seen in figs. 1 and 3.







The coin-inlet is formed in a piece A fixed on a disc A^1, which can be turned about a vertical axis by means of the inlet-piece as a handle; the disc being fitted in the upper part of a hollow cylindrical body-case B, and being retained in position by a cover made in halves, and fixed by screws. One side of the inlet-passage is normally inclined, being formed on a piece A^2 mounted on a horizontal axis, but weighted so as to assume the position shown in fig. 1. When a coin has been inserted, and is wholly within A, the part A^2 is, by pressure of thumb or finger on its upper outer end, made to assume a position in which its guiding surface is vertical; and while obstructing the top inlet opening, it uncovers a slot formed across the centre of the disc, and extending downwards in a part projecting down from the under side of the disc. This arrangement is intended to prevent the fraudulent introduction of a wire or instrument. The middle of the slot, as seen in fig. 3, is not concentric with the disc; and the coin, when in the slot, projects more on one side than on the other. The inlet-piece A may be in any position when the coin is inserted; but the coin does not descend far enough to act on the meter freeing mechanism unless or until after turning the inlet-piece with its disc, the slot in the disc coincides with a notch in the cover. The laterally projecting side of the coin otherwise rests on the unnotched part of the ring or flange forming the cover. When the disc-slot and cover-slot coincide, the coin drops down to the position indicated by a dotted circle in fig. 3, and is there retained by a small cross-bolt C, and the projecting side of the coin engages between two internal teeth of a ring D. This is made with both internal and external teeth, and is fitted loosely in a groove made for it in the body-case B, while another ring lying upon it, and prevented from turning by a pin at one side, prevents this ring from being turned frictionally by the disc. When the ring D has been turned a certain distance round, the cross-bolt C is withdrawn; and the coin drops into a receptacle E—the turning of the toothed ring D being thereupon discontinued, whether the inlet-piece A be turned farther or not. The bolt C is formed on the vertical arm of a bell-crank having a horizontal arm, the outer end of which moves in contact with the under side of an inward flange formed on a cylindrical ring, and which flange has at one part of it a cam projection indicated by a dotted line in fig. 3. When the bell-crank arm, in turning round, encounters the cam projection, the bolt C becomes drawn in so as to release the coin; and it follows that the position of the cam projection will determine the extent of rotation which can be imparted by means of each coin. To further ensure the proper limitation of the rotation, the ring has fixed to it a stop-arm extending up inside the body-case B, and which is encountered by the coin when in turning it reaches the position at which it should stop, this stop-arm preventing any further rotation of the coin, and being so placed that, as the coin reaches it, the bolt is withdrawn, and the coin can drop into E.

A scale is marked on the outside of the ring (as shown in fig. 5); and a number of holes are formed in the ring, into one or other of which a screw can be arranged to fix the ring in a position corresponding to the price of gas—in other words, to the quantity to be delivered for each coin. A slot is formed in the body-case B at a part to give access to a few of the external teeth of the ring D, to enable a gas officer to adjust

the mechanism to zero or other position, by means of any suitable instrument. All the parts, with the exception of the upper part of the inlet-piece A, are enclosed in the casing of the receptacle E, which is fitted with a door with lock and key.

The mechanism which has been so far described may be combined with the meter mechanism by any suitable one of the many known devices proposed for that purpose. The device shown in figs. 1 and 2 is one which the patentee believed to be new when he applied for a patent, but which he has since ascertained was not so. In this device, the external teeth of the ring D gear with, and drive, a crown or bevel wheel on a screw-spindle F, parallel to which there is a second screw-spindle G, the latter being acted on by the meter mechanism through a worm gearing with a worm-wheel on the spindle G. Between the two screw-spindles E G there is a pinion H, gearing with them; both its teeth being inclined like those of a worm-wheel. When what may be termed the coin-spindle F is turned, it makes the pinion H roll along the meter or other spindle G, and a pointer J, moved by the centre of the pinion, shows on a scale the quantity of gas prepaid for. As the meter passes gas, the meter-spindle G makes the pinion H roll back on the coin-spindle E, so as to return the scale-pointer J towards zero. The pinion H is held in a small box fitted to slide on a fixed guide-rod; and a pin fixed in the box engages with the forked end of a lever, the other end of which acts on the spindle of the gas-inlet valve of the meter The pinion-box has fixed to it a stop projecting upwards, and which, when the scale-pointer J approaches the maximum end of the scale, acts on a flat bar L, which then prevents the introduction of additional coins by partially closing the notch in the cover.

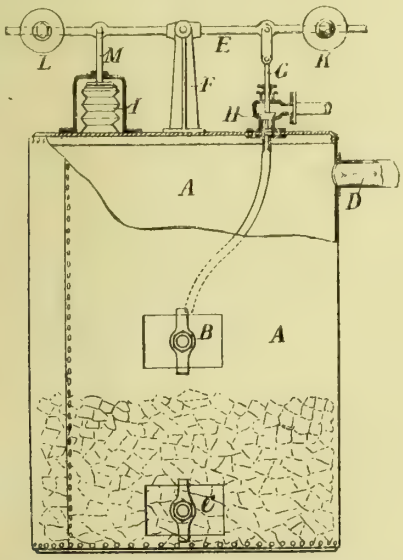
Production of Ammonia and other Products from Heating Coal or Carbonaceous Minerals.—Meikle, J., of Maryhill, Glasgow. No. 25,173; Dec. 28, 1895.

The claim for this invention is for the treatment of coal or other carbonaceous minerals, so as to obtain ammonia and other products, maintaining the residuary coke (produced by distilling off the volatile constituents of the coal in a retort or vessel) at a high temperature, and injecting superheated steam and "fire gases."

In carrying out the invention (of which no illustrations are given), the patentee proposes to first distil off the volatile constituents of the coal in any suitably externally-heated vessel; continuing to maintain the residuary coke at a high temperature, by injecting superheated steam into the retort, so as thereby to obtain a large quantity of ammonia. When, after a time, the evolution of ammonia decreases, there are injected along with the superheated steam "fire gases"—that is, "the gaseous products of combustion, by preference using such gaseous products as are formed by the combustion of producer gas"—introduced by the jet action of the steam, or by a blower. This use of fire gases in conjunction with superheated steam is said to produce a considerable additional yield of ammonia, which has mixed with it other products, including cyanogen compounds, which can be separated by any known means and separately utilized.

Producing Acetylene.—Gearing, E., of Harrogate. No. 25,203; Dec. 28, 1894.

This invention has reference to generators suitable for producing acetylene by the use of carbide of calcium and water; the supply of water being controlled in an automatic manner.



In the engraving—showing, partly in elevation and partly in vertical section, such a gas-generating apparatus—A (the main or body part of the generator) is constructed of steel plates riveted together; the opening, about midway of its height, for the introduction of carbide, being provided with a door B that can be hermetically closed. Another opening, provided with a similar door C at or near the bottom, is for the purpose of clearing out the lime and bye-products. The outlet D is at the side near the top for gas generated.

The apparatus for controlling the supply of water is arranged at the upper part of the generator body. It is so constructed that, when gas is being generated more rapidly than it is being drawn off through the outlet D, the consequent increase of pressure within the generator will operate the valve-controlling mechanism, so as to shut off (or partly shut off) the water supply, until, by the withdrawal of gas, the pressure in the generator falls, whereupon the water supply will be automatically more or less opened. E is a lever, having its fulcrum in a suitable standard or upright F. Connected to one of its arms is the spindle G of a controlling valve H; and to the other arm is a collapsable vessel I (or a diaphragm) exposed to the pressure of the gas within the generator. The arms are also furnished with weights K L, by adjusting which the apparatus can be set to cut off the supply of water on the gas within the generator attaining such pressure as may be predetermined. With this arrangement, when gas is being generated more rapidly than it is being drawn off, and the pressure within the generator consequently increases, such pressure acting against the under surface of the top of the collapsable vessel I (or upon the diaphragm, as the case may be) will lift the corresponding end of the lever E, thereby depressing the other end to which the water-valve spindle G is connected, and thus will gradually cut off the supply of water, and arrest the generation of gas—the valve closing against a suitable seat. As gas is drawn off, and the pressure is consequently reduced, a reverse action of the lever will occur, whereby the valve will be opened, the supply of water will be renewed, and generation of gas will again take place.

In lieu of the collapsable vessel shown, a diaphragm of any suitable construction—such as a disc of leather or vulcanized india-rubber—secured around its periphery to the surrounding casing, and provided with a central metal plate or plates for attachment of the connecting-rod M, might be substituted; and in lieu of a water-valve of the shape indicated at H, a valve capable of being worked directly or indirectly from the lever E might be substituted.

Gas Motor Engines.—Humphrey, H. A., of Northwich. No. 347; Jan. 5, 1895.

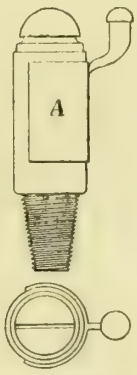
In engines of this construction, the charge, consisting of gas or oil vapour mixed with air (all under pressure) is pumped into a chamber between two pistons rigidly connected together, so as to constitute a slide-valve; and in this chamber, which is cooled by a water-jacket, when the two pistons are in such a position that they cover a port from the pump and a port to the working cylinder, the mixture is ignited. The pistons are then moved in one direction, so uncovering the ports that the combustion gases enter the working cylinder, expanding therein, and propelling its piston; and the pump, the piston of which moves with the main piston, draws in a fresh charge. When the main and pump pistons have completed their outstroke, the slide-valve is moved so as to open the cylinder-port to the exhaust; and a discharge-valve is opened from the combustion chamber, through which a current of air is caused to pass in such a manner as to clear out the combustion gases and fill the chamber with air, whereupon the chamber is again charged with combustible mixture, and the action is repeated. By adding a second larger working cylinder, and a third piston to the two which form the valve, so as to govern its port, the engine can be worked as a compound engine, the exhaust from the first working cylinder passing into the second larger cylinder, and operating therein on its piston, which is linked to a crank opposite to that for the piston of the first cylinder.

Gas-Engines.—Wildt, O. H., of Paris. No. 6151; March 25, 1895.

This invention relates to a gas-engine, the distinctive objects of which are: (1) To render such engines more economical, to reduce the temperature of the gases at the exhaust by a considerable prolongation of the expansion, and by utilizing the partial vacuum which may be created by cooling the products of combustion before allowing them to escape into the atmosphere, as in the case of air-engines. The volume of the burnt gases being greater at the termination of the expansion than that of the explosive mixture admitted, the contraction of the gases by cooling in a closed chamber must thus necessarily create a partial vacuum. (2) To obtain greater regularity in the working of such engines, by producing an impulse upon one or both faces of the piston at each revolution of the fly-wheel, while still retaining the advantage of inhaling the explosive mixture into the working cylinder itself. The impulse may be varied, according to the work to be done, by varying the volume of the mixture admitted, while the proportions of the gases constituting the explosive mixture may remain invariable; but the engine never misses fire during the working. To effect this object, the engine works upon the two-phase cycle principle—that is to say, considering one side of the piston only, it receives a working impulse at each outward stroke (from the end of the cylinder to the most forward point), while the exhaust of the burnt gases, the inhalation of a fresh mixture, and the compression to a regular or variable extent of the mixture, are all effected during the backward stroke.

Igniting Attachment for Gas-Burners.—Riordan, T. V., of Clapham. No. 16,428; Sept. 2, 1895.

This invention relates to an attachment for gas-burners, whereby the gas on issuing is ignited "by its chemical action upon a medium held by such attachment."



The attachment is formed of suitable resilient material; a spring clip being adapted to be slipped over or around an ordinary burner, and be securely maintained in position thereon. At the top of the clip, and attached thereto, is a small holder A (rounded or turned in the opposite direction) designed to receive "a suitable igniting medium." The attachment is adjusted so that the igniter may just catch the bottom of

the stream of gas issuing from the burner. The material employed is a mixture of platinum black, white clay, and flint powder, in or about the proportion of one part of each, thoroughly mixed together, and then moulded into plugs or pellets of the required dimensions. These are afterwards fired at a high temperature, which renders them very porous. In this plug or pellet is inserted one or more fine platinum wires twisted together, and projecting from the plug, so that when the "gas containing hydrogen is turned on and reaches the plug or pellet, the material of which the latter is composed is ignited through the agency of the finely-divided platinum, in the well-known manner."

APPLICATIONS FOR LETTERS PATENT.

21,315.—ALLEN, W., and BARKER, L. C., "Oil and gas engines." Nov. 11.
21,340.—CATON, G. J. J., "Burners for incandescent gas lighting." Nov. 11.
21,341.—CATON, G. J. J., "Burners for incandescent gas lighting." Nov. 11.
21,364.—HARDINGHAM, G. G. M., "Controlling the supply of gas to burners." Nov. 11.
21,369.—FELDMANN, S., "Bunsen burners." Nov. 11.
21,429.—HAWKYARD, J., and BRADDOCK, J., "Prepayment gas-meters." Nov. 12.
21,468.—CALVER, W., "Manufacture of gases." Nov. 12.
21,517.—THORNEYCROFT, W., "Manufacture of coke." Nov. 13.
21,521.—PINCKNEY, P., sen., "Power generator and heat motor." Nov. 13.
21,570.—SANFORD-BURTON, H., "Lamp for illuminating and other purposes." Nov. 13.
21,574.—FESSARD, E., "Gas and oil engines." Nov. 13.
21,581.—CORP, J., "Gas-lighting device." Nov. 13.
21,598.—CLEE, F. J., "Clip for the repairing of burst water-pipes." Nov. 14.
21,650.—HINCHLIFFE, J. S., "Oil and gas engines." Nov. 14.
21,678.—RASCHEN, J., and BROCK, J., "Manufacture of cyanides and ferrocyanides from sulphocyanides and recovery of bye-products." Nov. 14.
21,696.—EDGE, J., "Gas and oil motor engines." Nov. 15.
21,757.—GEARING, E., "Gas-burners." Nov. 15.
21,774.—MAGEE, J., "Gas-engines." Nov. 16.
21,793.—PINCKNEY, P., "Artificial lighting." Nov. 16.
21,846.—KIRKHAM, H., "Lighting incandescent gas-burners." Nov. 18.
21,880.—BLOMMART-MILES, E., "Automatically lighting and extinguishing street and other gas-lamps at any time desired." Nov. 18.
21,898.—STEVENS, J. H., and TOURTEL, J., "Coin-freed cocks for the supply of gas or other fluids." Nov. 18.
21,914.—HUGHES, T., "Coin-freed apparatus for meters." Nov. 18.
21,929.—HANCOCK, F. L., "Protecting incandescent gas mantles." Nov. 18.
22,055.—PURVES, J., and HYDE, H. L. W., "Making gas." Nov. 20.
22,132.—DOULTON, H. L., and MELDRUM, R., "Purifying water." Nov. 20.
22,303.—CRAIG, G., "Estimating the carbonic acid or other constituents in gases or products of combustion." Nov. 22.
22,401.—PEEBLES, D. B., "Coin-prepayment mechanism for gas-meters." Nov. 23.
22,402.—DION, A. DE, and BOUTON, C., "Motors worked by explosive mixtures." Nov. 23.
22,418.—NOTTINGHAM, W., "Portable grill for oil and gas stoves, ranges, and like purposes." Nov. 23.
22,432.—KERRIDGE, J. H., and YOUELL, H., "Starting gas and similar engines." Nov. 23.
22,438.—STEVENS, G., "Preventing the freezing of water in water-supply pipes, cisterns, and adjuncts." Nov. 23.
22,439.—SCHURR, A. E., "Fittings for incandescent gas-lights." Nov. 23.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Standards of Light.

SIR,—I thank Mr. Williams for his courteous reference to my article on this subject; but at the same time I must adhere to the statements I have already made. Mr. Williams still seems to think that the standard candle can be so modified as to be an accurate standard of light. From this I entirely disagree; and I still claim that the Dibdin ten-candle standard affords us the most absolutely accurate means of ascertaining the illuminating power of all grades of gas.

Mr. Williams has confessed that "a candle determination of value appeals strongly to public sentiment, by giving a demonstration of value which is satisfying to popular claims and expectation founded upon long usage." If this is admitted, what possible objection can there be to the maintenance of the term "candles," although applied to a standard of another character? My special point is that, in using standard candles, we have what professes to be a standard, but which is actually nothing of the kind. There are so many complications with regard to wick, temperature, material, and general conditions of working, that certain and definite results are almost impossible to obtain. Although many suggestions have been made to rectify the abnormal results given by the standard candle, as yet there has been nothing definitely proved to have any practical value.

With regard to a gaseous standard, such as the Dibdin so called ten candle, we have at least a fixed and constant standard of light. We have no complications of wick, melting-point of solid material, or temperature, &c., and that the light is expressed in terms of candles is simply a concession to popular prejudice, as it was thought undesirable to alter the form of expressing the amount of light afforded by the gas supplied to the public.

"VERITAS."

Nov. 29, 1895.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1896) RELATING TO GAS AND WATER SUPPLY AND ELECTRIC LIGHTING.

Aldershot Gas and Water.—The Aldershot Gas and Water Company intend to apply for powers to construct a tramroad between the Tongham Railway Station and the gas-works, and also for an extension of their water limits so as to include portions of Farnham, Seale, and Wanborough, in Surrey. Additional capital will be required; and it is proposed to adopt the sliding-scale. Authority will be sought to make agreements between the Company and the Frimley and Farnborough District Water Company and the North Camp and Farnborough District Gas Company, Limited, as to the purchase of the whole or part of such undertakings. In the Bill for which notice has been given, provisions will be contained in regard to the purchase of additional lands by agreement at Aldershot and Farnborough, in Southampton, and at Farnham, Frimley, Ash, Seale, and Wanborough, in Surrey. The Company will ask to be empowered to lay mains within the extended water limits, levy rates and charges, and apply their funds for the purposes above enumerated.

Aldrington Water.—The Aldrington Estate Water Company, Limited, have given notice of their intention to apply for the incorporation of a new Company, under the name of the Hove and Aldrington Water Company, with authority to supply water in the parishes of Aldrington and Hove, in Sussex, and to levy rates and charges therefor. The Memorandum and Articles of Association of the original Company are to be altered, and additional powers will be applied for.

Barry Urban District Council.—The Barry Urban District Council intend to apply for authority to extend their limits of gas and water supply so as to include for the former commodity the whole of the parish of St. Andrew's Major, and for the latter so much of that parish as is not contained in the water area of the Cardiff Corporation. It is proposed to carry out extensions of the water-works, comprising a boring on Dinas Powis Moor, and two conduits or pipe-lines. Among the provisions of the Bill to be promoted, is one in regard to the licensing by the Council of plumbers for gas and water purposes; and others as to borrowing money and levying rates and charges.

Bexhill Water and Gas.—Power will be sought by the Bexhill Water and Gas Company to obtain additional lands and waters for the purpose of extending their works and supply. They also intend to ask for authority to produce and supply electricity within the limits of the Bexhill Water and Gas Act, 1885, and acquire electricity undertakings of other companies, corporations, and persons. Additional capital will be required.

Bilston Improvement.—Authority will be sought by the Bilston Urban District Council for the confirmation of an agreement entered into between them and the Wolverhampton Corporation, or for the framing of another agreement, for the transfer to the Council of the existing rights of the Corporation in regard to the supply of water in part of the parish of Coseley, in Staffordshire. Money powers will be included in the Bill to be promoted.

Birmingham Corporation Water.—The Corporation of Birmingham wish to be empowered to make certain deviations of the aqueduct authorized by their Water Act of 1892, and to relinquish portions thereof; also to acquire lands and easements for the deposition of spoil and other purposes. The first deviation commences at Whitton, in the parish of Burford, and terminates at Caynham; the second commences at Kidderminster Foreign, and ends in the parish of Wolverley. Other purposes of the Bill to be promoted were mentioned in the JOURNAL last week (p. 1099).

Bournemouth Gas and Water.—The Bournemouth Gas and Water Company will apply for an extension of their limits of supply, and power to construct new gas and water works, manufacture and store gas, manufacture and convert residuals, appropriate waters, divert streams, &c. In the Bill to be brought in, provisions will be included in regard to the production and supply of electricity for lighting and other purposes; the selling and dealing in electrical and gas appliances and fittings; and the supply of gas for heating, cooking, and motive power purposes. Authority will be sought to acquire lands for the purposes of both the gas and water works; to purchase the undertaking of the West Hampshire Water Company; and to alter the charges throughout the extended limits. The districts for the supply of water by the two Companies are to be adjusted. Further capital will be required.

Brighton Corporation.—Notice has been given by the Corporation of Brighton of their intention to apply for sanction to the transfer to them of the undertaking of the Shoreham and District Water Company, and the extension of their limits of supply so as to include the Company's district and also West Blatchington. Additional works, consisting of three adits or headings, connected with each other, are projected. The usual powers granted to suppliers of water will be sought, as well as authority to apply the existing funds of the Corporation and raise more money for the above-named purposes. The Company will, of course, be dissolved upon the transfer of their undertaking.

British Gaslight Company, Limited.—The British Gaslight Company, Limited, intend to ask for power to expend further capital upon the enlargement of their Norwich station. Land contiguous to the Company's works at Thorpe is to be acquired for the purpose.

Burton-upon-Trent Corporation.—In a General Bill to be applied for by the Burton-upon-Trent Corporation, authority will be sought to enable them to manufacture, purchase, sell, hire, and let on hire appliances and fittings for the consumption and utilization of gas and electric energy for the purposes of light, heat, and power, and to recover charges therefor; also to enter premises and remove meters therefrom when a supply of gas or electricity has been discontinued. It is proposed to alter the date for making up the accounts of the electric light undertaking, and to appoint an auditor or auditors of the borough accounts, in addition to, or in substitution for, the auditors under the Municipal Corporations Acts. The Corporation will ask for an extension of their borrowing powers.

Cheltenham Corporation Gas.—Power will be sought by the Cheltenham Corporation to purchase, by compulsion or agreement, the undertaking of the Cheltenham Gas Company; maintain, continue, and enlarge the existing works; and supply gas in the parish and borough of Cheltenham, as well as in various adjacent parishes. The Company's Acts are to be amended and applied to the Corporation; and the Company will be dissolved. Special provision is to be made for the appointment of auditors of the accounts, and for dealing with any surplus income accruing from the gas undertaking after its transfer to the Corporation. Additional borrowing powers will be required.

Cheltenham Gas.—The Cheltenham Gas Company intend to apply for authority to consolidate their capital into one class of stock, and define the amount of dividend to be paid thereon; also to raise more capital. Additional lands will be required for extending the works; and it is proposed to construct a railway from them to the Midland Railway. In the Bill to be promoted, further provisions will be included as to the supply of gas and fittings, &c.

Chester Corporation.—The Corporation of Chester intend to apply for power to construct a weir or tidal dam and works in or across the River Dee, and for authority to prevent the pollution of the river above the weir. In the Bill to be promoted, there will be provisions for contributions being made to the expenses by the Chester Water Company and landowners who will be benefited by the works. It is proposed to give power to the Company to supply water to the public baths, &c., and to apply their funds and raise other money for the purposes specified. The Corporation will ask permission to borrow more money.

Colwyn Bay and District Gas.—The Colwyn Bay and District Gas and Lighting Company, Limited, desire to be dissolved and re-incorporated with power to supply gas in Colwyn, Colwyn Bay, Llandrillo-yn-Rhos, and Eirias. It is proposed to define the existing capital, and apply for authority to increase it. The present works are to be extended on lands to be purchased. The Company will ask to be empowered to manufacture and deal in stoves, machinery, and appliances, sell gas in bulk, and generally carry on their business with the usual rights and privileges.

Cowes Gas.—The Cowes Gaslight and Coke Company intend to apply for authority to dissolve the original Company, and re-incorporate it under the name of the Cowes Gas Company, or such other as may be determined, with powers of supply in the parishes of Cowes and Northwood. It is proposed to continue the existing, and construct additional works on the lands at present held, or on others to be acquired; to manufacture gas, residuals, meters, fittings, &c.; and to supply gas in bulk. Further capital will be required.

Darlington Extension and Improvement.—The Darlington Corporation contemplate carrying out a number of schemes for the improvement of the town; and they will apply for the necessary authority to enable them to do this. They wish for power to purchase compulsorily lands for the extension of the gas-works and for constructing electric light works, to manufacture and convert residual products, and to charge differential prices for gas. The electric lighting area is to be enlarged. Provisions are to be made with respect to the supply of water to certain specified classes of houses, and the prevention of waste and contamination. Meters and fittings may be provided by the Corporation, who will ask to be allowed to raise more money.

Derby Corporation Water.—The Derby Corporation intend to apply for authority to acquire, by compulsion or agreement, all or part of the undertaking of the Meerbrook Sough Company, and construct certain water-works, consisting of a pumping-station at Crich, a conduit or pipe-line from the sough to the station, a service reservoir at Crich, and other pipe-lines. It is proposed to extend the present limits of the Corporation, and to apply thereto existing enactments relating to water supply. Power will be sought to use for the above-named purposes money raised under the provisions of the Derby Corporation Act, 1890, and to obtain more on loan.

Drogheda Corporation.—The Drogheda Corporation have given notice of their intention to promote a Bill for the extension of their boundaries; and it will include provisions for the purchase, compulsorily or by agreement, of the undertaking of the Drogheda Water-Works Company, with the powers of supply and other privileges appertaining thereto. The Company will, of course, be dissolved. Authority will be sought to acquire lands and construct and maintain additional works; and for these and the general purposes of the business further borrowing powers will be asked.

Dublin Corporation.—The Dublin Corporation intend to apply for power to supply water to the Commissioners of the several townships of Pembroke, Kilmainham, Blackrock, Kingstown, Dalkey, Killiney and Ballybrack, Bray, Clontarf, and Drumcondra, and to prescribe the quantity of such supply per head of the population of such townships; also to provide that all water taken by the Commissioners shall be supplied by meter, and prescribe the price and the mode of payment by the Commissioners, or any of them, for such water; and further to provide for the recovery of any sums due to the Corporation in respect of this supply. In the Bill to be applied for, provisions will be included in regard to the testing of gas. These are noticed in another part of the JOURNAL.

East London Water-Works (Height of Supply).—The London County Council intend to apply for power to make further provision with respect to the supply of water by the East London Water-Works Company. The "further provision" in question is, in fact, to require the Company to keep water supplied constantly throughout their district, at such a pressure as will make it reach the top of the highest houses. It is proposed to ask for the repeal of so much of the East London Water-Works Act of 1853, or of any other Act relating to the Company, as excepts from incorporation therewith section 35 of the Water-Works Clauses Act, 1847; and likewise the repeal of section 60 of the East London Water-Works Act, 1853, and the incorporation with the Company's Acts of section 35 of the General Act of 1847. Any provisions of this Act which are not now applicable to the Company are to be extended to them, with or without modification. The Company are to be subject to penalties for failure to comply with any of the provisions of the intended Act; and it is proposed that the Council shall have power to sue for them. The Company's Acts of 1853, 1854, 1862, 1867, 1881, 1886, and 1894, and any others affecting them, are to be amended as far as may be necessary.

East Surrey Water.—The East Surrey Water-Works Company desire authority to purchase the undertakings of the Reigate and Kenley Water Companies, and extend their limits of supply. It is proposed to exclude portions of Banstead and Kingswood or Ewell from the area of the Sutton District Water Company; and provision will be made for purchasing works within the extended limits. The debenture stock of the Company is to be consolidated; and additional capital will be applied for.

East Warwickshire Water.—The East Warwickshire Water Company intend to apply for authority to construct new works, comprising a pumping-station and a reservoir at Bedworth, another pumping-station at Chilvers-Coton, and three conduits or pipe-lines; and to increase the rates and charges prescribed by their Act of 1882. Additional capital will be required.

Eastbourne Corporation Water.—The Corporation of Eastbourne have given notice of their intention to apply for an Act to empower them to introduce a new supply of water into the town. It is proposed to construct a pumping-station (to be called the Friston station) in the parish of Westdean, a reservoir on Warren Hill, and several aqueducts or pipe-lines, one of which will terminate in the Paradise reservoir of the Eastbourne Water Company. Power will be sought to purchase the Company's undertaking by compulsion or agreement; and their works are to be maintained and improved. The present limits of supply are to be extended, and regulations laid down for preventing undue consumption and waste. Underground and other waters are to be diverted and appropriated, and lands and easements purchased compulsorily. Money powers will be included in the Bill to be promoted.

Eastbourne Water.—The Eastbourne Water Company are desirous of extending their limits of supply; and they purpose asking Parliament to authorize them to do this, and also to construct new works, comprising pumping-stations in the parishes of Jevington and Friston, and various pipe-lines. Additional capital will be applied for. The Bill to be promoted will include provisions in regard to agreements between the Company and local authorities as to the supply of water in bulk, and the raising and application of funds.

Edinburgh Extension.—Application is to be made for an Act to extend the boundaries of Edinburgh so as to incorporate Leith and Portobello and certain other districts. It is proposed to dissolve the Gas Commission of the Edinburgh and Leith Corporations, and also the Edinburgh and District Water Trust, and vest their powers and property in the enlarged Corporation. The scheme comprises necessarily the acquisition of the undertaking of the Portobello Gas Company, and the extension of the limits of both gas and water supply. Authority will be sought to raise more money.

Falkirk and District Water.—The Falkirk and Larbert Water Trustees purpose making application for power to construct additional works, acquire lands, and impound water. The area of compulsory supply is to be extended and defined; and provision will be made for the levying of rates and charges, and the alteration thereof. Additional money will be required.

Fylde Water.—The Fylde Water Company intend to seek power to construct new works, consisting of an aqueduct or pipe-line from their existing filter-beds to the township of Blackpool, in the parish of Bispham. Application will be made for an extension of the limits of supply, and for authority to raise more capital.

Guildford Gas.—The Guildford Gas Company will apply for power to construct a line of railway to connect their works with the London and South-Western Railway; and to acquire lands for this purpose and for the manufacture and storage of gas and residuals. The Bill to be promoted will contain provisions for enabling the Company to produce and supply electricity for lighting, &c., construct and acquire works, rights, and machinery, and apply their capital to all or any of these purposes. The present capital is to be consolidated; and more money will be wanted.

Huddersfield Improvement.—The Huddersfield Corporation intend to apply for power to carry out a number of works for the improvement of the town; and among other things in contemplation is the purchase by agreement, and with the sanction of the Local Government Board, of the undertaking of the Longwood Gas Company, and the dissolution of that Company. Authority will also be sought to manufacture and store gas and residuals on further lands in Huddersfield. Provision is to be made that "notice shall be given to the Corporation before any pipes or fittings used for the conveyance or consumption of gas are covered over;" and the Corporation will ask to be empowered to "inspect and examine the same, and compel the removal of such as, from their natural construction or workmanship, would be likely to allow of an escape of gas," and to "prescribe the material, size, and strength of any pipes and fittings so to be used." Another matter for which sanction will be asked is the alteration of the position in the gas-works of the testing-place prescribed in section 28 of the Huddersfield Corporation Water-Works and Improvement Act, 1876. Additional borrowing powers will be applied for.

Huddersfield Water-Works.—The Huddersfield Corporation will apply for authority to lay a line of pipes from the Deer Hill reservoir to Shepley, at which place they purpose constructing a service reservoir. In connection with these works, additional lands will be required. The Corporation will also ask for an extension of time for the completion of the Blakeley reservoir, and also for additional borrowing powers.

Ilfracombe Gas.—The Ilfracombe Gas Company intend to apply for power to extend their limits of supply, acquire lands, and erect new works for the manufacture and storage of gas and residual products; such lands being situated at Hele, in the parish of Ilfracombe. It is proposed to construct a wall, embankment, or breakwater, and dredge and reclaim the foreshore at Hele. The Company will also seek power to enter into agreements with local authorities and other persons for the sale of gas in bulk or otherwise within or beyond their limits; and they will ask for authority to manufacture and deal in stoves, machinery, and other apparatus or appliances. They also

wish to be authorized to obtain power to produce and supply electricity for lighting and other purposes, and to construct and acquire works, rights, and machinery for this purpose. Additional capital will be required; and the shares of the Company are to be consolidated and converted.

Kent Water Board.—Application is to be made for the constitution and incorporation of a Water Board for the urban districts of Beckenham, Bromley, Dartford, Erith, and Bexley; and the rural districts of Bromley, Dartford, and Sevenoaks, in the county of Kent. Particulars in regard to this scheme were given in the JOURNAL last week (p. 1099).

Kirkcaldy and Dysart Water.—The Water Commissioners of Kirkcaldy and Dysart will apply for authority to construct new works in order to afford an additional supply of water for general purposes and for compensation. They comprise a reservoir, bye-wash, filter-beds, aqueducts, and pipe-lines in the parish of Leslie; a distributing reservoir, aqueducts, and pipe-lines in the parish of Dysart; and a reservoir and other works in the parish of Portmoak. Power will be sought to acquire lands, streams, and other property compulsorily or by agreement, and to supply water in and beyond the present limits. More money will be applied for; and permission will be asked to alter the existing rates and charges.

Lanarkshire (Middle Ward District) Water.—Authority will be sought by the District Committee of the Middle Ward of Lanark to abandon certain works authorized by the Lanarkshire (Middle Ward District) Water Act, 1892, and construct new works, comprising a number of reservoirs and pipe-lines. Power will be sought to acquire land and divert and appropriate water, to levy rates and charges, and to borrow money.

Leamington Corporation.—In a Bill of which notice has been given by the Leamington Corporation, provisions will be included for the purchase, by compulsion or agreement, of the undertaking of the Leamington Priors Gas Company, and the consequent dissolution of the Company—all their rights, powers, and privileges being transferred to the Corporation. Other provisions relate to water supply; extension of the Corporation's powers being required with respect to pressure, rates and charges, sale by measure, supply of fittings, the payment of rates by owners of small houses, and other matters. Further borrowing powers will be applied for.

London Sea Water Supply.—Notice has been given of an intended application to Parliament for power to form a Company for carrying out a scheme of sea water supply for London. The head works are to be at Lancing, in Sussex, where there will be a reservoir; another is to be at Bramber, and the various conduits will connect these reservoirs and bring the water to the Metropolis. The pipes will pass through Steyning, Horsham, Dorking, Leatherhead, Epsom, Wimbledon, Mitcham, Tooting Graveney, Streatham, Clapham, Battersea, Chelsea, Kensington, and the various parishes in and adjacent to the City. There will be sixteen conduits in all; and the London terminus is to be at the junction of Great College Street with Abingdon Street, Westminster. The Company will ask for powers to supply consumers with sea water in all the districts specified in the notice, as well as in all others through which their pipes pass. All the usual privileges granted to suppliers of water will be applied for.

Malvern Link.—The Malvern Link Urban District Council desire to extend the area under their control, and carry out some important works to improve the supply of water. These comprise a storage reservoir and filter-beds, in the parishes of Colwall and Mathon Royal, in Hereford and Worcester, and a number of conduits or pipe-lines connected therewith. Power will be sought to interfere with land springs, streams, roads, and other property; to supply water in the ordinary way and in bulk; to levy rates and charges, &c. Provision will be made for furnishing compensation water to streams; and also as to raising more money.

Manchester Corporation.—In a Bill to be promoted by the Manchester Corporation to enable them to carry out certain street improvements, provision will be made for the transfer to the Corporation of the townships of Partington and Carrington from the district now served by the North Cheshire Water Company, with powers of supply therein, and for the necessary amendment in this respect of certain Acts and Orders of the Company and Corporation respectively. Further borrowing powers will be included.

Matlock Bath Gas.—Authority will be sought by the Matlock Bath and Scarthin Nick Urban District Council to acquire the undertaking of the Matlock Bath Gas Company, Limited, and manufacture and supply gas in the district of the Council, in the urban district of Bonsall, and such parts of the urban district of Matlock and the rural district of Cromford as may be defined. The usual powers (including the inspection and testing of gas-fittings in new buildings) will be applied for, as well as permission to raise more money.

Newcastle-upon-Tyne and Gateshead Gas.—The Newcastle-upon-Tyne and Gateshead Gas Company intend to seek authority to acquire, by compulsion or agreement, certain lands for the enlargement of their works; and they will ask for an extension of the power to lay mains outside their district, so as to make a connection between the existing and the proposed new works. They wish to be empowered to enter into agreements with any other gas company for the sale in bulk to such company of gas manufactured by the Newcastle Company; and also with any local authority, body, or person for the supply of gas beyond the Company's authorized limits, and not within those of any other gas company. Additional capital will be required.

New River Company.—The New River Company have given notice of their intention to apply for power to carry out an extensive series of works, a general indication of which appeared in the JOURNAL last week (p. 1098).

North Wales Counties Lunatic Asylum (Water Supply).—The Visiting Committee of the North Wales Counties Lunatic Asylum, situate at Denbigh, intend to apply for power to construct water works, and to impound and abstract the waters of Llyn Bran, in the parish of Nantglyn, in Denbigh, and of the Afon Brenig stream. The Committee wish for authority to supply water to anybody within a "reasonable distance" of the proposed works, and to levy charges therefor; also to sell water in bulk. Power to apply the county fund, and other money to be raised, for the above-named purposes, will be included in the Bill.

Padiham Urban District Council (Water).—The Padiham Urban District Council desire an extension of time for the construction of certain works authorized by the Padiham Local Board Act, 1889; and also of the period within which certain rights, easements, and privileges, granted by an indenture dated Nov. 1, 1892, may be exercised. Additional money powers are to be applied for.

Porthcawl Water.—The Porthcawl Water Company, Limited, desire to be dissolved and re-incorporated, with power to continue and enlarge their existing works, supply water in Newton Nottage and Sker, levy rates and charges therefor, deal in fittings and meters, and generally carry on the business of a water company. The capital is to be defined and regulated.

Portsmouth Water.—The Borough of Portsmouth Water-Works Company intend to apply for power to carry out certain extensions, and to acquire additional lands and springs. It is proposed to alter the limits of supply so as to include parts of Chalton, Porchester, and Westbourne; and permission will be asked to apply the present funds and to raise more money for the purposes specified.

Redheugh Bridge.—The Redheugh Bridge Company propose applying for power to remove and re-construct their bridge; and they will ask that the Newcastle and Gateshead Gas and Water Companies may be required to subscribe towards the expenses; the right being accorded to them to lay down and maintain their pipes on the bridge, on terms to be agreed upon.

Sandwich Corporation Gas.—The Corporation of Sandwich purpose applying for authority to acquire land and construct works for the manufacture and storage of gas and residual products, and to supply gas within the borough; also to purchase, by compulsion or agreement, the undertaking of the Sandwich Gas Company. Power will be sought to maintain, continue, extend, enlarge, and, if deemed necessary, discontinue the existing works of the Company, sell the site and plant, and dispose of the proceeds; supply gas and fittings within the borough; enter into agreements with other authorities or companies as to the sale of gas in bulk; and levy rates and charges. The necessary borrowing powers will be applied for.

Sheffield Corporation Water.—The Corporation of Sheffield wish to be empowered to construct new reservoirs and carry out other works to improve their water undertaking. It is proposed to make one reservoir at Langsett, in the parish of Penistone, another at Bradfield, in the parish of Ecclesfield, and a third to be situated partly in Langsett and Hunshelf and partly in Bradfield; and, in connection therewith, construct various pipe-lines and incidental works. Power will be sought to divert and use the waters of the Little Don or Porter River, and its tributaries. Provision will be made for giving compensation, and for the supply of water to the Corporations of Barnsley, Rotherham, and Doncaster, with whom, either collectively or singly, agreements may be made. These Corporations are to be authorized to increase their rates and borrow money; and the Rotherham Corporation are to have power to consolidate their loans, and spread their repayment over an extended time. Costs were incurred in opposing the Barnsley Water Bill of last session; and provision is to be made for paying these and the costs of the application now to be made. Among the other matters contained in the notice are power to purchase lands, to charge to capital account the cost of meters supplied by the Corporation, to purchase the water undertaking of the Stocksbridge Urban District Council, to sell water to local authorities, and to raise more money on loan.

South Metropolitan Gas.—The principal portions of the notice given by the South Metropolitan Gas Company of their intention to promote a Bill for converting the capital and other purposes, were published in the JOURNAL last week (p. 1092).

Southwark and Vauxhall Water.—As mentioned in the JOURNAL last week (p. 1098), the Southwark and Vauxhall Water Company intend to apply for power to carry out an important scheme for the extension of their works. It comprises wells, adits, and two pumping-stations at Harefield; four storage reservoirs, each having a superficial water area of 250,000 square yards, at Walton-upon-Thames; and various conduits or pipe-lines passing through Harefield, Hillingdon, East and West Hillingdon, Uxbridge, Southall, Hayes, Norwood, Heston, Isleworth, Twickenham, Hampton, Hayes End, Walton, and West Molesey. Power will be sought to purchase lands and easements, to connect various portions of the works, to purchase or otherwise acquire water in bulk, &c. Additional share and loan capital will be applied for; and special provision is to be made as to the manner of raising it.

Staines Reservoirs.—Notice has been given of an intention to apply to Parliament for authority to form a Joint Committee of representatives of the West Middlesex, the Grand Junction, and the New River Companies to carry out the scheme of reservoirs at Staines which was prepared by Mr. W. Hunter and the late Mr. A. Fraser, and laid before the Royal Commission on Water Supply presided over by Lord Balfour of Burleigh. Particulars in regard to this scheme appeared in the JOURNAL last week (p. 1097).

Whittington Gas.—The Whittington Gas Company, Limited, desire to be dissolved and re-incorporated with change of name, and power to manufacture and supply gas in the parishes of Whittington and Brimington, in Derby; to sell gas in bulk for supply within or beyond the Company's limits; to make and sell meters, fittings, &c.; and to levy rates and charges. Provisions in regard to capital will be included in the Bill to be promoted.

Ystrad Gas and Water.—The Ystrad Gas and Water Company intend to apply for authority to construct new works, comprising two reservoirs, a pumping station and tank, a service tank, and several conduits or pipe-lines. Additional capital will be required for the purpose.

Ystradyfodwg Urban District Council Gas and Water.—The Ystradyfodwg Urban District Council intend to apply for power to purchase, by compulsion or agreement, the undertakings of the Ystrad Gas and Water Company, and to carry them on with all the usual privileges. They will ask for authority to continue and maintain the existing water-works and construct new works, divert and use waters,

purchase lands, streams, &c. They will also seek authority to make bye-laws, rules, and regulations, and levy rates, rents, and charges. Additional borrowing and other powers will be sought. In the event of the consideration or value of the undertakings being determined by arbitration, the Arbitrators are to have regard, among other matters, to the following, or some of them: The adequacy and efficiency of the present sources of water supply, and of the reservoirs, filter-beds, filtration arrangements, wells, mains, conduits, pipes, machinery, and plant of the Company to meet present and future requirements; the probable necessity of the future introduction of a new source of supply of water, or new or improved water-works; and the deductions from any compensation claimed by the Company which may, in the opinion of the Arbitrators, be reasonably made in respect of any insufficiency of the present storage or filtration of the Company, or of the provision of supplementary supplies of water.

NOTICES OF APPLICATIONS TO THE BOARD OF TRADE FOR PROVISIONAL ORDERS (SESSION 1896).

Under the Gas and Water Works Facilities Act, 1870.

Amersham, Beaconsfield, and District Water.—The Amersham, Beaconsfield, and District Water Company, Limited, will apply for power to construct works and supply water in the parishes of Amersham, Coleshill, Beaconsfield, Chesham Bois, Chalfont St. Giles, Chenies, Seer Green, Penn, and Tyler's Green, all in Bucks. The works comprise a well and pumping-station at Amersham, a service reservoir at Coleshill, and various aqueducts or pipe-lines. Authority will be sought to raise money and levy rates and charges.

Ampthill Water.—Application is to be made by Mr. J. T. Green, of Ampthill, for authority to construct works and supply water in the parishes of Ampthill, Houghton Conquest, Barton, Higham, Gobion, Silsoe, Flitton, and Mauldon, in Bedfordshire, and in bulk or otherwise to local and sanitary authorities, companies, and persons within or beyond those limits. The principal works are to be situated at Barton-in-the-Clay, whence the water will be conveyed by a conduit, passing through most of the above-named places, to a reservoir at Ampthill, from which it will be distributed to the town. The usual general powers, as well as others in regard to the raising of capital, will be applied for.

Bishop's Waltham Water.—The Bishop's Waltham Water-Works Company, Limited, intend to apply for authority to extend the limits of supply defined by the Bishop's Waltham Order, 1894, so as to include the parishes of Corhampton, Curdridge, Droxford, Exton, Hambledon, Meonstoke, Shedfield, Swanmore, Soberton, Upham, Warnford, and West Meon, all in the county of Southampton. Additional share and loan capital will be required.

Burnham and District Water.—The Burnham, Dorney, and Hitcham Water Company, Limited, will ask to be authorized to continue and maintain water-works, open streets and roads, supply water by meter or otherwise, provide meters and fittings, and generally carry on the business of a water company, in Burnham, Dorney, Hitcham, and Farnham Royal. It is proposed to amend the provisions of the Slough Water-Works Act, 1875, and any other Act or Order relating to the Slough Water Company, and to define or modify their limits. Capital powers will be applied for.

Chester-le-Street and Pelton Gas.—The Chester-le-Street and Pelton Parish Lighting Company, Limited, intend making application for leave to extend the works at South Burns, Chester-le-Street. Power will also be sought to enable the Company to sell gas in bulk, supply gas fittings and appliances, and acquire and hold patent rights and licences in relation to the manufacture of coal tar, coke, pitch, and all other residual products. The capital of the Company applicable to these purposes is to be fixed and defined, and authority to raise more money will be sought.

East Huntingdonshire Water.—The East Huntingdonshire Water Company will apply for power to construct additional works, consisting of a well and pumping-station at Bassingbourn, in Cambridge, and an aqueduct or pipe-line starting therefrom and ending at Bourn in a junction with the Company's present main. The limits of supply are to be extended. The Company will ask for an alteration and definition of existing capital, and power to raise more money.

Fort William Gas.—Mr. Hugh Mayberry, of Glasgow, intends to apply for power to continue and maintain the gas-works now existing at Fort William, in the county of Inverness, and to supply gas, meters, fittings, &c. The limits of supply are to be defined; and power will be sought to lay mains and pipes, break up streets, and levy rates and charges. The existing capital is to be defined and regulated.

Hemel Hempstead Water.—The Hemel Hempstead Water-Works and Laundry Company, Limited, will ask for authority to maintain and continue their existing works, and construct new ones. The Order to be applied for will define the limits of supply, and contain provisions as to the levying of rents, rates, and charges. The capital is to be regulated and defined; and power to raise more money will be sought.

Laindon Gas and Water.—Application will be made for authority to incorporate a Company to construct gas and water works, and manufacture and supply gas and supply water in the parishes of Laindon Hills, Lee Chapel, Laindon, Little Burstead, and Great Burstead (including Billericay), in Essex. The usual powers will be sought to lay mains and pipes, break up roads, levy rates and charges, and supply fittings and apparatus.

Maidstone Gas.—The Maidstone Gas Company intend to apply for an enlargement of their existing borrowing powers so as to be enabled to raise by loan an amount equal to one-third of the entire share capital, including premiums, instead of the sum now authorized. The provisions of the Company's Acts of 1858 and 1880 are to be altered in those parts which are inconsistent with the objects of the intended Order.

Maidstone Water.—The Maidstone Water Company purpose applying for authority to consolidate their existing capital, and to raise further money by the issue of shares or upon debentures.

Matlock Bath Gas.—Application is to be made by the Matlock Bath Gas and Coke Company, Limited, to maintain, continue, and enlarge their existing works, and manufacture and supply gas within the urban districts of Matlock, Matlock Bath, and Scarthin Nick (except such parts as are now supplied by the Matlock and District Gas Company, Limited), and Bonsall, and the rural district of Cromford, all in Derbyshire; also to sell gas in bulk. Further capital will be applied for.

Oswestry Gas.—The Oswestry Gaslight and Coke Company, Limited, will apply for power to maintain and continue their gas-works, and manufacture and supply gas in the parishes of Oswestry (urban and rural), Selattyn, and Whittington, in Shropshire; to make agreements with local authorities and others, and sell gas in bulk for use beyond those limits; and to supply gas fittings, apparatus, &c. The existing capital is to be defined; and provision will be made for increasing it.

Settle Gas.—The Settle Gas Company, Limited, will seek power to maintain and continue their existing gas-works between Settle and Giggleswick, in the West Riding of Yorkshire, and to supply gas in bulk to any local authority or gas company for resale and distribution in adjacent districts beyond the locality supplied by the Company. They also seek to be authorized to supply gas in the whole of the townships of Settle and Giggleswick; and to have conferred upon them the usual powers in reference to gas-stoves, cooking apparatus, and all other articles connected with the consumption or use of gas. The existing capital is to be defined and regulated; and such provisions as may be deemed expedient in regard thereto will be applied for.

Tilehurst, Pangbourne, and District Water.—The Tilehurst, Pangbourne, and District Water Company, Limited, intend to apply for authority to extend their limits of supply to certain other contiguous places in Berkshire and Oxfordshire; and they will ask for additional capital for the general purposes of their undertaking.

Under the Electric Lighting Acts, 1882 and 1888.

Applications will be made under the above-named Acts for powers in regard to the supply of electricity for lighting and other purposes in the following places: Allerton, Ashton-on-Mersey, Ambleside, Bangor, Bath, Battersea, Bray (Ireland), Bristol (Suburbs), Colwyn Bay, Cork, Cowes, Devonport, Folkestone, Gloucester, Godalming, Great Berkhamstead, Great Crosby, Huddersfield, Huyton-with-Roby, Ipswich, Keswick, Kettering, King's Lynn, Kingston, Lincoln, Liverpool, London (South), Manchester, Margate, Merthyr Tydfil, Middleton, Newington, Newmarket, Pembroke, Prescot, Queenstown, Rathmines, and Rathgar, Sale, and Wells.

NOTICES OF APPLICATIONS TO THE LOCAL GOVERNMENT BOARD (SESSION 1896) FOR PROVISIONAL ORDERS.

Under the Gas and Water Works Facilities Act, 1870, and the Public Health Act, 1875.

Driffield Gas.—The Urban District Council of Great Driffield will apply for authority to acquire the undertaking of the Driffield Gas Company, continue and extend the existing gas-works, manufacture and sell gas and fittings, and generally carry on the business of gas supply. Power to borrow money will be sought.

Sandwich Corporation Gas.—The Sandwich Corporation intend to apply to the Local Government Board for authority to purchase by agreement the undertaking of the Sandwich Gas Company, and carry it on with all the privileges usually conferred on suppliers of gas. The limits of supply are the borough of Sandwich; but the Corporation will ask to be authorized to sell gas in bulk to parties outside. An extension of the borrowing powers of the Corporation will be required.

South Molton Gas.—The Corporation of South Molton purpose making application for power to purchase the undertaking of the South Molton Gas Company, to manufacture gas and residuals, and generally carry on the business of gas supply in and beyond the borough. Authority will be sought to raise money for the above-named purposes on the security of the rates.

Willson and Ellis's Improved Metallic Carbides.—As bearing more or less directly upon the gas industry, notice may here be taken of an announcement that application is to be made to Parliament next session for an Act to antedate, continue, and confirm letters patent granted or to be granted in respect of the following applications: Application for letters patent, bearing date the 1st day of September, 1894, and numbered 16,705, by Thomas Leopold Willson, Electrical Engineer, of No. 19, West Thirty-Eighth Street, New York, for the term of fourteen years, for an invention of "Improved metallic carbides for use in the production of acetylene, and means for producing the same." Application for letters patent, bearing date the 27th day of August, 1894, and numbered 16,342, by George Beloe Ellis (a communication from Thomas Leopold Willson), for a term of fourteen years, for an invention of "Improvements in the production of metallic carbides, and of illuminating gas derived therefrom." Authority will be sought for the Comptroller-General of Patents, Designs, and Trade Marks to antedate these patents to Feb. 28, 1894, the date of the application in the United States; and after this has been done, the patents are to be valid as from that date.

The East London Water Company's Reservoirs.—The great reservoir for filtered water which the East London Company have been constructing at Hagger Lane, Walthamstow, is rapidly approaching completion. It was reported some time ago that it had sustained serious damage; and, considering the magnitude of the work, the report was a somewhat serious one. It is a large brick and concrete reservoir capable of holding 8 million gallons of water; and it is to be arched over. Three or four hundred men have been engaged on the construction of it ever since the spring. What really happened was that a small portion of one of the walls slipped on its foundation. Very little injury was caused; and what was done has been repaired.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Wednesday, Nov. 27.

(*Before the* LORD CHIEF JUSTICE *and a Special Jury.*)

The Fareham Electric Light Company, Limited, v. The Fareham District Council.

In this case, the plaintiff Company sought to recover damages from the defendants in respect of an alleged breach of a contract by the latter to purchase the undertaking of the Company at a price to be fixed by arbitration.

Mr. ROBSON, Q.C., and Mr. R. M. BRAY appeared for the plaintiffs; Sir E. CLARKE, Q.C., Mr. CHANNELL, Q.C., and Mr. GLEN represented the defendants.

Mr. ROBSON, in opening the case, said the Fareham District Council were the successors of the Fareham Local Board, whose liabilities they had taken over. The Fareham Electric Light Company was a small Company incorporated in 1890 for the purpose of supplying electric light to the district of Fareham; and it was composed of persons resident and interested in Fareham. Prior to the formation of the Company, the town was lighted by gas; but there had been very considerable complaints, and there was great feeling in the district with regard to the way in which both the public and the private lighting was carried out, and as to the desirability of introducing the electric light. In June, 1890, the Company entered into a contract to supply the Local Board with the electric light for three years. The terms were very low—being only 3d. per unit; whereas they were charging 8d. per unit to private consumers. In February, 1892, there was an inquiry by the Board of Trade in regard to obtaining a Provisional Order; and one was granted in which there was a clause authorizing the Company to transfer their business to the Local Authority. There was also a clause whereby the undertakers were, within a period of two years from the granting of the Order, to remove certain overhead wires and put them underground. These wires were not taken down by the stipulated time, nor were they removed when the Board agreed to purchase the undertaking. During the first three years, the working of the Company resulted in a loss; and in 1894, the Directors came to the conclusion that, unless they could get more support from the public, and a larger sum from the Local Board for the supply they were furnishing to them, they would not be justified in going on. They accordingly wrote to the Board, offering to sell the undertaking by valuation or at cost price. Nothing was done on this offer; and on the 28th of May, 1894, the Company informed the Board by letter that, unless something was done, they would have to apply to the Board of Trade for leave to abandon the Order. On the 4th of June, the Board decided to buy for a fixed sum; and on the 15th, their Clerk transmitted a copy of that resolution to the Company. The sum fixed was £5000; the Company to remove the overhead wires and erect a new engine at a cost of not more than £1000. Several meetings of the ratepayers in Fareham were held on the question of whether the Company's undertaking should be purchased; the feeling in favour of a purchase, if any, by valuation, and not at a fixed sum, prevailing. On the 16th of August, the contract in question was entered into, whereby it was agreed that the Company should sell and transfer, and the Local Board should purchase, the defendants' undertaking, at a price to be ascertained by the valuation of it as a going concern—the sum to be fixed by arbitration. The most important clause in this contract was that the Company should use their best endeavours to obtain from the Board of Trade their approval of the transfer of the undertaking, and that the Board should be equally diligent in trying to obtain from the Local Government Board their approval of the transfer, and their sanction to the borrowing by the Board of the amount required for the purchase. This was the contract which the plaintiffs alleged that the defendants had broken, because they had not used their best endeavours to obtain the consent of the Local Government Board, but, on the contrary, had done their utmost to cause it to be withheld. The Arbitrators appointed had assessed the value of the undertaking at £4886.

Mr. *J. Blake*, the Manager of the Company, was called, and proved the correspondence which had taken place between the parties, and also the contract in question. Witness was a member of the Local Board; but, except by inadvertence, he had not voted at the Board on the question of acquiring the electric light undertaking.

In cross-examination, he said that three of the members of the old Board who were in favour of the electric light had not since been re-elected.

Thursday, Nov. 28.

On the case being resumed to-day,

Sir E. CLARKE said his contention was that, if the Local Board had laid all the facts of the case before the Local Government Board, there was no probability of the latter giving their sanction to the contract. No doubt there had been a breach of the agreement on the part of the Board to use their best endeavours to obtain the requisite consent; but this was a question of damages.

The LORD CHIEF JUSTICE said he proposed to ask the jury whether they believed that, if the existing Council had represented to the Local Government Board that they wished the contract to be carried out, there was any doubt that that Board would have given their consent; or, if they had told the Local Government Board that they thought the contract was not an advantageous one, but that if they broke it they would incur heavy damages, whether the Board would not, in those circumstances, have given effect to the contract.

Sir E. CLARKE said the Local Government Board, in guarding the interests of the ratepayers, would have protected them by refusing to allow an expenditure to be incurred of which they disapproved.

The LORD CHIEF JUSTICE remarked that the carrying out of undertakings entered into in good faith by public bodies was a very important consideration.

Sir E. CLARKE said the Board carried through the contract in known disobedience to the views of the ratepayers whom they were supposed to represent.

Mr. ROBSON said he should submit, as a matter of law, that his learned friend was not entitled to lead evidence to any of the points he had taken. Sir E. Clarke had said that he did not charge dishonesty in the sense of actual fraud; but that the Local Board took advantage of an accidental position in order to carry out a contract that was not for the benefit of the ratepayers.

The LORD CHIEF JUSTICE said, if the parties agreed that the jury should be discharged, he would give his ruling on the point, so that the matter might go straight to the Court of Appeal.

This course was not assented to.

Mr. *Blake* was then cross-examined as to his interest in the Company, and the meetings which had been held in the district in regard to the advisability of purchasing the electric light undertaking.

Sir E. CLARKE, for the defence, said he would not deny that a contract had been entered into whereby the Local Board were to use their best endeavours to obtain a loan for the purpose of purchasing the electric light undertaking. But the purchase was to be conditional on the sanction of the Local Government Board being obtained; and the jury would have to consider whether, in all the circumstances of the case, it was probable that that Board would have sanctioned such a loan. The contract was drawn up in such a way that, if the Local Government Board had attached any onerous conditions to the granting of the loan, such as its speedy repayment, the Board could have legally declined to carry out the contract.

The LORD CHIEF JUSTICE then summed up the case.

After a brief deliberation, a verdict was returned for the plaintiffs for £3800.

His LORDSHIP granted a stay of execution until the 15th of January next, with a view to an appeal.

CAMBRIDGE COUNTY COURT.—Wednesday, Nov. 20.

(*Before His Honour Judge* BAGSHAWE, Q.C.)

The Charges for High Water-Services at Cambridge.

Several water-rate cases instituted by the Cambridge Water-Works Company were heard to-day. The first (against Mr. A. A. Walker) was the most interesting; the facts being briefly these: The action was for two quarters' water-rate. The first item, 10s. 6d.—the percentage on the annual value of the house—was not disputed, nor was a charge of 2s. 6d. for the first water-closet; but the next item, 1s. 6d. for a second water-closet, was. Then "the first high service, 2s. 6d," was disputed as to charge; and the second and third high services were disputed *in toto*. The expression "high service" was defined by the Company's Act as a delivery of water, other than for a water-closet, at an elevation of more than 10 feet from the ground. The Company's practice had been, where they had to deliver above 10 feet from the ground, unless the water was used exclusively for a bath or water-closet (which were both charged for separately), to make high-service charges.

Mr. J. F. P. RAWLINSON appeared for the plaintiffs; Dr. COOPER represented some of the defendants.

Mr. RAWLINSON, having stated the case as above set forth, submitted that the test of a charge for high service was simply this: Did the Company supply from the mains into the consumer's tap, or whatever it was, at an elevation of 10 feet above the level of the ground? He explained that, in this instance, there were three deliveries above the 10-feet level; and therefore they charged for three high services. Regarding the charge for the second water-closet, the claim was made under section 37 of the Company's Act. The closet was not under the same roof as the house, but it had a roof that touched the house. It was supplied by the Company with water; and, Counsel remarked, from a common-sense point of view, surely they ought to be paid for it.

George Kirkup, one of the Company's inspectors of fittings, stated that there were two taps in the kitchen; two on the first floor over a hand-basin; and two in the bath-room over a hand-basin. The cold-water taps branched from the Company's rising main, which passed on to the cistern in the roof.

In cross-examination by Dr. COOPER, witness said there was only one rising main, which was first tapped in the scullery.

His HONOUR, after consulting a plan in conjunction with Counsel on both sides, said the chief point would be this: Was the pipe down to the point where it supplied the sink continuous with the rising main? If it was continuous, and was not interrupted by any tap or valve, from the main, then the point the Company made was that as long as the water was in the pipe it was in the Company's custody, and when it was out of the pipe it was "delivered" within the meaning of the Act.

Mr. RAWLINSON said that was his contention.

Mr. *W. J. Gwenfelt*, a clerk and draughtsman in the service of the Company, said he had been to the defendant's house, and had found that one water-closet was on the first floor, and the other just outside the door leading into the scullery. The roof of the closet touched the main building.

Dr. COOPER: If it was considered expedient or advisable, could not this water-closet be removed without affecting the scullery or the main building?

Witness: It need not affect what you may term the main building. But it would certainly affect the scullery; and that is a part of the main building.

His HONOUR said he thought he had all the material facts.

Dr. COOPER, in the course of his argument for the defendant, declared that it was a matter of notoriety that since the Company came into existence, up to within a few months ago, they had never made a claim for high service. The Act said the delivery at high service should mean, and should be considered as being, a delivery of water, other than for a water closet or a bath, at an elevation of 10 feet above the pavement. Therefore the delivery for a water closet or bath was not high service, unless there was a distinct and separate service on the part of the Company. There was no distinct and separate high service to the tap in the lavatory. The water which was discharged into the cistern was for the purpose of obtaining hot water for the bath, for which a charge was already made. Respecting the question of the second closet, the words of the section were "if in

any house;" and Counsel submitted that the second water-closet could not be said to be "in" the house, and therefore should be included in the domestic service.

Mr. RAWLINSON rose to reply to the argument advanced by Dr. Cooper; but

His HONOUR said he need not trouble him upon any of the points raised. His opinion was that the second water-closet was used for the purposes of the house, and was part of the same structure; and as to the rising main, in his opinion, at every point at which water was drawn off it was "delivered." His judgment was for the amount claimed, less 2s. 6d., with costs and Counsel's fee.

The other cases—in one of which the question as to high service was again raised—were all decided in the Company's favour; but they did not contain any other points of general interest.

Newhaven and Seaford Water Company.—The annual meeting of this Company was held last Tuesday, when it was reported that the result of the twelve months' working was a profit of £1150. The balance available for division was £1155; and the Directors recommended a dividend at the rate of 5 per cent. per annum. After paying this, a balance of £378 would remain, of which it was proposed to place £250 to the reserve fund. The report was adopted.

Incandescent Gas-Burners for Street Lighting.—There cannot now be the slightest doubt as to the success of incandescent gas-lamps for street lighting purposes in numerous towns; but they will not answer in Cardiff—at all events the Borough Engineer (Mr. W. Harpur) says so. At the last meeting of the Lighting and Electrical Committee of the Corporation, he reported upon a small installation of five of the lights that had been fitted up in Charles Street, and said he did not hesitate to give it as his opinion that they were not suitable for outdoor lighting. They were so delicate that, if anything went wrong with them, they could not trust a lamplighter to interfere with them, or set them right, but had to send a fitter. Only a short time ago, on a rather stormy night, two out of the five lamps could not be lit. The Cardiff Corporation are the owners of the electric lighting works.

The Average Meter Question in Canterbury.—At a meeting of the Canterbury Town Council last Wednesday, a letter was read from the Gas and Water Company declining to accept the Council's terms for fixing meters in various parts of the city, testing the illuminating power of the gas, and imposing a penalty of 1s. for every lamp found with the light extinguished when it should be burning—a rebate also to be made when the lamp-meters showed that the gas estimated had not been consumed. The Company declined to fix and maintain twenty meters at their own expense; and as to testing the gas, they insisted on receiving the two hours' notice allowed under their Act. The Town Clerk was directed to inform the Company that, if they would pay for ten of the meters, the Council would pay for the other ten; and if terms could not be agreed upon in respect of the meters and the other questions, the arbitration clauses of the Gas-Works Clauses Act of 1871 would be put into operation.

The Wentwood Water Scheme of the Newport Corporation.—At the meeting of the Newport Corporation last Tuesday, Colonel Lyne referred to an impression which had got abroad that the Wentwood water scheme had been abandoned by the Water Committee. He declared that this was not the case. The works had only been suspended; and he believed that ultimately they would be carried out. The Council subsequently went into Committee for the purpose of further dealing with questions affecting the scheme. It is reported that a deputation from the Committee have had an interview with Mr. J. Young, of Glasgow, the contractor for the new works, and have ascertained that he is willing for £60,000 to relinquish the contract, the total amount of which was about £90,000. For the £60,000, Mr. Young would leave the plant already on the ground, and afford the opportunity for the Corporation, by entering into other engagements, to complete the work, or vary it in any way which might hereafter be decided on. Mr. Young has, it is understood, been settled with.

Lecture on Coal Gas.—At a recent meeting of the Primitive Methodist (First Circuit) Improvement Society in York, a lecture on "Coal Gas" was given by Mr. J. H. Hill, the superintendent of fittings of the York Gas Company. It was accompanied by experiments, and was attentively listened to by a numerous audience. The preparation of coal gas was shown in operation and by diagrams, after which the various gases constituting it, in both its unpurified and purified state, were exhibited, and their characteristics indicated. One attractive feature of the experiments was the production of acetylene gas. The lecturer stated that efforts had been made to use acetylene as an enricher for gases of a poor quality; but the high price of calcium carbide, from which it was produced, precluded this at present. Doubtless cheapening would take place in time; and thus another means of improving gaslight would be placed in the gas manufacturers' hands. The various properties of coal gas, such as its explosiveness, its heating power, &c., were also noticed. At the close, a vote of thanks was passed to Mr. Hill for his interesting and successful lecture.

Fire in a Purifier at the Poplar Gas-Works.—A highly exaggerated account appeared in several of the London evening papers last Wednesday of an accident, attended by some personal injuries, which had occurred about seven o'clock in the morning at the Poplar works of the Commercial Gas Company. One of the halfpenny prints came out with the startling heading: "Gas Explodes and Injures Twenty-Four Men;" and anyone might have supposed, on seeing this, that the entire works had been wrecked. We learn, however, that the actual facts are briefly as follows: Owing to the recklessness on the part of the workmen themselves, in having lighted a gas-jet within 6 feet of a purifier-cover they were lifting, the gas left in the purifier after being shut off lighted, and burnt round the edges of the lid, but without explosion. As the purifier is 40 feet square, along the edge to which the current of air drew the gas there was for a few seconds a considerable flame, which slightly burnt five of the nearest men about their heads and hands. They walked to the Poplar Hospital to receive attention; and four of them were kept for the night. There was not the slightest damage to the purifier or the building, or to any of the appliances.

MISCELLANEOUS NEWS.

ORIENTAL GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Wednesday, at the Offices, Finsbury House, Blomfield Street, E.C.—Mr. J. BLACKET GILL in the chair.

The SECRETARY (Mr. H. J. Luff) read the notice calling the meeting; and the Directors' report and accounts were then submitted.

The CHAIRMAN, having welcomed the shareholders to the new offices, said the report entered so fully into the history of the Company during the past year that he did not think there was very much that it was necessary for him to dwell upon. With regard to the accounts, he found that they had spent more for coal. This arose from two causes, one of which was satisfactory, the other perhaps not so much so. In the first place, they had carbonized more coal to meet the demand for gas; but, on the other hand, he was sorry to say the price of coal had increased considerably in India, and their contracts for the next three years were somewhat in excess of the price they had previously paid. In the twelve months, they had received £1564 more in gas-rental, which was an increase of about 1¾ per cent., and was fairly satisfactory. They had also realized a further £1425 from residuals and fittings. There had been 185 new consumers, representing 625 additional burners, and 117 new lamps connected. All this, he thought the shareholders would agree, was gratifying. Unfortunately, the increased profit, as the report informed them, was almost swept away by £2402 extra loss on exchange; making the total of that item close upon £29,000. They had been enabled to put £1500 more to the reserve account. He desired to draw attention to the fact that this was a reserve account, because he remembered that, after the last meeting, upon some shares being offered for sale, it was stated that the Company had a good reserve fund. He wished that it were a fund invested outside the works; but the money was used in the works, and therefore it could only be called a reserve account. The Directors recommended the payment of a final dividend of 4½ per cent., which made the dividend for the past year the same as in the preceding year—viz., 8 per cent. per annum, after paying which they carried forward £2578 more than on the last occasion. Under these circumstances, he thought the shareholders would agree that the position of the Company was satisfactory. The private lighting showed a small increase; and it was now something like 41 per cent. of the whole of the lighting business. Their Manager (Mr. D. C. Niven) informed them that electricity had not made much progress in Calcutta. During the year, there had been a meeting there of electrical experts, who had decided that it would be unwise to lay electric mains in the streets; and they were consequently going to have overhead wires. He (the Chairman) thought that possibly the shareholders might regard this with a little satisfaction; it was certainly a slight advantage to them. They had, however, their Manager told them, a permanent and powerful rival in oil, which was unfortunate. One particularly satisfactory item in the accounts was that they had been able to pay off £7250 of debenture debt. He imagined the best thing they could do to strengthen their position was to repay all the debentures as they fell due. It was the policy of the Directors to keep paying them off; and he hoped, when their agreement expired, they would be free from debenture debt. He was sure the shareholders would approve of this policy. The incandescent gas-light, he thought, had been of some advantage to them in Calcutta. It might, and no doubt did, lessen the consumption of gas to some extent; but it was a strong opponent of electricity. The Incandescent Gaslight Companies seemed to be having a pleasant time among themselves; and he hoped the time would come when gas companies would obtain some of the advantages at a little less cost. However, the light was a useful handmaid to gas. He was sorry to say that, since the report was printed, an unfortunate accident had happened at their works. Three guide-wheel brackets of their larger gasholder had broken in the middle of the night. Their Manager was aroused by hearing a noise; and he found that the holder had got out of gear, and a quantity of gas had escaped. However, it really meant only a slight loss; and they might congratulate themselves that no lives were lost, and no further damage done to the works. They might also congratulate themselves on the fact that they had a Manager who was equal to an emergency of this sort. The Directors knew it had caused Mr. Niven a considerable amount of anxiety. They were, however, glad to learn that the holder was again at work; and though possibly it would require a little more repairing, he was glad the worst had passed. He was pleased to have this opportunity of bearing testimony to the ability their Manager had shown on many occasions, and to the thorough trustworthiness and willingness with which he entered into their interests, and strove to promote them. The agreement with the Municipality for public lighting expired in May, 1901. No further steps had been taken on either side as to a renewal; but they would be most happy at any time to meet the Municipality, to discuss the matter in a perfectly friendly manner. More than this, it would probably not be wise for him to say. A somewhat unique event had happened during the past year. One of the Directors (Mr. R. Miller) visited Calcutta on business of his own; and he very kindly spent some time in inspecting the Company's works, and making himself acquainted with their affairs there. No doubt Mr. Miller would tell the shareholders what he thought of their business. The Directors were very glad to have him among them, as his Indian experience was of great value to them. Their Sub-Engineer (Mr. Bertram Ellis) had been home on sick-leave this year; and the Directors had taken advantage of this to consult with him on various matters. The Company were in a fairly prosperous position; and were it not for the unfortunate rupee, they would be able to show a much better state of things. Those who took a pessimistic view told them that exchange was going to be much worse; and those who took an opposite view said it was going to be better. There was no doubt exchange was a great drag on the Company; but all they could do was to bear it in a philosophical manner, and to do all in their

power to increase the business so as to counterbalance this great disadvantage as much as possible. He concluded by moving the adoption of the report and accounts.

Mr. N. E. B. GAREY seconded the motion.

Mr. J. COPPEN suggested that, as the contract with the Municipality would expire in 1901, the time had arrived when the Directors should approach the authorities with the view of obtaining a fresh one. Supposing that they did not succeed in getting a new contract, he presumed they would be started off "bag and baggage."

The CHAIRMAN: No, no. We have the private business, which is 41 per cent. of the lighting. We do not intend to lose that; and, indeed, there is no chance of losing it.

Mr. J. P. MOORE asked what would be the loss to the Company in the event of the Municipality not renewing the contract?

The CHAIRMAN replied that 59 per cent. of the lighting came from the Municipality. The loss of this would, of course, be a serious thing; but there was no reason to anticipate losing it. Of course, they must take into account the residuals, which produced a considerable amount.

Mr. E. T. E. BESLEY, Q.C., hoped the Board would not approach the Municipality. He always thought that it was unwise to appear to be eager to enter into a contract; and, in his opinion, it was far better policy to "lie low," and not urge the Municipality. No Municipality would agree to a contract six years in advance, or, if they did, they would want the other party to give up something. Therefore, he thought it would be better to wait until they were nearer the end of the contract before taking steps in the matter.

The CHAIRMAN, replying to Mr. Whitley, stated that, in making up their accounts, they took the rupee at its nominal value of 2s.; and the difference between the 2s. and the current value was included in the item of loss on exchange (£28,939).

Mr. H. D. ELLIS explained, with reference to the reserve account, that their stocks, which now stood at something like £20,000, were provided partly out of the money placed to that account. If they had not this reserve account, they would have to raise capital with which to buy stocks.

The motion was then carried.

The CHAIRMAN, having moved the declaration of a dividend of 4½ per cent., making 8 per cent. for the year, free of income-tax, stated that some time ago the Company had a Local Committee. One of the members, however, died; and the one who was left resigned. The Directors had, in consequence, been considering the best mode of securing an audit of the Company's accounts abroad; and they had come to the conclusion to employ a first-rate firm of accountants in Calcutta, who would forward a monthly statement. The suggestion that this should be done emanated from their Manager; so that the arrangement was very satisfactory.

Mr. GAREY seconded the motion, which was agreed to.

Mr. R. MILLER said the Chairman had mentioned that he (the speaker) had visited, at the beginning of the year, the scene of the Company's operations. While in Calcutta, he took every opportunity of going over their works. Although he did not interfere at all with the technical matters connected with the business, he took the greatest possible interest in satisfying himself as to the personality of those in charge; and he could assure the shareholders that their interests in Calcutta were not only in technically capable hands, but in the hands of a man who was devoted every hour to their service. The small untoward event the Chairman had alluded to was an instance of the value of such a man to the Company. Their Manager was exceedingly attentive to their business. He was desirous of spreading the private demand for gas, as distinct from the Municipal demand, to its utmost. As to the works, of course he could not give an opinion as an expert; but, speaking with limited knowledge of such matters, he should say they were in an extremely satisfactory condition.

The retiring Directors (Messrs. Garey and Ellis) were re-elected; and the Auditors (Messrs. Eastman and Savage) were re-appointed.

A vote of thanks to the Chairman and Directors for their efficient services was passed; and the thanks of the shareholders were also accorded to the Engineer, Assistant-Engineer, Secretary, and the staff at home and abroad.

The proceedings then terminated.

SINGAPORE GAS COMPANY, LIMITED.

An Extraordinary Half-Yearly Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Mr. SAMUEL SPENCER in the chair.

The SECRETARY (Mr. R. M. Christie) read the notice calling the meeting; and the Directors' report and the accounts for the half year ending June last were taken as read (see *ante*, p. 1041)

The CHAIRMAN, in moving the adoption of the report and accounts, said it was with the deepest regret that the Directors had not a better state of things to submit to the shareholders; the past half-year's working having really been the worst it had ever been their lot to present to them. When before the shareholders six months ago, the Directors thought they were justified in saying that they might hope they had come to the end of what might be considered the climax of a series of bad half-years' working; but, to their great regret, the past half year had closed with something worse, as, notwithstanding all their efforts, the profits had come out next to nothing. This arose from the further loss due to the very low rate of exchange, amounting to a difference of ⅞d. per dollar less than anything they had ever before experienced, added to which the cost of coal came out to £1 14s 6d per ton, although it was bought at an average rate of £1 1s 7d sterling. But through the low rate of the dollar, the price into the stores came to the former figure, which was a higher price per ton (with one exception) than they had had in the past three years. The increase in the loss on exchange and the price of coal together amounted to £1,350 more than in the previous half year. The profit on fittings was also reduced to the extent of £400, arising, the Board thought, entirely from the absence of business in this department. Besides, they had, unfortunately, had a very poor return from the coal carbonized, in consequence—so their Manager (Mr. H. W. Smith) informed them—of their stokers leaving to return to China; and the new men engaged in their places, having to learn their work, had not produced so much gas per ton by something like 1000 cubic feet. Under these most disappointing circumstances, it was satisfactory that they had not made a loss; and the Board were thankful the position was not worse. When they met six months since, the Directors had every confidence that the working for the past half year would put them in a position to recommend a dividend; but owing to the disastrous results he had alluded to, they did not do so. They preferred leaving the matter in the hands of the shareholders, and would be pleased to fall in with any decision at which they might arrive. The balance would admit of a dividend at the rate of 2½ per cent. per annum; and a sum of £270 would remain to be carried forward. So far as the Directors could judge, with the improved rate of exchange now ruling, and more satisfactory results in the retort-house, they must have a better return this half year; and in that case, they could maintain, if not increase, the dividend at the next meeting. At the same time, if the shareholders were disposed to forego a dividend on this occasion, it would put the Directors in a much better position for the current half year, and enable them to clear off an old debt of about £950, which was incurred some years ago in helping to pay the dividend then declared, and which had been running ever since at a charge of 5 per cent. Turning to the accounts, it would be noticed that the item of sundry creditors was about £900 more; but, on the other hand, stocks had increased by something like £1000—the extra amount being for coal and pipes. There had been an expenditure for plant during the past half year, amounting to £400, chiefly caused by an extension of mains, as the Municipality required an additional 1¼ miles of street lighting. The increased price of gas had resulted in a gain of about £500. During the half year, the Directors had had to renew about one-third of their debentures at the same rate as before—viz., 6 per cent. This was disappointing, as he considered they ought to have obtained them at ½ or 1 per cent. less; but, as this could not be done, they had to submit. Before the next debentures became due, he trusted they would be a dividend-paying Company, and able to issue them at not more than 5 per cent. The shareholders would have noticed from the report that their Manager had resigned. Mr. Smith said he much regretted having to do this, as Singapore suited him; but the change was entirely owing to the health of his wife. The Directors were making arrangements for another Manager, and hoped to secure his services at the end of January, so that he could reach Singapore early in March, and enable Mr. Smith to return at the end of that month.

Mr. W. T. BATTEN, in seconding the motion, said his feelings that day were those of great disappointment. Six months ago, when he and the other Directors stood before the shareholders, they, with the exception of Mr. Green, believed they were out of their troubles, and almost promised that, at this meeting, they would be able to declare a dividend. They undoubtedly would have been in a position to do so if they had not had an abnormally bad half year. Exchange had been worse than ever; coal had cost more; and, instead of doing as well as they expected, they had had, owing to their stokers leaving, an unsatisfactory make of gas per ton of coal. Consequently, the Directors were compelled to advise the shareholders to forego the 2½ per cent. dividend which they had intended to pay. When the balance-sheet was made up, it was decided to pay this dividend, because the Directors felt that the shareholders had been long-suffering. But their Auditors (Messrs. Magnus Ohren and T. Guyatt) sent the Directors a semi-official letter to this effect: "We beg to remind you that, whatever dividend you may pay, you are depriving yourselves of the amount of working capital which is absolutely necessary for carrying on the business of the Company. We may also remind you that, in our opinion, the two sums due to creditors for borrowed money—David King £930 and Henry Smith £686—on which the Company is paying interest, should be paid off before a dividend is recommended to the shareholders." If the shareholders would leave the balance in the hands of the Directors, it would greatly help them. They had done their best for the shareholders; and they were sorry they had not been more successful.

Mr. H. J. ROBUS, while fully acknowledging that the Directors had had to contend with some uphill work in carrying on the concern, said that, after the Chairman and Mr. Batten had, at the last meeting, practically promised a dividend on this occasion, he was much disappointed with the results. He criticized certain items in the accounts, and suggested that perhaps it would be wise to alter the form of the profit and loss account, so as to give the details in a more explicit manner. He really could not understand where the extra £1100 had gone in coal; and he gave notice that, at the next meeting, he should move that an Investigation Committee be appointed to confer with the Directors as to the future working of the Company.

Mr. DYER was also disappointed. He fully expected that, with the increase in the price of gas, they would have come out with at least £500 profit. He saw that coal had cost them £1079 more, from which additional expenditure they had only realized £533. There must surely be something wrong somewhere; and it would be interesting to know how much gas their Manager had been getting from the coal. His own conviction was that the works had been allowed to run down.

Mr. B. GREEN stated that the make of gas had been 8197 cubic feet per ton of coal carbonized; and the sale, 7887 cubic feet. This, of course, was a very low make; but they could not get the Chinese and Malay stokers to work like Englishmen. He thought that there was a prospect of the Company now earning a profit, and that next half year the Directors would be in a position to recommend a dividend.

Mr. ROBBINS, calling attention to a sum of £423 that had been added for extensions during the half year, expressed the opinion that, in the present position of the Company, it was most unwise to go on spending money on the works and plant. Commenting on the accounts, he pointed out that the gas and meter rental was placed at £1170. But on the other side they had to set against that £543 for prompt payment and allowances; bad debts about £3; and loss on exchange, £371. Therefore the gas and meter rental was really only £4,753, of which sum they paid away £1496 for salaries and collectors' commission, which was over 30 per cent. He urged that the new Manager should go out with express instructions that some alteration should be made in this respect.

Mr. F. Crisp observed that in 1893 they had an amount for sundry creditors of £5219; while now the item stood at £2868, £1000 of which was accounted for by the increase in the stock of coal, &c. He thought the present Directors had, in the past three years, brought the concern from a state of bankruptcy into a sounder position. The balance-sheet was a better one than they had had since he had been a shareholder.

Mr. S. Simmelkjör remarked that the form in which the accounts were presented was misleading. For instance, the gas and meter rental was put at £9170, which was equal to £3 18s. 11d. per ton of coal carbonized. He did not know of any Company who received so much. But was it true that they had obtained this large amount? Their gas-rental was paid in the currency of the country; and therefore they had received about $42,000. This had been put down in the accounts at £9170. What they had actually received was $42,000 at the rate of 2s. 3d., which represented something like £5000, which, in his opinion, ought to have been the amount entered in the accounts. For coal, they had only spent £4000; while for the bye-products they had taken credit for £3521, so that, from this source alone, they had got back about 90 per cent. of the cost of coal. He dealt with other items in the profit and loss account in a similar manner; and, before concluding, he expressed the opinion that there was every prospect of the Company doing a good business.

Mr. Batten, replying to Mr. Robus, stated that the extra cost of £1100 for coal was due to it having to be bought abroad. As to Mr. Simmelkjör's remarks, the accounts were undoubtedly inflated; and, if they could only carry out the suggestions Mr. Simmelkjör had made, it might be to the benefit of the Company. But there were difficulties in the way—difficulties of management and book-keeping, which he could not then go into. They brought dollars over at 4s. 6d., but they would, by way of experiment, make a change to 4s.; and, if this worked advantageously, they would make a further change. In answer to Mr. Robbins, he pointed out that they were compelled to spend money when called upon by the Municipality for extensions.

The motion was then carried.

Resolutions were also passed thanking the Chairman and Directors, the Auditors, and the officials, for their services.

Mr. Magnus Ohren, in replying for the Auditors, stated that there were in the accounts many items that they would like to see altered; but the great blot on the accounts, so far as he could see, was bad working. The coal had not produced sufficient gas; if it had, they would have made a profit. He hoped the new Manager would devote a great deal of his attention to the retort-house, because there a dividend could be produced.

This concluded the proceedings, which had been of unusual length.

THE DUBLIN CORPORATION AND THE GAS COMPANY.

The Gas-Testing Arrangements.

In our "Parliamentary Intelligence" to-day, we allude to the intended application of the Dublin Corporation for parliamentary powers in regard to the testing of the gas supplied by the Alliance Company. The following are the proposals of the Corporation as contained in the notice given for the Bill: Provision is to be made for the appointment by the Corporation of gas examiners, whose duties are to be prescribed; and also for ensuring that the quality, purity, and pressure of the gas supplied by the Company is equal to the standard. The standard price of gas is to be revised. The situation and number of the testing-places, and the apparatus for testing the illuminating power, purity, and pressure of the gas within the city, are to be determined; and the provisions of the Company's Act of 1883, having reference to the price of gas, are to be altered and amended. The accounts of the Company are to be audited; and, so far as may be necessary, the above-named Act, as well as any other relating to the Company, is to be varied or repealed. Provision will be made for the appointment by the Board of Trade of persons to act as Gas Referees, who are to prescribe and certify the number and situation of any additional testing-places, and the apparatus and materials and arrangements therein. The Company are to give the Referees all reasonable access to their works, and afford them all such facilities as may be necessary for the proper discharge of their duties. It is proposed that the Board of Trade shall, on the application of the Corporation, determine as to the efficiency of all apparatus, materials, and arrangements supplied by, or in charge of, the Company for testing the illuminating power and purity of the gas; and on such application they are to settle and determine any matter on which a dispute or difference may have arisen between the Company and the Corporation. The Company are to give notice to the Corporation before they shall be entitled to examine, test, or inspect the meters, governors, or other plant belonging to the Corporation. In the event of the Company failing to comply with any of the obligations imposed upon them by the intended Act, or with any regulation or requirement prescribed or certified by the Gas Referees, they are to be liable to such penalties as may be prescribed in the Act and the Public Act; and provision is to be made for the recovery of these penalties.

The Affairs of the Para Gas Company.—In a letter which appeared in the Journal for the 12th ult. from Mr. S. Joshua Cooper, attention was directed to a meeting of the shareholders of the Pará Gas Company which had been convened for the purpose of considering a proposal of the Directors to reconstruct the Company, giving the preference shareholders priority of repayment of capital in case of winding up—an advantage they have not hitherto possessed. As it is customary for the proceedings at the meetings of this Company to be reported in the Journal, and readers may be expecting a report on this occasion, it may be mentioned that a representative attended as usual, but was not allowed to remain. He was informed that the Directors considered it advisable that the proceedings should be private, as, in the course of the discussion, reference might be made to matters, which, in the interests of the Company, it would be well not to publish.

WORKMEN AS DIRECTORS.

Mr. Livesey Interviewed.

[From the *Globe*, Friday, Nov. 29.]

Public announcement has just been made of the fact that, in the coming parliamentary session, the South Metropolitan Gas Company will seek for power to permit their workpeople, in virtue of their interest in the undertaking, to enjoy the privilege of representation on the Board of Directors. This proposal, first heard of some months since, is of so novel a character, and, in its ultimate effect upon the relations between capital and labour, may so seriously influence the existing economic conditions, that the result of an interview with Mr. George Livesey, the Chairman of the Company, and parent of the scheme, cannot fail to be of interest. The exact details of a somewhat Utopian idea have not yet been settled; but Mr. Livesey, in answer to questions by a representative of the *Globe*, indicated pretty fully the nature of this unlooked-for development of the profit-sharing scheme instituted at the time of the now historic strike, and a development, it should be added, in regard to the wisdom of which opinions on the Board are sharply divided. The men having now agreed that half their share of profits shall be invested in the Company's stock, Mr. Livesey contends that the further development must sooner or later be a demand for some voice in the management of their own property So far no such demand has been made; the Chairman prefers to anticipate it.

They have already invested £26,500, said Mr. Livesey; and I anticipate that in three years it will have reached £50,000, the sum which I suggest should carry with it the right of representation. The employees have made no suggestion whatever that they should have any voice in the management; and when the profit-sharing was started, it was clearly stated that it would not carry with it any part in the control of affairs.

Why, then, did I take the initiative? Well, the idea was first suggested to me when I was a member of the Labour Commission; and, having closely watched labour questions, I have noted that the drift of opinion of the best of the labour leaders has been in favour of works being conducted on co-operative lines. I know it is objected that my scheme is premature; and it is also contended that the proportion of the employees' holding is so small, compared with the total capital (excluding debentures) of £2,250,000—which is worth more than double, and represents £5,000,000 at least—that it could give no right to a share in the management for a very long time.

How many is it proposed that the £50,000 should place on the Board? was asked.—That we have not determined, answered Mr. Livesey. Some say they would rather have two than one on the Board, and I rather incline to that opinion. Both the employees and officers ought to be represented; and the difficulty is that the officers do not wish to be represented. My idea is that, in course of time, we should have two or three employees on the Board.

Have you considered that this would tend to minimize the power of what one must term the real shareholder Directors?—Well, it would be a case of three to seven, was the reply; and if the seven could not hold their own in all that was right and proper, they ought not to be Directors.

Might it not happen that this development of the bonus system, in itself an act of grace, would lead to further demands from within, as well as from the men themselves?—Oh, said Mr. Livesey, we have dropped that term. The annual bonus was in the first instance an act of grace; but I am satisfied now the employees earn the bonus by the increased interest they take in the business. As to the other point, that is what my friends are afraid of; but I think it would be much the reverse. The more open you are, the more you will win their confidence. My idea is that the Workman Director would find most difficulty with the class of men who would think he was on the Board to look after their especial interests. It is so hard to make some understand that the interests of employer and employed are identical

Do you not contemplate that no little trouble would arise from the dual duties and position of such Directors?—Yes; that is one of the objections. They say you will be expecting a man to be a workman five days in the week and a director the remaining day; but I believe the men have sufficient sense to understand the position. The fact that the workmen themselves would create the authority of their foremen, for instance, would make them more ready to respect that authority than when imposed arbitrarily.

Is not this double *rôle* expecting from a man a rather heroic attitude?—I know that will be said; but that is my opinion from all I have been able to gather. There is somewhat of an analogy already One of the workmen in the Leith Gas-Works has been elected on the Corporation; and it is quite within the range of possibility that he will be elected on the Gas Committee, as the Corporation manage the lighting.

So he may at night give orders to the Engineer who in the day would be his master. Is not that rather Gilbertian?—It may be so, said the Chairman. I admit it is an experiment; but the scheme is to be terminable in three years, and is to receive the approval of the Board of Trade before it is put in force. If it does not succeed, of course, it can be dropped.

But once given the power, the men would hardly relinquish it?—I should put it to them, and say, "It is an avowed experiment. If you select men who will enter into the spirit of the thing, it will continue; but if you choose those of the agitating class, and difficulties arise, it will be your fault if it is dropped." It is said they would strike if it dropped. I do not believe it. They would acquiesce—they are neither Socialists nor the fools Trade Unions would have us believe.

A man direct from the gas-retort cannot, it was suggested, possess such commercial knowledge as one looks for in a Director of such an undertaking as the South Metropolitan Gas Company.—The workmen are rising rapidly into power, was the reply. I want to educate them to use that power wisely. We require that a man elected by his fellows must have been seven years in regular service with the Company, and have invested not less than £100. I admit, said Mr. Livesey, in answer to another question, that a Director's qualification is very

different—£2000 of stock, worth £6000. Of course, I say, let the workman's fee be proportionate—from 10s. to £1; and not more than an ordinary day's pay.

Does not this suggest great disparity? Accumulations of profit-sharing, a boon granted by the shareholders, will rank with capital purchased at high prices in the open market?—When their money is so applied, the men have as much right as anyone else to a voice in the control of their funds. On the principle of the widow's mite, his £50 of total savings will be more to him than the £5000 of the man of wealth. Relatively, his interest in the concern will, therefore, be greater than that of the larger shareholder.

Questioned as to whether he did not anticipate that the Workman Director might be more open to temptation in business dealings, Mr. Livesey said he had no such fear. He added that by the time the £50,000 was reached there would be 2500 employees owning stock. "I say," concluded the Chairman, "that in the course of time the policy we have pursued (and the Board was perfectly unanimous, and enthusiastically so, in making our people shareholders) would lead to the men asking for representation. I merely anticipate that demand."

Some examples of the application of the workman-director proposal were furnished by Mr. Aneurin Williams in the following letter in last Saturday's *Globe*: "I think it will interest your readers to know that I am every week presiding at the Board of Management of a small limited liability business in London, where three out of the nine Directors are ordinary working men employed in the business, and elected by their fellow-workmen to represent them. This is the arrangement which you call Gilbertian; and yet, though it no more works perfectly than any other human institution, it certainly works well. The business is, as I have said, a small one, employing some fifty hands, who are practically all shareholders; but the capital held by outsiders is three or four times the amount of that held by employees. There are, in fact, some dozens of flourishing businesses in the United Kingdom—registered under the Industrial and Provident Societies Acts—which have one or more employee directors; I mean ordinary journeymen. I could name to you one doing a trade of £40,000 a year, and employing 300 hands, where the Board of Management has consisted of employees almost exclusively from the foundation of the business eight years ago, and where the shareholders have received an average of about 7 per cent. Here, too, the capital of outsiders largely preponderates. I could refer you to larger businesses, though the figures would still be small compared to those of the South Metropolitan Gas Company. But when the thing has been proved to work well over and over again on a substantial commercial scale, does the increase of size make so much difference? You rightly say that the workman is apt to be deficient in commercial knowledge. My experience shows me how true that is. But he is usually quick to learn—at least to learn that he is ignorant; and meanwhile he is rich in knowledge of details of the business, and (not least valuable) of the feelings and opinions of the employees."

ELECTRIC LIGHTING NOTES.

Is the electric lighting undertaking of the Worcester Corporation a success or not? was the question discussed at the meeting of the City Council on the 20th ult. A small sum which it was recommended should be spent at the Powick generating station stirred Mr. Rushton to inquire how much more money was going to be spent on these works. The Council, he asserted, scarcely knew where they were; and as to income—they knew nothing of it. He moved an instruction to the Electricity Committee to supply the Council with a statement of all costs and expenditure incurred from the commencement of the works up to the present, and of the income from all sources; also the amount of all works entered into by the Committee, but not yet carried out. This found a seconder in Mr. Blackford, whose opinion was that the electric light was a very great mystery. This time last year, when the station was opened, it was, he said, held out to the Council that the electric light would take the place of gas; and they would save some £3000 otherwise paid to the Gas Company. Now he understood that they were about to contract with the Company for street lighting by incandescent gas-lamps; and no one knew what that would cost. The electric lighting had not been carried out to the satisfaction of the ratepayers or the Council in the manner which it ought to have been done. Alderman Day admitted that more money had been spent than was contemplated; while Mr. Yeates observed that he was led to understand from Mr. Preece's statement that there was sufficient power at the station to light the whole of the city. There was no street lighted by electricity from the top of Foregate Street up to the water-works. They were spending between £70,000 and £80,000; but why did not the Electricity Committee go on lighting the streets, and so give the citizens some confidence in the scheme? All that they had at present was the electric lighting of Foregate Street, High Street, Mealcheapen Street, and Broad Street. Mr. Chaplin denied that the Committee had spent £70,000, and stated that the correct figure was only £51,500. The discussion was carried on in the same vein by one or two other members; and then the Chairman (Mr. G. H. Williamson) responded. He did not think it reasonable that, within twelve months of starting a large undertaking like the electricity works, the Council should expect the Committee to say it would be a financial success. With regard to street lighting, the Committee found the incandescent electric lamps for this purpose would not pay. If the Council wanted additional arc lighting as in the High Street, they should state how far they would extend it. But the Committee were not prepared to say that they could light a large number of streets with incandescent lamps at the same price as with gas. If the Watch Committee wished to light streets with incandescent lamps, that was their business. In conclusion, Mr. Williamson pressed his colleagues to take a more hopeful view, and appealed to those who had the mains already laid near their doors to adopt the electric light. The amendment was lost by 27 votes to 9, and the original motion was carried.

The Electricity Department of the St. Pancras Vestry require more money. Thus the Committee, at last Wednesday's meeting of the Vestry, reported as follows: "On the presentation to the Vestry in April last of the annual accounts of the electricity undertaking, in the report accompanying the accounts, it was shown that a further loan of £10,000 was required to adjust the capital account. The application for the loan at that time was deferred, pending the negotiations with the London County Council on the question of the period for which loans for initial purposes for electric lighting undertakings should be granted. The period of 42 years for these purposes having since been conceded by the Council, your Committee recommend—'That application be made to the London County Council for a loan of £10,000, repayable in 42 years by equal half-yearly instalments of principal and interest combined.'" This simple little financial transaction was agreed to without discussion. Later in the evening, the incandescent system of gas lighting came in for notice; the Committee reporting that, as instructed by the Vestry on the 25th of September, they had further considered the letter from the Lighting Corporation, Limited, respecting the lighting of the public streets by their system, and had caused inquiries to be made about it. They reported as follows: "The Lighting Corporation system is an improved Wenham gas-lamp, and not the Welsbach incandescent gas-light. No public street lighting by the Corporation's lamps is yet in operation in London; and until a specimen of the light in the streets is seen by the Committee, they recommend that no action be taken." To this the Vestry assented. Then came the consideration of the demand of a firm for compensation in consequence of damage done to their premises by the disturbance of the footways during the building of a manhole; and the Committee recommended that a sum of £15 should be paid in full discharge of all claims—a small matter in itself, but a valuable precedent.

The Bromley Urban District Council have resolved to hand over to a private company their Provisional Order empowering them to supply electric light and energy, subject to the approval of the Board of Trade, and on payment of £777, the cost of obtaining the Order. The Council have come to this decision because they do not think it would pay to put the electric light into competition with the local gas supply; and as the Board have within their reach all the figures necessary to come to a safe solution, it is not likely that they would have relinquished the Order if there had been any likelihood of the electric light being profitable.

Last Thursday, the Vestry of Hampstead presented an edifying and altogether unintentional illustration of the risk of self-exposure that attends the proverbial pugnacious dweller in glass houses. The vestrymen waxed exceeding wroth over the alleged "bad quality and quantity" of the gas supplied by The Gaslight and Coke Company to the public lamps in the parish, and decided to approach the London County Council on the subject. It would therefore be inferred that the electrical illuminant supplied to the ratepayers by the indignant Vestry is of the most satisfactory character, and that its quality and quantity are above reproach. But what are the facts? At the same meeting of the Vestry, a member asked Mr. Cottam, the Chief Electrical Engineer, whether he had made provision for preventing "such a collapse of the electric light as occurred the previous night." No suggestion of complaint to a higher authority was made; but Mr. Cottam's reply, to the effect that such provision had been made, but that the unfortunate occurrence referred to resulted from dilatoriness of a contractor, was received with but little comment—Mr. Watts only expressing surprise that any contract should be agreed to by the Vestry without its containing a clause whereby the contractor is fined for not fulfilling his undertaking within the specified limit. For some time past, the Lighting Committee have been considering the advisability of lighting the High Street and approaches with either electric arc lamps or incandescent gas-lamps; and they reported that they did not think it desirable at present to introduce either system. Mr. Thwaites, the Chairman of the Electricity Committee, followed up this statement by adding that incandescent gas lighting for street-lamps was only in its experimental stage; while the Vestry, being suppliers of electric current themselves, would not be justified in experimenting with the incandescent gas light. A sum of more than £2000 was voted for laying down the necessary mains and transformers for the further extension of the electric light to private residences.

Last week, the City of London Electric Lighting Company, Limited, invited subscriptions for an issue of £100,000 of 5 per cent. debenture stock at the price of £128 per cent.; being the balance of an authorized issue of £400,000, redeemable by the Company at £125 per cent. This opportunity was taken for furnishing some particulars as to the position and progress of the Company. Their expenditure amounted on June 30 to £1,078,684; the assets on the same date being £130,932. On October 30, 1892, the number of customers supplied was 200, or equal to 18,100 8-candle power lamps connected; on Oct. 30 last, the number was 3820, or equal to 180,000 lamps of that power. The gross income for the period ending Dec. 31, 1892, was £12,449; for last year it was £68,864; while for the nine months ending Sept. 30 it was £60,389, as compared with £38,761 for the corresponding period of 1894.

The Town Clerk reported to the Finance Committee of the Cardiff Corporation last Wednesday that the Local Government Board had given their consent to the Corporation borrowing £12,885 for electric lighting purposes, to be repaid with interest within 25 years.

Mr. G. W. Willcocks held an inquiry at Huddersfield last Thursday into an application made by the Corporation to the Local Government Board for sanction to borrow £50,000 for the purpose of extending the electric lighting works and plant. It was stated by the Town Clerk (Mr. F. C. Lloyd) that the Council had already obtained power to borrow £50,000 for the erection of the present works, and the supply of energy for a fixed area. There were now 256 consumers, and 36 applicants waiting for supply. The present borrowing powers were exhausted to within £3000, and that was required for work in hand. The Corporation had had a large demand from districts in the borough outside the compulsory area of supply; and the Engineer was of opinion that provision should be made for a total supply of 50,000-candle power. Alderman Calvert, the Chairman of the Electric Lighting Committee, said that last year the present undertaking had a balance of £1,376 over working expenses, but this was not sufficient to pay the interest and annual instalment of the first loan, owing to the

short period for which the loan was granted. The Town Clerk announced that he had been to the Board of Trade, who told him that, when they fixed the time for the repayment of the capital at 15 years, it was pretty much an experiment, and that the application for an extension of time was unanswerable, and would be granted. In reply to the Inspector, he said they would have to be content with an extension to 25 years for the present, and then make an application later on for the period to be prolonged.

THE WATER-WORKS PURCHASE QUESTION AT PORTSMOUTH.

A Special Water Committee of the Portsmouth Town Council to whom had been referred the consideration of the question as to terms being arranged for the purchase of the Water Company's property, presented a report at the last meeting of the Corporation. In this they submitted copies of documents dealing with the matter, and asked for instructions. The documents included the report of the Committee to the Council in 1893; and a letter, dated Oct. 22, from Mr. R. W. Ford, the Secretary to the Water Company, saying that, if the Council wished to revive and continue the negotiations for the purchase of the water-works, which had been broken off, the Directors would be happy to consider any proposals. They could not be reasonably expected, however, to offer the undertaking on lower terms than formerly, and especially as the Company's capital, expenditure, and income had since substantially increased. The Chairman (Alderman Scott-Foster) said the Committee wanted to know if the Council meant business; for it was quite useless for the members of the Committee to interview the Directors over and over again if in the end nothing was to be done in the way of purchase. He believed that, if they could obtain a hundred years in which to repay the principal, they could purchase with safety, and show a profit on the first year's working of between £500 and £1000. He moved that the Committee be instructed to go on with the negotiations. Mr. Ashdowne seconded the motion, which was supported by Sir W. Pink. Mr. Evans considered the price too high. If, he said, they purchased on such terms, they would for the next ten years be losing £2000 a year, for the Council could not hope to manage the water-works as well as the Directors were doing. Alderman Scott-Foster, in reply, said that they would not purchase at all, unless they could get 80 years for repayment, with the suspension of the sinking fund for five years, or unless they could get 100 years for the repayment. They would not think of proceeding if it was found there would be a deficiency. The time for purchasing the works was now or never. If they let other places go to the Company, and get supplied, they would never be able to purchase. The resolution was carried by a large majority.

LAMBETH WATER-WORKS COMPANY.

The Directors' Report.

At the Half-Yearly General Meeting of this Company last Tuesday, the Directors reported that, in the six months ending September 30, there had been an expenditure of £9110 on capital account; making a total outlay of £893,072 on new works, &c., since the passing of the Metropolis Water Act, 1871. During the half year, 1732 houses and other supplies of water, estimated to yield an annual rental of £3685, were connected with the works, as compared with 1357 houses, producing a rental of £3458, in the corresponding six months of 1894. With regard to revenue, there was an increase of £3024 in water-rents; but, on the other hand, there was an augmentation in the expenditure to the extent of £15,046. This principally occurred under the following heads: Distribution, mostly due to repairing and lowering mains fractured during the frost of last winter, £9930; pumping and engine charges, due to the alteration of engines at Ditton, and to the extra cost of pumping in consequence of leakages from consumers' lead pipes after the frost and during the subsequent drought, £5366; Thames Conservancy (the increased payment under the Act of 1894), £340; rates and taxes, £455; and law and parliamentary, £707. There was a reduction of £577 under the head of storage, and of £1571 for filtration, in both cases owing to comparison with a period when special renewal works were in progress. The surplus transferred from the revenue account to the dividend and interest account was £60,299. There was to the credit of the latter account, after payment of interest on debenture stock, an available balance of £53,450, out of which the Directors recommended the distribution of a dividend at the rate of £7 5s. per cent. per annum on all the share capital of the Company. This dividend amounted to £52,562; and a balance of £888 remained to be carried forward, in addition to £1750 standing to the credit of the contingency fund. The declaration of the dividend would entail a payment of £1040 to the Chamberlain of London under the sinking-fund clause of the Company's Act of 1886. The Directors expressed regret that the extraordinary and unavoidable expense incurred in repairing damage caused by the frost of last winter necessitated a further reduction in the dividend. The frost entailed a cost of no less than £27,882 on the Company. Of this sum, £13,427 was charged in the accounts for the half year ended March 31; £7228 was included in the accounts for the six months to the 30th of September; and the remainder is to be carried forward. Apart from contingencies, equally unforeseen as the phenomenal frost of last winter, the Directors regard the intrinsic value of the undertaking as unimpaired. The Engineer reported that all the works and plant of the Company were in good and efficient working condition. A constant supply of water was laid on to 1119 houses in the period under review; and it is now given to 64,856 out of a total of 102,285 houses—being 63 per cent. of the entire number, or 83 per cent. of the houses, &c., supplied by the Company in the Administrative County of London. The area under constant supply is still being extended. With regard to the troubles entailed by the frost of last winter, and the subsequent inquiry by the Official Water Examiner (Major-General A. de Courcy Scott, R.E.), the Directors reported that the inquiry had not concluded; the Company having still to state their case. The report closed with a reference to the proceedings of the Select Committee of the House of Commons on the Company's Bill of last session, which, it may be remembered, came to an abrupt termination on the dissolution of Parliament; and also to the inquiry recently held by Colonel Ducat, R.E., in regard to the capacity of closet-flushing cisterns, no report on which has yet been received.

BIRMINGHAM CORPORATION WATER BILL.

A Special Meeting of the Birmingham City Council was held last Tuesday—the Mayor (Mr. J. Smith) presiding—to receive the report of the Water Committee upon their proposed application to Parliament during the coming session (*ante*, p. 1099).

Alderman Lawley Parker first moved that the draft of a Bill for empowering the Corporation to acquire sites for the deposit of spoil from the aqueduct works authorized under the Corporation Water Act of 1892, to construct a line of railway from Rubery Station to the site of the authorized reservoir at Frankley, and for other purposes, be approved, and that a public meeting be held to receive the authority of the ratepayers to the Bill being proceeded with. He said the estimated cost of the work proposed to be carried out was £110,000. As a matter of fact, however, there was no increase in the capital outlay; but, on the contrary, the Committee believed there would be a saving in the expenditure. In the first place, they required land for the purposes of deposit of spoil; and this was included in the general sum for the land for the purposes of the undertaking in the Act of 1892. The new Bill also provided for two short deviations of the aqueduct—deviations which were in the direction of economy; and the cost of the land and the aqueduct in the 1892 Act would more than cover their cost. The railway for conveying the material needed at the Frankley reservoir and works would also be in the interest of economy; and that portion of the undertaking was really the only new work. He thought that the outlay for the railway might be estimated at from £7000 to £12,000, according to the requirements of the Board of Trade; but the sum would be saved by the reduction of the cost of haulage of material to the works.

Alderman Pollack seconded the motion, which was unanimously carried.

Alderman Lawley Parker, in moving the adoption of the report, said that, since the Council approved the principle of the Bill, there had been a marked difference in the attitude of the landowners; and he was glad to say that not a few spoil-banks had been acquired on far more reasonable terms than contemplated by the landowners themselves. The Committee had been able to arrange terms with Lord Cobham for the acquisition of land for the railway and the quarry and spoil sites; and he did not think it was likely the Bill would be opposed by his Lordship. The Committee did not contemplate doing any portion of the work themselves. There seemed to be some confusion in the minds of certain members as to the policy adopted by the Committee in carrying out the whole of the great water scheme. In May, 1893, the Committee reported that they had decided that the dams at Caban Coch should be constructed by the Corporation, and that the works for the railway and aqueduct would be contracted for. This was approved by the Council; and in February, 1894, the Council also approved the decision of the Committee to do the work in the valley near the dam themselves, on the ground of safety. The comparative cost of the work was about one-fourth of the whole; the other three-fourths would be contracted for in the usual way.

Alderman Cook seconded the motion, which, after a number of questions had been answered, was unanimously agreed to.

THE NIDD WATER-WORKS OF THE BRADFORD CORPORATION.

The construction of the new water-works of the Bradford Corporation is now proceeding apace. With the exception of the service reservoir and filter-beds at Chellow Heights, and the Angram, Lodge, and High Woodale reservoirs near the source of the Nidd, all the various portions of the works are in hand; and on the supply works proper, extending from High Woodale, near Little Whernside, right away south to Chellow Heights, a distance of nearly forty miles, 2000 workmen are busy constructing tunnels, aqueducts, cut-and-cover work, and bridges at numerous points along the route. At the same time, the construction of the great Gouthwaite compensation reservoir, two miles beyond Pateley Bridge, is being steadily carried out, and the roads interfered with are being rapidly deviated. The reservoirs at the head waters of the Nidd above Woodale will probably not be begun for some years; but, in the meantime, an embankment is being made across the Nidd at this point, and a small impounding reservoir constructed, from which a partial supply of Nidd water will be obtained. The Gouthwaite reservoir is one of the most important parts of the whole undertaking. Across the Nidd Valley, about two miles above Pateley Bridge, a massive embankment is being built, which intercepts the Nidd, and will convert the valley above the embankment into what might well be called a small lake, two miles long and half a mile broad. The embankment will be 750 feet long and 110 feet in depth; and already it has been constructed for a length of 320 feet, and to a depth of 50 feet. This immense dam is composed of masonry; and in its composition and formation is almost novel in this country—the only one similar to it being that in connection with the Liverpool works at Lake Vyrnwy. The above particulars are extracted from an article in the *Bradford Observer*, which closes by remarking upon the vast amount of supervision which an undertaking of this kind involves, and the heavy responsibility that will rest for some years on the Corporation Water Engineer (Mr. James Watson).

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The situation of Engineer and Manager of the Perth Corporation Gas-Works, vacant by the retirement of Mr. Thomas Whimster, has been filled up by the appointment of Mr. Andrew Wilson, Assistant Manager of the Carlisle Corporation Gas-Works. Mr. Wilson is the son of Mr. Thomas Wilson, the highly-esteemed Manager of the Coatbridge Gas Company. I stated last week that the original list of 43 applicants had been cut down to nine. On Monday night, the Gas Commission met in private, and reduced the nine to a list of three—Mr. Wilson; Mr. W. S. M'Gregor, of Leslie; and Mr. G. W. Anderson, of Whyteleafe, Surrey. These were voted upon, with the following result: Wilson, 15; M'Gregor, 7; and Anderson, 3. Mr. Wilson thus had a majority of votes over the other two, and was at once adopted. A public meeting of the Commissioners was held on Thursday, when the recommendation that Mr. Wilson be appointed was submitted in a resolution which also contained the provisions that the salary was to be £300, that the appointment was to be during the pleasure of the Commission, and that the new Manager was to commence his duties on an early date. Lord Provost Dewar moved the adoption of the recommendation. He said he thought the Commission had made a very wise selection. They had got a young man—perhaps some might say too young—but he did not think his youth was any objection. Personally, he thought it a recommendation. He was not an untried man; he had all the experience of a gas engineer. His father was a well-known gas engineer; and under his tuition he had attained already considerable distinction in the profession. Mr. Wilson began life by learning gas engineering; and he also studied chemistry under Dr. Tatlock. What, perhaps, recommended Mr. Wilson to him was that Mr. Hepworth, who was then Engineer of the Carlisle Gas-Works, selected him to be his assistant. That was a high recommendation; and during the two-and-a-half years he had given entire satisfaction to the Corporation there, and both to Mr. Hepworth and his successor, the present Engineer of the Carlisle Gas-Works. He had no doubt Mr. Wilson would become a well-known man in the gas world; and they might congratulate themselves and the community that they had secured his services. Bailie Cuthbert seconded the adoption of the recommendation, which was agreed to unanimously.

Mr. Wilson is 27 years of age. He was educated at Allan Glen's School, Glasgow, which is one of the new establishments in which the technical side of education is developed in preference to the classical. After leaving school, he spent seven years in equipping himself for the post of gas manager. These seven years he distributed as follows: Two years in the drawing office of the Barrowfield Iron-Works, Glasgow, learning the designing and construction of gas plant; one year in the fitting shop of Messrs. Lamberton and Co., engineers, of Coatbridge, learning the practical use of tools and the construction of engines and engineering plant generally; two years in the laboratory of Mr. Tatlock, City Analyst of Glasgow, studying the chemistry of gas and its bye-products; and, finally, two years under his father at the Coatbridge Gas-Works, where he went through every branch of gas manufacture and engineering, from the retort to the consumer's burner, and where he held the post of Superintendent of the Mains and Service Department. During these two last years, he designed for his father plant to the value of over £30,000, as well as superintending its erection at Coatbridge and other places for which his father is consulting engineer. Two-and-a-half years ago he went to Carlisle, where he has had entire charge of the manufacture and distribution of gas, as well as the working of plant for the recovery of residuals. He holds first-class certificates in chemistry, machine construction, and electric lighting, from the Science and Art Department, and a first-class honours certificate for examination in gas manufacture, from the City and Guilds of London Institute.

Mr. Wilson is to be congratulated upon his early advancement to one of the leading appointments connected with the gas industry in Scotland. This selection emphasizes a feature which has developed in recent years, not only in the gas industry, but in other branches—the certainty with which young men who are specially trained for a particular calling are coming to the front. We have, among the gas managers of some years' standing, men in whom the working side was the predominating and the intellectual side was the accessory, albeit the accessory which raised them above the companions with whom they started life. It is a sort of melancholy feeling that there would appear to be no prizes for such men now. They may succeed in getting into small works; but there they must remain, no matter how good their results may be. The successful applicant now must be mentally equipped, more than practically. He must have the hall-mark of some teaching institution; and if he possesses that, no matter though his experience may be limited, his professional pathway is easy. I can recall no instance in recent years in which a gas manager of long experience has obtained a situation in Scotland; but I have several in my mind in which the appointments have gone to young men with a scholastic training. I make no comment on the practice, whether I consider it good or bad. I merely wish to point out that if anyone desires to fill an important position in the gas industry, he must first arm himself with credentials as to capabilities in regard to other matters than the mere making and distributing of gas. There will be no promotion for him unless he does.

The Edinburgh and Leith Gas Commissioners held a meeting on Monday. The most interesting item of business they had before them had reference to the election of one of the workers in the Leith works as a Town Councillor in Leith. I was in expectation that Mr. Kelly's election might lead to some experience being had on a subject similar to that of the workman-director; but this has not been realized. In the first place, Mr. Kelly was not appointed by the Leith Town Council to represent them on the Gas Commission; and in the second place, Mr. Kelly has left the service of the Commissioners. A question was put by—somewhat strangely—a labour representative who is sent to the Commission by the Edinburgh Town Council, whether Mr. Kelly was not debarred by the self denying ordinance from continuing in the employment of the Commissioners. The Clerk replied that he was debarred, but Mr. J. G. Holburn, M.P., who is a Leith representative, explained that Mr. Kelly left the service of the Commission immediately after his election to the Leith Council. No question such as I expected, therefore, can arise.

The figures of the Engineers as to the output of gas showed an increase on the month of 4,814,000 cubic feet; and since the 15th of May, of 23,096,000 cubic feet. Bailie Kinloch Anderson, referring to this, said it would be observed, from the report for the month, that the influence of the electric light was now being felt. In Edinburgh, there was an increase of under 700,000 cubic feet; whereas in Leith, where they had not the electric light, the increase was over 4,000,000 cubic feet, and was the proportionate increase they had had for some time. He had no doubt, however, that they would be able to hold their own.

One other item which was before the Commissioners must be mentioned. The extraordinary letter by Dr. Taylor, suggesting the removal of the Edinburgh Gas-Works to a site outside the city, had been considered by the Works Committee since the last meeting of the Commission; and the resolution of the Commissioners, on the recommendation of the Committee, was to take no action in the matter, but to thank Dr. Taylor for his communication.

It is reported from Earlston, a small town in Berwickshire, where there is a gas-works, that the owners offered to sell the works and plant to the community, but that the parties could not agree as to terms; the representatives of the community offering £600, and the vendors asking £1000. The negotiations thereupon, it is said, were broken off; and the townspeople received intimation that the supply of gas would be stopped, I think from to-night, whereupon it was resolved to advertise for offers for the erection of a new gas-works.

In Uddingston, a fine residential suburb of Glasgow, there has been some trouble on recent evenings, in the matter of the gas supply. On Sunday night, it was very weak; but on Tuesday night there was, it is said, an almost entire failure. The residents attribute the defect in the supply to the inefficient working of some new plant. That may be, but it should only be a temporary cause; and I have no doubt, considering the qualifications of the Manager, that when an explanation is given, it will be found to be quite a satisfactory one.

The Millport Police Commissioners have held their second statutory meeting, and unanimously resolved to adopt the Burghs Gas Supply Act. At present, the price of gas is 5s. 10d. per 1000 cubic feet; and the acquisition of the Gas Company's undertaking is looked upon as likely to lead in course of time to a reduction in price. The Largs Police Commissioners have also held their second meeting; but after discussion, they resolved to do nothing more in the matter in the meantime.

The Falkirk Gas Commissioners this week resolved, in consequence of the success of experiments with incandescent gas-burners in the public lighting of Glasgow, to fit these burners to a number of lamps in the town. At the same meeting, they decided to introduce prepayment meters.

In Kilsyth, where the gas supply is in the hands of the Police Commissioners, Mr. Shanks, the Convener of the Gas Committee, reported on Monday that he was in the gas-works the previous Saturday night; that at nine o'clock the whole of the retorts they have were in use; and that the large gasholder was entirely empty, and there was only one plate of the small holder to draw upon. They might tide over this winter as they were; but they would require to consider as to the providing of a new gasholder, and other extensions. The Committee would go into the matter and report to the Commission. This was agreed to.

The Finance Committee of the Arbroath Gas Corporation have given a well-deserved snub to the Harbour Trust bondholders, whose doings I referred to a fortnight ago. A firm of solicitors had written in the name of the bondholders, pointing out that the price of gas had been reduced from 5s. 10d. to 4s. 2d. per 1000 cubic feet, and that their security was thereby interfered with. A reply to the communication was directed to be sent, to the effect that the Corporation alone had the power to fix the price of gas, and that they had no concern with the Harbour subvention.

The rapid progress being made in the construction of the new aqueduct for conveying water from Loch Katrine to Glasgow is evidenced by the letting of the last contract—viz., the one at the loch itself. The conduit is 1 mile 27 chains long, and runs in a northerly direction from the north end of the Loch Chon work to Loch Katrine. The contract includes the driving of a tunnel 2347 yards long, in addition to the construction of a substantial masonry inlet basin, as well as the work entailed in raising the level of the existing basin. The Contractors are Messrs. Lawson and Son, whose offer was £40,450. The Engineer to the Water Trust is Mr. J. M. Gale, M.Inst.C.E., who has for many years ably filled this important post.

Storage Extensions at the Sowerby Bridge Gas-Works.—The Sowerby Bridge District Council have recently spent £900 in adding a lift to one of their gasholders; making its capacity 90,000 cubic feet, and bringing the total storage accommodation of the works to 490,000 cubic feet, which is about equal to a day's consumption at this time of the year. It is stated that it is intended to make further storage provision by erecting a new three-lift holder. Among other work which has been carried out has been the laying of new mains, at a cost of £2000. In respect of the gas-works loans, about £50,000 has been paid off; and there is now owing, in round figures, £27,000.

The Public Lighting of Kingston-on-Thames.—The Kingston-on-Thames Gas Company recently offered to undertake the lighting of the public lamps with incandescent burners, including the supply of mantles, at the same charge per lamp as formerly—£3 12s.—but with a first charge of 35s. per lamp for supplying and fitting the incandescent burners and lanterns. They suggested, however, that the present time was inopportune for any extensive alteration in this direction, as there would probably be a considerable reduction in the cost of incandescent burners when the patent disputes now pending were ended. There are 600 lamps in the borough, and the Town Council feel they would not be justified in incurring the expenditure which the change would involve. They have therefore resolved to continue the present system of lighting.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 30.

Sulphate of Ammonia.—The market has ruled quieter; and prices are tending rather in buyers' favour. In consequence of increasing supplies, dealers have been enabled to complete their requirements for the month without affecting values; and, there now being no pressing needs, business can only be done at a concession on prices lately paid. Of course, it is known that the bulk of the orders for December has already been absorbed by dealers; and as consumers are therefore not competing to any extent, values are somewhat irregular. It is difficult to estimate the future. On the one hand, makers still demand a premium of 7s. 6d. to 10s. per ton; while, on the other, speculative offers are being made abroad at very little above current values. Quotations are £8 13s. 9d. to £8 15s. east coast, and £8 16s. 3d. to £8 17s. 6d. f.o.b. Liverpool.

Nitrate of Soda.—It will have been noticed from the proceedings at the Companies' meetings this week that a combination appears as far off as ever; and any substantial improvement can hardly be expected for some time to come. Cargoes, November sailing, are worth about 7s. 7½d. Spot price is still 7s. 9d. per cwt.

LONDON, *Nov.* 30.

Tar Products.—Important sales of anthracene are reported; and the market for this article is undoubtedly better than it has been for a considerable time. Benzols continue strong; and values have materially advanced. The removal of the surplus production for enriching gas has had the effect of alarming colour manufacturers in respect to their future supply. Naphthalene salts are in request at improving rates. Carbolic acid is steady; and considerable shipments of it are being made. Pitch is weak, and looks as if it might see lower prices. The following rates have been paid during the week: Tar, 18s. 9d. to 24s. Pitch, 33s., west coast; 36s. 6d., east coast. Benzols, 90's, 2s. 1½d.; 50's, 1s. 10½d. Solvent naphtha, 1s. 3d. Toluol, 1s. 11d. Crude, 30 per cent., naphtha, 6d. Naphthalene, pressed, 50s.; drained, 30s. Cresylic acid, 1s. 1d.; crude, 9d. Carbolic acid, 60's, 1s. 8d.; 75's, 2s. 1½d. Anthracene, "A," 11½d.; "B," 10½d. All, excepting tar, less 2½ per cent. for cash.

Sulphate of Ammonia continues dull. The advance of the season does not, as was anticipated, bring higher prices. There is no parallel in the history of the trade, where prices have remained so low at this period of the year. Indeed, to-day's values are lower than sulphate has ever realized before. There is more inquiry for forward delivery; but makers invariably and naturally expect a considerable advance in price. Business has been done during the week for prompt delivery at £8 12s. 6d. to £8 15s., less 3½ per cent. at all ports, excepting London, which is quoted £9. Gas liquor is quoted at 7s. to 8s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the past week, a very strong feeling has been aroused among coal traders here, with regard to the action of the railway companies on the increased siding-rents question. Notwithstanding the proposal made by the Coal Traders' Association, that any disputes between the merchants and the companies on this matter should be brought before the Board of Trade for settlement, the railway companies entered County Court actions against a number of traders in the district to recover these increased charges. Several of these actions have been dismissed by the County Court Judges as out of their jurisdiction; and others have since, I understand, been withdrawn by the railway companies. As the Coal Traders' Association had been put to great expense in preparing to meet these cases, the harassing policy pursued by the railway companies towards its customers has naturally caused a good deal of exasperation, especially as it had been hoped that the companies would have abstained from putting the coal traders to such unnecessary expenditure of time and money, in meeting a number of County Court actions, pending the decision of the Board of Trade with regard to the whole question. The business doing in most descriptions of fuel continues very moderate; and many of the pits are only working about four days per week, especially those raising the commoner qualities. House-fire coals have during the week been in perhaps rather better demand; but prices show no upward move. In the lower qualities of round coal suitable for iron-making, steam, and general manufacturing purposes, the supplies offering continue far in excess of the demand; and very low figures are being accepted. As regards engine classes of fuel, business continues limited, with prices cut extremely low; but a fairly active business is reported in the better qualities. At the pit mouth, house coals remain at about 10s. 6d. per ton for best Wigan Arley; 9s. to 9s. 6d., for seconds Arley and Pemberton four-feet; 7s. to 7s. 6d., for common house-fire qualities; 5s. 6d. to 6s., for ordinary steam and forge coal; and 6s. 6d., for some of the better sorts. Engine fuel ranges from as low as 3s. to 3s. 6d. per ton for inferior descriptions; with 4s. 6d. to 5s. quoted for the better qualities. No improvement whatever is noticeable as regards the shipping trade; business continuing very slow, with prices ruling extremely low. Ordinary steam coal does not average more than 7s. to 7s. 6d. per ton delivered at the High Level, Liverpool, or the Garston Docks.

Northern Coal Trade.—There has been increased dulness in the demand for steam coal in the North, and short time is now general at many of the Northumbrian collieries, though the price is still without much alteration. For best Northumbrian steam coal, the general quotation is still 8s. per ton f.o.b., though for one or two special markets 8s. 3d. is asked. Against this is to be set the fact that coal has in one or two cases been sold at slightly less than 8s. For second-class steam the general quotation is 7s. 6d. per ton f.o.b.; and for small steam the price varies from 3s. 9d. to 4s. The gas coal trade is now very active, the demand being at about its highest point; and the largeness of the deliveries on old contracts is so great that most of the output is taken up thereby, and there is very little for casual sale with some of the best of the gas coal collieries. For odd cargoes, when obtainable, from 6s. 6d. to 7s. 3d. per ton is the current price; but the bulk of the production is disposed of on contracts that are below these rates. In the manufacturing coal trade, there is very little alteration; the prices being practically unchanged this week. The large locomotive coal contracts are as yet unsettled in this district; but as the tenders are below the current year's prices, and as counter-offers are usually made, it is to be expected that the contracts when settled in a fortnight or so will certainly be at a reduction of some moment. As to the coke trade, there is considerable activity in the home markets, though for export there is the falling off that is general at this time of the year when Baltic shipments grow necessarily limited. More blast furnace coke is being sent to the North-west. The basis of price for shipment is 14s. 6d. to 15s. per ton f.o.b. In regard to gas coke, there are negotiations in progress for the quantities used by manufacturers for next year; but there are wide margins between the views of buyers and sellers as to the prices that are to rule. In the meantime, the exports of coke are fairly good, and help to keep down stocks, which would otherwise be large. For shipment, about 10s. per ton f.o.b. is the current quotation for gas coke.

Scotch Coal Trade.—There is no market change this week. There is a fair quantity of business doing; but the supply is more than equal to the demand, and prices are, if anything, lower than last week, though not quotably so. There is a general expectation of an improvement when the engineers' dispute is at an end, as there is a great deal of work on hand, and the demand will be greater than it is now. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 152,011 tons—an increase on the quantity in the preceding week of 5125 tons, and an increase as compared with the corresponding week of last year of 16,619 tons. For the year to date, the total shipments have been 6,743,930 tons—an increase over the corresponding period of last year of 2,070,498 tons, but a decrease on 1893 of 540,970 tons.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1132.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest. £	s.	d.
£			p. c.	GAS COMPANIES.						
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	23—24	..	4	7	6
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	..	4	5	8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4	11	9
200,000	5	14 Nov.	6¾	Bombay, Limited	5	6¼ 7¼	..	4	9	8
40,000	5	,,	6½	Do. New	4	5—5½	..	4	14	7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	253—258	..	4	13	0
180,000	,,	,,	9	Do. New	100	205—210	..	4	5	8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4	14	10
933,500	Stck.	29 Aug.	5	Bristol	100	124—128	..	3	18	1
320,000	20	27 Sept.	11¼	British	20	54½—55½	..	4	1	1
50,000	10	29 Aug.	11¼	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4	17	10
51,510	10	,,	8½	Do. 7 p. c.	10	18½—19½	..	4	7	2
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	8—8½	..	4	14	1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5	15	5
150,000	20	11 July	8¼	Cagliari, Limited	20	30—32	−1	5	3	3
550,000	Stck.	26 Oct.	13½	Commercial, Old Stock	100	320—325	..	4	3	1
165,000	,,	,,	10½	Do. New do.	100	247—252	..	4	3	4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3	1	3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	278—283	..	4	11	10
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	..	4	11	10
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	125—130	..	4	0	9
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4	3	0
351,060	10	,,	11	Do. Partly paid	7½	17—18	..	4	14	3
5,616,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	292—297	+½	4	5	10
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3	11	5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	284—288	..	3	9	5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3	11	5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3	13	2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3	10	9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3	9	8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3	10	7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	137—142	+2	2	16	4
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	147—152	..	2	19	2
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2	17	11
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	233—238	−2	5	0	10
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6—6½	..	4	12	4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4	6	2
541,920	20	14 Nov.	5	Monte Video, Limited	20	16½—17½	−½	5	14	3
150,000	5	28 Nov.	8	Oriental, Limited	5	7½—8	+¼	5	0	0
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6	7	3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8	0	0
				People's Gas of Chicago—						
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105—110	..	5	9	1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5	12	1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11—12	..	5	16	8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4	2	8
1,350,000	,,	,,	12	Do. B do.	100	307—312	−1	3	16	11
308,685	,,	,,	13	Do. C do.	100	325—330	..	3	18	9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	..	2	16	2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4	17	10
				WATER COMPANIES.						
746,021	Stck.	26 June	10	Chelsea, Ordinary	100	297—302	+2	3	6	2
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	215—220	−3	3	3	7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2	15	6
700,000	50	26 June	6½	Grand Junction	50	110—115	..	2	16	6
708,000	Stck.	29 Aug.	12	Kent	100	307—312	..	3	16	11
1,043,800	100	26 June	7¼†	Lambeth, 10 p. c. max.	100	247—252	−2	2	17	8
406,200	100	,,	7¼†	Do. 7½ p. c. max.	100	210—215	+2	3	7	6
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2	14	2
500,000	100	14 Aug.	12⅔	New River, New Shares	100	380—390	..	3	3	7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2	14	2
902,300	Stck.	12 June	4	S'thwk & V'xhall, 10 p.c. max.	100	138—143	−7	2	15	11
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2	15	2
1,155,066	Stck.	12 June	10	West Middlesex	100	293—298	..	3	7	1

*Ex div.

† Next dividend will be at this rate.

The Leeds Gas Committee and Modern Retort-House Plant.—The Gas Committee of the Leeds Corporation, having in contemplation the extension of the gas-works at Meadow Lane, are looking about with a view to finding more modern and economical gas-making appliances than they have at present in use. In May last, the Committee paid a visit to the gas-works of the Glasgow Corporation, where they saw the Arrol-Foulis system of mechanical stoking, with which they were highly pleased. But before making up their minds on the subject, they propose to visit towns where other systems of stoking have been adopted. Brentford and East Greenwich are to be visited by the Committee.

Sales of Shares.—In accordance with the announcement which appeared in our advertisement columns, Mr. M. Stainton sold by auction yesterday, at the offices of the *South Shields Gas Company*, £10,000 of the Company's new stock, sanctioned by their Act of 1886. The highest figure obtained was £213 5s. per £100; the total amount realized by the sale being nearly £21,000.——On Monday last week, Mr. Alfred Richards sold by auction, at the Mart, Tokenhouse Yard, E.C., 1500 £10 shares (7 per cent.) in the *West Ham Gas Company*. The prices ranged from £14 to £15 10s. per share; the total amount realized being £21,597 10s.——At Worksop last Wednesday, £1500 of preference stock in the *Worksop Water Company* (bearing 4½ per cent. interest) was sold at prices ranging from £113 10s. to £114 10s. per cent.

The Water Supply of Deal.—Dissatisfaction is being expressed at the water supply of Deal; and at the monthly meeting of the Town Council last Tuesday, a Committee was appointed to make preliminary inquiries and confer with the Walmer District Council with reference to the acquisition of the undertaking of the Water Company by the former authority. On the following evening, a serious fire occurred in Middle Street, at which a lady (Miss F. B. Smith) lost her life. At the inquest on Thursday, there seemed to be a desire to put blame upon the Company for inadequate service. The Company's Secretary and Manager (Mr. W. R. Hammond), however, stated that there was a constant supply under pressure up to a point so close to the scene of the fire that, if a valve had been opened, there would have been water in two minutes at full pressure. From some inexplicable reason, the Fire Brigade did not turn on the water themselves, nor did they acquaint the turncock, as they were always told to do. The jury returned a verdict of "Accidental death;" but they added the following rider: "The jury are very strongly of opinion that the Water Company should give a constant supply of water; the present arrangement being very unsatisfactory for general and household requirements, and in case of fire, the danger to life and property is very greatly increased."

The Teignmouth Gas-Works.—Some discussion took place at the meeting of the Teignmouth District Council last Tuesday respecting the financial position of the gas undertaking. Mr. F. Wheatley, in presenting the report of the Finance Committee, said he anticipated a serious deficit on the gas account next Lady Day. The total receipts to that date he estimated at £1795; while including the sum of £1405 now owing, the liabilities would be £2320. There would thus be a deficit of £525, besides which there was the cost of the coal, which would have to be purchased. Under the present arrangement, they were not able to buy to the best advantage. This increased the difficulty of the position, and something ought to be done to remedy it. They ought to raise the price of gas. The Chairman (Mr. T. W. Hutchings) said this was a matter for the Gas Committee. To this Mr. Wheatley replied that nothing was being done; and unless speedy action were taken, the price could not be increased until Midsummer. Mr. Harris, the Chairman of the Gas Committee, said that eighteen months or two years ago, when coal was dear, he was in favour of increasing the price; but the majority of members were against it. On the reading of the minutes of the Gas Committee, it transpired that the stock of coal had dwindled down to a fortnight's consumption; and the Manager recommended that a temporary supply should be obtained by rail till the next shipload arrived. Mr. G. H. Jarvis pointed out that there was a resolution on the minutes to the effect that the coal-stores should be filled when winter commenced; but instead of being full, they were now empty. He thought this was bad management. It was decided to procure a supply as recommended by the Manager.

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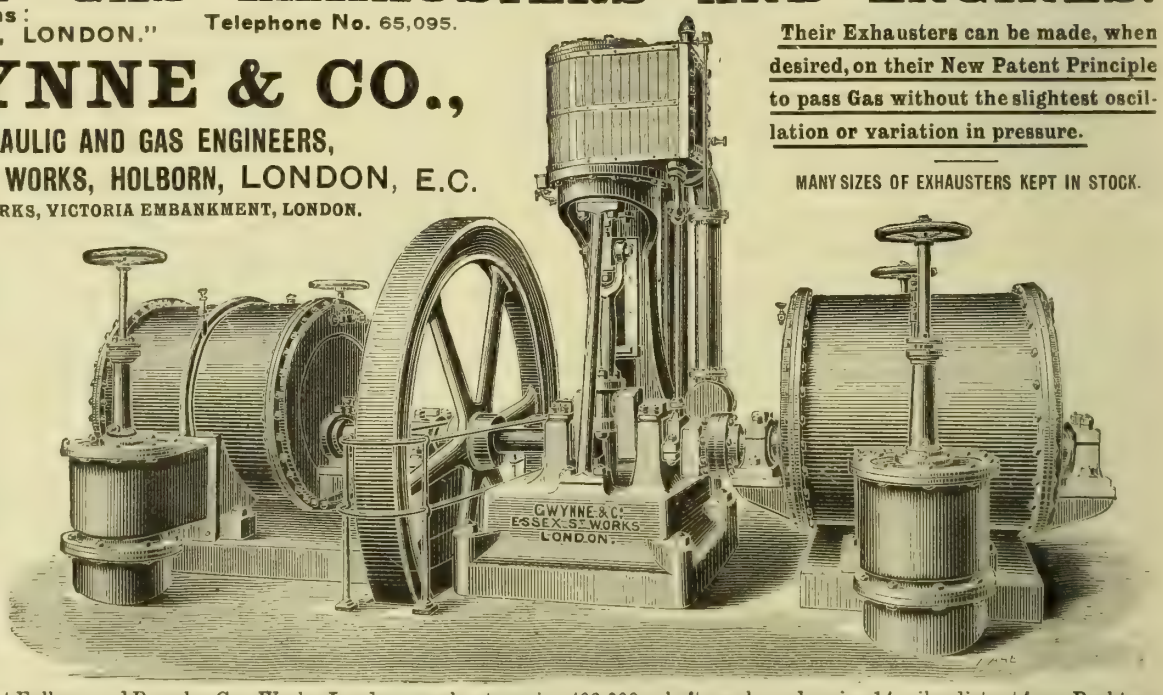

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EDITORIAL NOTES.

Expected Termination of the Engineers' Strike.

It has been arranged that Lord James of Hereford is to preside to-morrow over a joint meeting of the federated employers of the Clyde and the representatives of the engineers on strike; and expectations are confidently held that this means a speedy resumption of work. It is greatly to be hoped that the expectation will not be disappointed; for it is high time the affair was settled, if settlement is procurable by any means short of the exhaustion of one side. The facts that a conference is to be held, and that such a prudent statesman and man of the world as Lord James of Hereford has consented to appear at the head of it, are sufficient evidence to prove that the moving spirits in the strike are not prepared to stake the future of the Amalgamated Society of Engineers upon the present issue. It may be concluded from what has actually happened on the Clyde, as well as from what is not going to happen, that, for all their protestations of confidence, the strike organizers have had enough of it for the present. As they would probably themselves express it, they have "seen the red light," in the unexpected federation of the employers; and when work is resumed, it is not likely to be so liable to local and sectional interruptions as before. Unless we misread the lesson of the whole business, time will most assuredly show that, in acting promptly and resolutely, as they did, regardless of contumely, the Belfast and Clyde shipbuilders have saved the industry of these centres, and probably of the whole country, from ruin at the hands of the New Unionists of the men's society. Up to a point, the men had all the advantages of combination; and they sought to use their power to deal piecemeal with their employers, who, for commercial reasons, could not see their way to combining their own forces. The culminating point of this policy, which has been so familiarized to the industrial world and the general public that it has seemed quite the natural and proper thing for Labour to do, was reached when the agitation of members of the Amalgamated Society of Engineers for an increased rate of wages and the acceptance of the principle of a minimum wage, begun on the Clyde, was shifted to, and became acute in Belfast.

The employers knew what was coming, by the preliminary skirmish at Clydebank in March. But they did not know where the next outbreak would be, nor what pretext would be offered for the action of the Union. As a matter of historical fact, it came at Belfast, upon the pretext, since shown to be baseless, that the employers on the Lagan had broken faith with their men by withholding a promised increase in the rate of wages. According to a report supplied by Mr. J. Stafford Ransome to the Iron Trade Employers' Association, there was never any such promise made by the employers; and the Belfast strike was a cut-and-dried affair ordered by the officials of the Amalgamated Society of Engineers, who thought they could reduce the Belfast masters much more easily than the Clyde employers, whose turn was to have come next. This simple strategy was, however, confounded by the combined action of the threatened employers. It may well be imagined that nobody could be more surprised and annoyed than the strikers when confronted with organized resistance all along the line. A roar of execration rose from them and their partisans of the platform and the press. The phenomenon of organized Capital was, indeed, so strange and so unexpected, that generally well-informed people misunderstood it; and all the newspapers were full of reproaches addressed to the employers, who, it was thought, should have "known "better." It will be understood ere long that it was the would-be philanthropic critics who did not understand the business. For a wonder, Capital and the administrative and commercial intelligence that usually goes with it rose to the emergency, and did what Artemus Ward vainly implored President Lincoln to do in similar circumstances —"caved in the Emergency's head."

The whole situation, so far as the origin of the strike is concerned, is explained in Mr. Ransome's report already mentioned; and the method and working of the employers' Federation are fully explained in an article in *The Times* of Friday last, written by the able special correspondent who has been watching the course of events on the Clyde. This account trenchantly exposes the folly of those self-

appointed champions of the strikers who have ventured to call the recent action of the associated employers suicidal, treasonable, and what not, upon the basis of "the "frail hypothesis that the men who direct the destinies of "what is, perhaps, the most important of our national "industries do not know their own business." We, at any rate, have all along held the opposite opinion; and we are not without hope of seeing the day when it will be realized by the public, and eventually even by writers in popular newspapers, that the best friends of Labour are to be found among those who decline to place their judgment at the feet of the apostles of Trade Unionism, whether Old or New. There is every reason to hope and believe that, whatever the professional agitators may think of it, this short, sharp action on the Clyde and the Lagan will be fruitful of results of the greatest benefit to the working members of trade societies, who needed showing that their leaders are not omnipotent.

The Board of Trade and the Standard of Light.

THE subject of the standard of light for gas testing was brought before the London County Council last Tuesday by the presentation of a report from the Public Control Committee, which recapitulated what had been done in the matter since the Board of Trade Committee formulated their recommendations in this regard. It was stated that in May last the Council caused a letter to be addressed to the Board of Trade, urging the immediate introduction of a Bill to give effect to these recommendations; and the Chairman of the Public Control Committee and the Clerk of the Council subsequently had an interview with Sir Courtenay Boyle to further press the matter. It appears that Sir Courtenay Boyle at first thought the Council ought to undertake this part of the business; but upon its being represented to him that there would be a greater probability of success if the Bill were introduced by the Board of Trade with the agreement of all parties, he "was "understood to intimate that this course would probably be "taken." This does not strike one as constituting a particularly warm promise; but, at any rate, the dissolution, which occurred very shortly afterwards, stopped further proceedings in the matter for the year. Most properly the Committee have now returned to the subject, and have recommended that the Board of Trade should again be stirred up to take the necessary proceedings for effecting a statutory change in the methods of gas testing upon the lines recommended. If anything is to come of the former action of the Board, now is the time to move. It has been understood all along, and the condition is referred to in the above account of what transpired at the interview of the County Council representatives with Sir Courtenay Boyle, that the Board of Trade are quite disposed to deal with the matter by a Departmental Bill, if all the parties concerned are in complete agreement as to what is wanted. Unless this condition precedent is fulfilled, the Board of Trade will not move. It seems to follow from the proceedings of the County Council that this body are willing for the recommendations of the now familiar report to be embodied in a Bill; but nothing is said as to their desiring to have anything added to them, such as, for example, the legalization of portable photometer testings. On the other hand, it has been stated that the Gas Companies will not be satisfied with any fresh statutory settlement of the photometrical question which does not remove their grievances in respect of the instrument itself, and the liberty of the Gas Referees to alter the pattern of it without consulting them. Thus it would appear that the perfect agreement of all the parties concerned to an amendment of the law applying to the testing of London gas for illuminating power is not to be taken for granted. Nevertheless, there should be no insurmountable obstacle to the conclusion of terms of agreement among the parties, if the Board of Trade are really desirous of putting an end to a state of things in this regard which is admittedly irksome to everybody concerned. A satisfactory issue greatly depends upon the spirit in which the County Council mean to approach the question as a whole.

The Gas Question in Liverpool.

A NECESSARY step has been taken towards the more hopeful treatment of the gas question of Liverpool by the formal rescinding of the resolution passed by the old City Council on the 2nd of October, instructing the Town Clerk to take proceedings for enabling the Corporation to promote a Bill in Parliament for the establishment of a competitive gas supply. Enough was said here about this piece of municipal fatuity at the time; and we do not desire to offer any comment on the reparation now made for it, beyond congratulating the city upon the restoration of sanity to the counsels of the Corporation. Of a piece with this procedure was the omission of Alderman Smith (who was responsible for leading the old Council astray in their gas affairs) from the new Sub-Committee appointed to deal with the gas question. Nobody wishes to import personalities into matters of this kind; but it is obvious, from Alderman Smith's record, that he would be out of place in the new Sub-Committee. The future conduct of negotiations between the Corporation and the Directors of the Gas Company, proceeding "with a clean sheet of paper, "unprejudiced by anything that had gone before," as Sir Arthur Forwood put it, must be confided to fresh and unprejudiced hands. As a matter of fact, Sir Arthur Forwood himself will be the leader of the Corporation in this most momentous business; and the main lines of his policy have already been publicly sketched out and noticed in these columns. As we understand it, this policy aims first of all at the re-establishment of relations of mutual confidence between the Corporation and the Directors of the Gas Company, which were destroyed by the majority of the old City Council. As the policy of this extinguished body did not effect the smallest good for the city, perhaps the citizens will not only support Sir Arthur Forwood in trying something different, but will also have patience while the new policy gathers force and prepares its results. A popularly elected body may change its constitution and its character in a day; but an established interest can only be influenced by regular approaches, and be bent to take a new development by degrees. When the Directors of the Liverpool Gas Company are thoroughly assured that the Corporation understand as well as they do themselves the conditions under which the city is supplied with gas, and are furthermore satisfied that there is no hostile intent inspiring Corporation inquiry as to whether these conditions, or any of them, can be modified to the advantage of the community, and how, we cannot believe that they will withhold from the Corporation any assistance it may be in their power to lend towards the elucidation of these questions. The existing settlement may be the best possible for all parties. If so, inquiry will establish the fact. Improvement may be possible and expedient in some respects. Who would stand in the way of it? Liverpool has a right to the best gas service that science, good management, and ample resources of every kind can provide; and it has also a right to satisfy itself that it receives all that is due to it in this regard.

The Gas Affairs of Birmingham.

THERE was an interesting debate in the Birmingham City Council last Tuesday upon and about the Corporation gas undertaking. It arose in connection with the presentation of a report by the Gas Committee concerning a variety of matters incidental to the working of the department, which disclosed a number of features illustrative of the progress of a large gas undertaking at the present day. The consumption of gas continues to increase; entailing incessant vigilance on the part of the management to keep pace with it, and to avoid being pinched in some section of the manufacturing or distributing plant. The use of machinery is being largely extended in the gas-works in Birmingham, as the expenditure accounts of the Committee testify; and the Chairman (Alderman Pollack) is fain to confess that all the saving that can be realized in this way is needed to make up for the depreciated value of coke and ammonia. The Committee seem to realize better than they have formerly done that if they can buy coal at a cheap rate, they must sell coke at a correspondingly low price. This helps the coke off; but it does not return so much as the Committee would like to see in their revenue accounts under this head. In the circumstances, it is not surprising that they should think about starting carburetted water-gas plant, which would tend to keep coke from glutting the market. Like many other suppliers of gas who have tried the prepayment meter system, the Committee find their own inspectors the best canvassers for new connections in this class of consumption. It is curious how the question of the demand for prepayment meters is influenced by the method in which it is put to the community. It has repeatedly been

argued in different places that there is "no demand" for this accommodation; and to the retort that the system is "going "like wildfire" in some neighbouring district, the reply has been offered that this is only because of the commission offered to the inspectors—as though this proved anything besides the inefficiency of the other agency, whatever it might be, which could merely produce a negative result. Having been disappointed in house owners and agents, the Birmingham Gas Committee have at length placed about a thousand prepayment meters through the efforts of their inspectors, and are getting more orders than can be attended to. This is according to general experience; every meter when fixed acting as an attraction and an advertisement. What with this and other new work, the fittings branch of the Birmingham Gas Department has more than the regular working staff can attend to. The Committee are not at all anxious to push the trade of this branch, out of consideration for the private plumbers and gas-fitters of the town. But the public usually prefer to have their wants attended to by the workmen in the employ of the Corporation; and nobody who has had many dealings with the ordinary "three-branch hand" will wonder very much at this preference.

The Votes of Gas Shareholders and Town Councillors.

As will be seen from an article which appears in another column, the question of the right of gas shareholders to vote upon certain matters in their capacity of members of local authorities has been referred to Mr. H. H. Asquith, Q.C., the ex-Home Secretary, by the Town Clerk of Reigate, where the difficulty recently assumed considerable prominence. There was on this occasion shown to exist a conflict of opinion upon the point between Mr. G. Humphreys, and Sir Richard Webster and his junior (Mr. R. W. Wallace). Moreover, there was a difficulty in the mind of the Mayor of Reigate with regard to the discrimination of the gas shareholder members of the Town Council from their less fortunate colleagues. So much fuss arose over the matter, that the Town Clerk was instructed to state a case for further Counsel's opinion; and the learned gentleman appears to have done his very best to put such categorical questions to Mr. Asquith as should close every opening for the entry of "all possible, "probable shadow of doubt, all possible doubt whatever." The result is that Sir Richard Webster and his learned friend and junior are held to be justified rather than Mr. Humphreys. Mr. Asquith is of opinion that the members of a local authority should not vote upon any question in the issue of which they have an interest. This is, of course, not news. It will be noticed, however, that the learned Counsel mentions "interest" under three qualifications, which are not necessarily identical, although he evidently means them to be regarded as being so. He states, first of all, that gas shareholders have a "pecuniary interest" in the question whether a Town Council of which they happen to be members should apply for an electric lighting Licence; and he goes on to discuss the nature of the "private interest" which might conflict with public duty, eventually finding it again in such "pecuniary interest" as a man of business might be supposed to have regard to when ordering his affairs—that is to say, a substantial interest. It is all very legal and right and proper, we suppose; but in the case of a good many members of local authorities who happen to be interested in a small way in gas undertakings, and who are, strictly speaking, incapacitated, according to the preponderance of opinion, from serving their constituents in certain affairs, the maxim "*De minimis non curat lex*" asserts itself. The purity of local authorities is evidently, in the judgment of lawyers, easily susceptible to blemishment. All the same, most people have, in the ordinary course of their lives, to steer their way between conflicting interests of far greater deflecting power than the possession of a few gas shares is ever likely to exert upon the judgment of any honest man who is worthy of the position of town councillor.

The Rebuilding of the "Journal" Offices having now been completed, the Editorial and Publishing Departments will this week be transferred from Temple Chambers and No. 1, Gough Square. Correspondents and friends calling will kindly note that the only address in future for JOURNAL business will be the old one—No. 11, Bolt Court, Fleet Street, E.C.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1210.)

THE condition of things on the Stock Exchange last week was such as the markets have been strangers to for some considerable time. There was a very decided lull, not to say a general calm. A few fitful puffs blew now and then—first from one quarter, and then from another; but the tide of speculation was at slack water. Movements were thus very slight and irregular; and prices have not undergone much change. The general attitude perhaps was watchful and cautious; all eyes being turned towards the East, where the daily phases of the Turkish *imbroglio* have all the attractions of startling diplomatic novelty. What the next move may be, it is difficult to foresee; but, in the absence of anything serious, the resumption of activity on the Stock Exchange until after the turn of the year is not probable. The Money Market is just as quiet as it can probably be. The Gas Market had a capital week; business being brisk and lively, and prices not only recovering the slight leeway which they somewhat unaccountably drifted into during the preceding week, but showing a smart tendency in favour of perceptible improvement. In Gaslights, the "A" stock opened at once with a rising disposition; and though one special bargain was done at 293½, that figure was soon left behind, and 296 was the closing mark. The secured issues were again in excellent form; and the "C," "D," and "E," 10 per cent. preference once more beat the record price. South Metropolitans were quiet, but firm. The "A" stock never marked anything lower than the top figure; while the "B" rose a point. Commercials remained very quiet; but with indications of latent strength all the week until the closing day, when the old stock came into prominent activity, and had a smart rise. The Suburban and Provincial division were unusually active, and very strong. Crystal Palace was repeatedly done at 130½; and the quotation now figures at better than a 4 per cent. price for money. There was a considerable rise also in Brentford old; and Bromley new improved half a point. The Continental group were rather quieter; but the tendency of Imperial to recover, which we noted last week, was realized by an advance of 2. Of the rest, Oriental made a further improvement, and San Paulo recovered. Buenos Ayres had a little relapse. Water stocks were rather quiet on the whole, but firm. Kent had a nice advance; and Southwark, after being further depressed, was smartly brought up to the position it held a fortnight ago.

The daily operations were: The Gas Market opened bright and cheerful; business being active, and prices good. Gaslight "A" rose 1; and Crystal Palace, 2. Things continued buoyant on Tuesday, and full of strength. Gaslight "C," "D," and "E" advanced 1½; and South Metropolitan "B," 1. Southwark Water fell 3. The general firmness was well maintained on Wednesday. Imperial Continental recovered 1; and Oriental gained ¼. Kent Water rose 3. The course of prices on Thursday was still mostly in advance. Brentford old rose 2; Imperial Continental, 1; and Bromley new, ½; but Continental Union receded 1; and Buenos Ayres, ¼. Southwark Water recovered 8. Friday was rather quieter, but equally firm. Brentford old increased 2 more; and San Paulo, ½. Saturday was active, with good business in Commercial old, which rose 2. Southwark Water had a further advance of 2.

ELECTRIC LIGHTING MEMORANDA.

Local Authorities and Electric Lighting Schemes—Refuse Destruction and Electric Lighting—Mr. E. Manville's Story—Dr. Fleming's Views.

IT must be conceded that the position of an ordinary member of a local authority confronted, as is pretty certain to be the case nowadays, wherever the district is populous enough to be styled "urban," with an electric lighting scheme, is anything but an enviable one. He may be a popular medical practitioner, an esteemed clergyman, a well-to-do shopkeeper, or merely a well-meaning busybody, quite capable of looking after the general sanitary administration of the locality with the needs of which he, as an old resident, is quite sufficiently well acquainted. Indeed, it may be granted that, as a rule, the local government authorities of our small urban communities are composed of men as well qualified to fulfil the duties of the position as could be found in their districts outside these bodies. When the ubiquitous electric lighting tout appears on the scene, however, he raises a question far transcending in importance and difficulty anything of which these estimable local magnates have usually had experience. Shall the district embark upon an electric lighting venture, or shall it refrain? It is a momentous issue, which never fails to assume a new aspect whenever and wherever disclosed. On the one hand, local patriotism, which the artful electrician never forgets to flatter, instigates the authorities to adopt what is so plausibly put before them as a "forward policy;" on the other side, there is the very doubtful expediency of doing anything that may increase the burden of the rates. Small wonder is it that, in their perplexity, the ordinary members of some local authorities fall under the influence of

those who may appear to them to have special qualifications for leading opinion in such a matter, and fail to realize till too late their true responsibility towards their constituents.

It is truly marvellous how local authorities are over and over again persuaded to consent to spend public money upon electric lighting schemes for which private capital could not be had at any price. It might be thought that the great army of electric lighting touts would find themselves handicapped by the obvious difficulty of explaining why it is that, in these times of lack of employment for capital, central station electric lighting is left entirely to local authorities, so far as the starting of fresh undertakings is concerned. But this obstacle does not appear to trouble these ingenious gentlemen. It is true that they have one or two attractive baits for adorning their proposals withal, which appeal specially to their intended victims. One of these is the suggestion for combining the destruction of town refuse with the generation of power for electric lighting. Nothing more specious than this idea has come into electricians' hands since the famous invention of French measurement, whereby the actual average illuminating power of arc lamps was quadrupled. Refuse destruction, coupled, if necessary, with thermal storage! There is a dazzling combination to set before the average vestryman or member of an urban sanitary authority! What can the doctor, the clergyman, the grocer say as to this? Naturally, he knows nothing about it, one way or the other; and he does not always know where reliable information on the subject is to be had.

The way in which the new bait for local authorities is prepared is shown in a paper recently read by Mr. E. Manville, a member of the Council of the Northern Society of Electrical Engineers, before a meeting of the Society in Manchester. This paper laid down the proposition, to begin with, that "it is by the utilization of the heat produced by the destruction of ashbin refuse that we may look to the cost of the production of electricity being materially reduced." The author went on immediately to speak about "the vast potential effect of the reduction of what are known as 'works costs' by at least one-third," which is therefore the extent of the advantage he professes to expect from this combination. We quite agree with his following observation, that "it is fortunate for the industry at large that the electrical supply enterprise in this kingdom is, and is likely to be, so largely in the hands of local authorities; for I am afraid that the *practicability* of effecting the combination of refuse destruction and electricity production could only be *practicable* in the hands of a local authority." There is more in this little bit of tautology than mere clumsy composition. It is indeed fortunate for those whose interest in this matter is the same as Mr. Manville's that they have members of local authorities and not directors of electric light companies to talk to in this strain. But to go on with the paper, which is, in the main, a description of plans for refuse destruction and electric power generation which the author has succeeded in getting adopted at Swansea and by the Shoreditch Vestry. It may be conceded that, for those who want to know what Swansea and Shoreditch are doing in this regard, and what it is hoped to gain thereby, the paper may be consulted with much advantage. Among other results, it is to be "feasible for the first time in this country to sell electricity for private lighting purposes at 2d. per B.T. unit, and to make no charge for the current used for public lighting purposes." Of course, if this can be done (at a profit to the local authority), Mr. Manville's promise, with which his paper concludes, "that the successful combination of dust destructors with electric lighting is in this way likely to produce a complete revolution in the prospects of electric lighting in this country," will be abundantly realized.

Electricians, however, like doctors, occasionally disagree; and it is then difficult for uninstructed outsiders to decide between them. We have given Mr. Manville's views, and can only append to them something taken from Dr. Fleming's report on the proposed electric lighting of Plymouth by the Corporation. The ideas of utilizing town refuse as fuel, and getting a day-load for the lighting plant by driving tramcars—the prime elements in Mr. Manville's solution of the problem of cheap electric lighting—were specially referred to Dr. Fleming; and he considers them with particular mention of the Shoreditch experiment. After premising that "the greatest caution is necessary in accepting many of the statements which have been made on this subject," the best Dr. Fleming can say of the experiment of thermal storage and destruction is that "it will be watched with great interest by engineers." But he thinks it will "be wise to hold back from following on the same lines until some experience has been gained of the safety and economy of such a system" in practice. Dr. Fleming has no objection to the Plymouth Borough Engineer putting destructor plant near the proposed electric lighting station, with a view to the possible utilization of the waste heat; but he strongly advises that, in the first place, the sanitary question should govern the working of the former, and that the latter should be quite independent of it. As to electric traction, Dr. Fleming also declares that the generating machines for it, if the idea is tried, should not be the same as those employed for lighting, though there is no objection to supplying steam for both from a common battery of boilers. All this is a terrible cut-down of Mr. Manville's pretensions; and the two views of the prospects of the proposed combinations must be left to prove themselves by the ordinary course.

THE CONTROL OF GAS UNDERTAKINGS.

A THOUGHTFUL essay on the "Control of Public Service Corporations," by Dr. A. R. Foote, has appeared in the *Engineering Magazine*. Its main interest for English readers, especially for those who are concerned in the supply of illuminating gas or the supervision of this service, consists in the manner in which the author, who has made this branch of political economy his especial study, lends independent support to the principles under which the gas companies of the United Kingdom are regulated by statute. It might be thought that these principles are too well established to require justification; but recent events in the municipal experience of an English city of the first importance go to show that, under the existing system of local self-government, communities are never secure from risk of their gas affairs being interfered with by agitators destitute of elementary acquaintance with the principles in question. Dr. Foote's object is to make out the case for the effective control of public service corporations, such as gas companies, as a preferential alternative to their undertakings being appropriated, ostensibly in the public interest, by the local authorities. Of the necessity and desirability of such control, there can be no question. A franchise or charter for supplying gas to a populous community, is a valuable property; and the only difference of opinion possible among those who have to consider the granting of such powers, is as to how this value can be conserved for the advantage of those who have the best right to it. Various solutions of this economic problem have been, and are still, in favour in different parts of the world. The most general view of the matter with European Governments is that a concession of the right to supply gas is something that should be paid for to the local authority both directly and indirectly. The British view has generally been that, after the capital sunk in the undertaking is sufficiently remunerated, the surplus of profit should go to the consumers. This principle is yet followed in the case of gas supply by companies. When the supply is taken over by the local authority, the principle is liable to be relinquished in favour of a modification of the Continental view. The ratepayers, represented by the local authority, are supposed to have a prior claim to the profits of the business; and the interest of the consumers is accordingly retired into the background. The popular American idea has hitherto been that competition in gas supply might be trusted to redound to the advantage of the consumers; but since experience has proved the contrary, there has been a revulsion of popular feeling in the United States in this regard—not tending to discredit the principle of competition, but in favour of arbitrary prescription of the selling price of gas by authority.

Of these different solutions of the same problem, it is possible to say a good deal on behalf of the first two. The advantages of the Continental, or concession, system are obvious and immediate; its drawbacks are matters of deferred realization. When it was originated, it afforded an easy way of extending the gas industry to localities whither it would not otherwise have penetrated. It seemed a fair and reasonable thing to ascertain from known factors what should be the price of gas in a particular place, and then to strike a bargain with the speculators who were willing to afford a supply upon those terms for a period long enough to enable them to recover their capital. The inherent weakness of the plan consisted in its neglect of the permanent character of the gas industry, and in its consequent disregard of the possible operation of the "unearned increment" in this connection. It is unnecessary to defend the established British system, as applied to gas companies. Neither the original settlement, upon the basis of maximum dividends, nor the amended one upon the sliding-scale, is ideally perfect; but it is sufficient for practical men that nothing better has ever been found, as is proved by the plain fact that where the principle properly operates, there the price of gas is lowest. With regard to the American system of competition in supply, tempered with mediæval arbitrariness in fixing the selling price, it is impossible to adduce any justification.

Dr. Foote is obliged to argue, for the instruction of people singularly obtuse to the contention, that there are certain public services to which the commercial principle of competition is not applicable in the public or any other interest. "Competition is supposed to stimulate demand through reducing prices. There is a limit, however, to the demand for any service within a specified area. It is not possible for two plants to render a service as cheaply as it can be done by one that could control and supply all the demand within the reach of both. The inevitable result of a multiplication of plants is an increased cost resulting in an increased price, or in a loss on the investment. The first is unjust to the users of the service; the last is unjust to investors in the plants. Uncertainty, resulting from short-time contracts, limited life of the corporation, and lack of protection in its area of operation, is a far more serious source of evil than a superficial observer can be made to understand." Then the writer goes on to give an instance. "The City of Baltimore furnishes an object-lesson for those who suppose that prices can be permanently reduced by the methods of competition. In unintelligent efforts to secure low-priced gas, franchises have been granted to one competing Company after another, until six gas plants, more or less complete, have been built in that city. One after another the competing Companies

have died, until now there is but one Company owning all the works, doing business on an investment several times larger than is necessary." Yet the moral of this story has not been learnt by the people most concerned; and it is probable that, for a consideration, another Baltimore gas franchise could be procured to-morrow.

The first essential to good service on the part of public supply corporations is security of tenure. Dr. Foote propounds as necessary to the proper working of such organizations and the public interest that they should be secure from competitors' "raids;" that uniformity of organization, accounting, independent inspection, and auditing should be required by the State; that capital should represent assets; that no charge should be permitted for franchises or privileges of any kind; that no limitation should be placed on the life of the corporation; that no taxes should be assessed upon its property, business, or income; that prices charged for services should be adjusted from time to time on the basis of cost of production, *plus* interest on capitalization, at the rate paid by the Municipality on its bonds, and a reasonable profit. "All surplus earnings should be used to retire bonds, without permitting a capitalization of the values represented by them; or, if no bonds, for extending the plant, without capitalizing the investment. Under these conditions, services can be rendered in the best known manner at the lowest practicable prices, and the corporation stocks and bonds will be the best investments in the world, because the self-interest of the corporations and of the users of the services they render will be well secured, and the Municipality will enjoy the best economic advantages science and art can devise."

It will be profitable to compare these ideals with exising British practice. We have the greater part, and the most practical, of them already, including protection of capital, uniformity of accounting, independent audit, gratis charters, corporations with perpetual succession and freehold rights in their property, no competition, and adjustment (automatic) of prices. We have not the proposed exemption from taxation, nor the extinction of capital obligations by the application of surplus earnings to this purpose. Is it too much to claim, as the consequence of the realization of these conditions, that the service of gas supply in the United Kingdom is actually, as Dr. Foote promises, "rendered in the best known manner at the lowest practicable prices"? Certain it is that the value of the investment in the case of British gas undertakings is unsurpassed; and it is hardly exaggerating to credit localities that are served by gas companies so circumstanced with enjoying "the best economic advantages that science and art can devise" in this respect.

There is, in theory, only one way of getting a better gas service than can be supplied by a company, and that is by entrusting it to a municipality. "Many people," says Dr. Foote, "honestly suppose that good services at low prices will result from public ownership," which belief he hesitates not to call a "fallacy." Without following the critic into all that he has to argue on this point, it will suffice to accept his proposition that "when a Government undertakes a business, its function of regulating and controlling that business is obliterated. The power of regulation can be exercised only by an authority outside of, and superior to, the corporation to be regulated." This is true all the world over; and so is the commentary that "there is no compensating gain to cover the loss of the power of regulation." Not contenting himself with this very emphatic declaration, the author repeats it as the parting message of his communication: "The paramount consideration to the people of every municipality is the *right to control*. If the control be wisely and justly administered, no sort of public ownership, participation in profits, or franchise price can possibly equal the public benefits that are certain to accrue from judicial control." We entirely agree. The history of the gas supply of English towns shows very plainly that when a gas undertaking passes out of the possession of the company, control of its working in the public interest ceases. There is no such jealous, suspicious testing of the gas supply anywhere as there is in London, Dublin, and Liverpool. Wherever the supply is in the hands of a local authority, nothing of the kind is heard of. The gas examiner becomes in such places the apologist for the gas makers whom under other conditions he accuses. He only finds sulphuretted hydrogen "occasionally" present in the gas, and the "average" of the tests for illuminating power is always quite up to the mark, when the doings of a corporation gas committee are in question. And gas profits! Where is the auditor who detects such an authority in the act of making extensions out of revenue, or doing any of the statutory wrongs which would bring a gas company into a "Court of summary jurisdiction"? It is true that in the English system the "Justices" are supposed to exercise the same control over a municipalized gas undertaking as they do over a gas company. But there is nobody to originate the complaints; and if this were done, Justices of the Peace are nowadays so often merely municipal magnates themselves that they would be sitting in judgment upon their own policy. The more the subject is considered, the more force will be seen to lie in Dr. Foote's contention, that, assuming public supply undertakings to be subject to the same conditions as to security and so forth in private and public ownership, the best interest of the community will be served by leaving them in private hands, subject to public control. By eliminating the incentive of private interest from the immediate administrators of these undertakings, the best guarantee of economy and efficiency is taken away; by removing the independent supervision and control of the public authority, the safeguard of the community is abrogated. It would not be regarded as a sane arrangement to constitute the shopkeeper his own inspector of weights and measures; yet this is very much the same thing as handing over the gas supply of a community to the local authority, subject only to the shadowy control of the local magistracy. Local authorities, as such, may be very admirable and reliable; but when they commence keeping shop, they should come under the same supervision as that to which other traders are required to submit. Unfortunately, it is not easy to formulate a scheme for effecting anything of the kind in their case.

Institution of Civil Engineers.—At the monthly ballot for membership of the Institution last Tuesday, the following were among the associate members elected: Mr. J. E. Askwith, of Waskerley, Darlington; Mr. J. W. Buckley, of Falmouth; and Mr. Herbert Lees, of Hexham.

Books Received.—Transactions of the Incorporated Gas Institute for 1895, edited by F. G. Burfield, Secretary. The volume contains the report of the proceedings at the Edinburgh meeting.——Transactions of the Société Technique de l'Industrie du Gaz en France for 1895, containing the report of the twenty-second annual Congress, held in Paris.——"Service Chemistry," by Vivian B. Lewes, F.I.C., F.C.S. Second and revised edition, illustrated. (London: W. B. Whittingham and Co., Limited, 91, Gracechurch Street.)

The Late Mr. Denny Lane and Electrical Science.—The current number of the *Electrician* contains an appreciative notice of the late Mr. Denny Lane, whose death was announced in the JOURNAL last week. Our contemporary says: "He was a man of large intellectual interests and many parts; and his loss will be felt not only among his friends in the gas industry, but also among electrical engineers. He ever took an interest in the progress of electrical science and its applications, and more particularly in that happy union of gas and electrical interests which is to be found in the gas-engine station—a type of station which Mr. Lane was the first to advocate. The contributions from time to time to our correspondence columns, also served to show that his interest in electrical matters was an active one."

The Automatic Gas-Meter (1895) Corporation, Limited.—In another part of the JOURNAL will be found the prospectus of this Company, which has been formed, with a capital of £100,000 in £1 shares, to take over, as a going concern, the property and assets of the Automatic Gas-Meter Company, Limited, and to continue the business of gas-meter manufacturers hitherto carried on in London, Manchester, and Leeds; and also to acquire the patent rights of Messrs. Thorp, Marsh, and Haynes for automatic prepayment gas-meters and attachments therefor. It will be noticed that upon the Board are Mr. T. Case Morris, a Director of the Liverpool United Gas Company, and Mr. Henry J. Davis, a Director of the Davis Gas-Stove Company, Limited. The subscription list will close on Friday next for both town and country.

Electric v. Gas Lighting at Hastings.—Our readers are aware that the electric light is a sharp competitor with gas at Hastings; but this fact does not apparently depreciate the value of the Gas Company's stock as an investment. As will be seen by a paragraph which appears in another part of the JOURNAL, some of their £20 shares sold last week for £46 and £48 apiece. In view of certain strong efforts which have lately been made to minimize the Company's prosperity, we think these may fairly be styled "record" prices. As it is the intention of the Directors to reduce the charge for gas 2d. per 1000 cubic feet (making it 3s.) from the 1st prox., the consumers will probably think twice before they give up this illuminant, the manufacture of which brings to the town a considerable revenue in the shape of a coal duty of 2s. 6d. per ton.

Personal.—Mr. A. P. Trotter, B.A., M.Inst.E.E., ormerly Editor of the *Electrician*, has been appointed Government Electrician and Inspector, under the Electric Lighting and Power Act, 1885, to the colony of Cape of Good Hope. He will leave for the Cape early in the new year.——The Gas Committee of the Belfast Corporation have appointed Mr. A. M'I. Cleland assistant to the Chief Gas Inspector (Mr. Lynass).——Mr. G. R. Casterton has been appointed Manager and Collector to the Biggleswade Gas Company, in place of Mr. F. Conder, deceased.——Mr. P. N. Russell, the founder of an engineering firm in Sydney, has given £50,000 for the endowment of a school of engineering in the University of Sydney.——Mr. H. Silvester, the Borough Analyst of West Bromwich, has been engaged by the Gas Committee to make independent tests of the gas in a room to be specially prepared for the purpose at the Town Hall.——Mr. R. Forster has resigned the chairmanship of the Gas Committee of the Carlisle Corporation; and it is possible the Vice-Chairman (Mr. Corbett) may succeed him.——Mr. H. Airey, the Chief Inspector at the Spitalfields gas-meter testing station of the London County Council, has retired, at the age of 67; and Mr. G. D. O'Byrne, an inspector at the station, is to succeed him. Mr. W. R. Land has been raised to the position vacated by Mr. O'Byrne.

THE RIGHT OF GAS SHAREHOLDERS TO VOTE UPON ELECTRIC LIGHTING QUESTIONS.

It may be remembered that, at a special meeting of the Reigate Town Council held in October (see *ante*, p. 833), to consider the expediency of carrying out an installation of the electric light in the borough—which, it may be pointed out, consists of the two towns of Reigate and Redhill—several letters were read from electrical supply companies, stating that they intended to apply to the Board of Trade for Provisional Orders to supply the light for public or private purposes, or both, within the borough area. After a heated debate, when a vote was about to be taken on the question whether permission should be given to a private company to lay down plant, or whether the Corporation should apply for a Licence or a Provisional Order, and perform the work themselves, a member asked the Mayor whether those shareholders in the local Gas Companies who had seats on the Council could vote upon the question. The Mayor asked the Town Clerk (Dr. Grece) to give an opinion upon the subject; and the latter thereupon read the following opinion of Mr. G. Humphreys, who had been consulted by the Corporation of Monmouth, where a similar point was raised. This opinion was quoted by the Town Clerk from the Journal for April 10, 1894, and was as follows:—

Proceedings at meetings of Town Councils are regulated by section 22 and Schedule II. of the Municipal Corporations Act, 1882 (45 and 46 Vict., cap. 50). By rule 13 of Schedule II., a Council may make Standing Orders for the regulation of their proceedings and business; but, from the fact that none was referred to, I assume that there is no Standing Order of the Monmouth Town Council applicable to the case. That being so, the matter depends on sub-section 3 of section 22 of the Act, which provides that a member of the Council shall not vote upon, or take part in the discussion of, any matter before the Council or a committee in which he has directly or indirectly, by himself or his partner, any pecuniary interest. In my opinion, the mere fact that Mr. Alderman Powell and Mr. Howse are Directors of the Monmouth Gas and Water Company did not cause them to have, within the true meaning of section 22, sub-section 3, a pecuniary interest, directly or indirectly, in the matter in question. I think, therefore, that the Mayor was bound to treat them in all respects in the same way as an ordinary member of the Council; and that the mere fact that they are Directors of the Monmouth Gas and Water Company does not disable them from taking part in the discussion of, or from voting upon, the scheme for electric lighting.

Having read the foregoing opinion, the Mayor, for a second time, was about to take a division on the question of electrical supply, when Mr. Viall, who had first raised the point in regard to the eligibility of gas shareholders to vote, produced legal opinions in support of his contention that they could not vote. One was signed by Sir Richard Webster (Attorney-General) and his junior, Mr. R. W. Wallace. It was dated March 12, 1895, and ran as follows:—

We are of opinion that, having regard to section 46 (B) of the Local Government Act, 1894, a member of an Urban District Council who is a shareholder in a company may not vote on any question in which the company is interested, unless the County Council has removed the prohibition. By sub-section (8), such a member is subject to a penalty not exceeding £20 for voting when prohibited. We are of opinion that notice should be given to the members who are shareholders in the gas company that, if they vote on the question of the electric lighting of the town, proceedings will be taken to enforce the above penalty against them, and to get their votes disallowed.

The other opinion brought forward by Mr. Viall was signed by Mr. R. S. (now Mr. Justice) Wright. It was as follows:—

The Urban Sanitary Authority of —— is a Corporation acting by the Council (see section 6 of the Public Health Act, 1875); and consequently the present question turns on the construction of section 22, sub-section 3, of the Municipal Corporations Act, 1882. In my opinion, those members of the Council who are shareholders in the Gas Company have a direct pecuniary interest in the question whether or not the Council shall give their consent to the application by the Electric Light Company for a Licence under 45 and 46 Vict., cap. 56, sec. 3; and such members are not entitled to vote on the question, or to take part in the discussion of it. No penalty is attached to a breach of section 22, sub-section 3; and all that can be done in order to prevent such members from voting will be to get some member of the Council to draw the attention of the Mayor to the facts that the votes in question ought not to be received, and will be invalid. (See Rule 10 of Schedule II. to the Municipal Corporations Act, 1882.)

After reading the opinions of Sir Richard Webster and Mr. Justice Wright, which were diametrically opposed to that given by Mr. Humphreys, the Town Clerk said he should have been satisfied to accept Mr. Humphreys' view as the correct one, had he not seen those put forward by the other eminent authorities. He accordingly declined to advise the Mayor to act in contradiction to the opinions expressed by the Attorney-General and Mr. Justice Wright.

The Mayor then left it to the discretion of any member who might come within the scope of the objection, to vote if he thought best to do so; stating, in support of his ruling, that, however familiar the fact might be that some members of the Council were shareholders, and also Directors, of one or other of the Gas Companies, he yet had, in his character of Mayor, no efficient cognizance of it, and could only act upon official knowledge, or at least upon the avowal of the members themselves, both of which were wanting. As a result of this ruling, several members present abstained from voting. But the discussion upon the question was so animated, and the opinions of a number of councillors were so divergent, that it was finally resolved that the Town Clerk should obtain Counsel's opinion as to the legality of gas shareholders voting. The opinion of Mr. H. H. Asquith, Q.C. (Home Secretary under the late Government), was accordingly sought. After setting forth the case in a very complete manner, he was requested to advise on the following questions:—

1.—Whether shareholders in the Reigate Gas Company, which is devoid of parliamentary duties and powers, were prohibited from speaking and voting upon the question before the Council.

2.—Whether shareholders in the Redhill Gas Company, which is invested with parliamentary powers and subject to statutory duties, are obnoxious to the same prohibition.

3.—Whether, in the absence of any official knowledge that a member of the Council is a shareholder, and obnoxious as such to the prohibition, the Mayor or other Chairman of the meeting should refuse permission for him to speak and vote.

4.—What class or order of questions would come within the scope of the prohibition?

5.—In the event of members of the Council speaking and voting when within the prohibition, what consequences would be entailed thereby (*a*) upon themselves, and (*b*) upon the vote taken?

6.—Generally, what would be the course for the Mayor or other Chairman of the meeting to pursue upon the emergence of similar questions hereafter?

Mr. Asquith's opinion is as follows:—

Temple, *Nov.* 5, 1895.

1 & 2.—I am of opinion that the shareholders in both the Gas Companies have a pecuniary interest in the question whether the Council should apply for a Licence authorizing them to supply electric lighting in the borough, within the meaning of section 22, sub-section 3, of the Municipal Corporations Act, 1882, and are therefore prohibited from voting upon, or taking part in the discussion of, the proposed resolution. I agree upon this point with the opinions of Sir R. Webster and Mr. R. S. Wright, quoted in the instructions. It is to be observed that section 46, sub-section (2) (C), of the Local Government Act, 1894, does not apply to the proceedings of the Council of a borough.

3.—Every member of the Council is, *primâ facie*, qualified to speak and vote upon every question that comes before it; and the Mayor is not bound to take the responsibility, and incur the risk, of refusing permission to any member to speak or vote, unless he has convincing proof (such, *e.g.*, as an admission by the member himself) that he has a disqualifying interest in the matter under discussion.

4.—No exhaustive or even approximate enumeration is possible of the class of questions to which the prohibition applies. Its object is to prevent the possibility of any conflict between public duty and private interest. The word "interest" is not to be construed, in my opinion, in its strict technical sense. Wherever the member is so situated towards the matter under discussion that, assuming him to act from the ordinary motives which govern men of business, his decision would, or might, be affected by its bearing upon his pecuniary interests, he ought to abstain from speaking or voting.

5.—There is no statutory penalty attached to a breach of the provisions of section 22, sub-section 3. A member who wilfully offends against the prohibition is probably guilty of a misdemeanour at common law, and subject to indictment. A resolution carried or rejected by the votes of disqualified members (by which is meant that, if those votes were disallowed, there would be a majority the other way) is invalidly carried or rejected, as the case may be.

6.—The Mayor should, in the case supposed, inform the Council that he is advised that shareholders in the Gas Companies may not speak or vote, and invite such members to declare themselves. They are not bound to do so; but if, after such an intimation, they speak or vote, they will do so clearly at their own peril.

(Signed) H. H. Asquith.

As a result of this opinion, the shareholders and directors of the local Gas Companies present at the adjourned meeting of the Reigate Town Council on Monday last week abstained from speaking and voting upon the electric lighting question; and a resolution by which the Council resolved to apply to the Board of Trade for a Licence in order to supply the electric light within the borough area was carried by one vote.

Electric Lighting Regulations.—According to a paragraph which appeared in *The Times* on Thursday last, Lord Kelvin, Mr. W. H. Preece, and Major Cardew, the Committee of Experts appointed by the Board of Trade, have presented their report on the questions referred to them as a result of the recent conference on the proposed new electric lighting regulations (*ante*, p. 1094.) The principal matter on which the Committee were asked to advise was as to the definition which should be officially laid down to constitute "low pressure." As presented to the conference, the revised regulation of the Board proposed that a pressure which could not at any time exceed 300 volts if continuous, or the equivalent of 150 volts if alternating, should be deemed a low-pressure supply. But the Institution of Electrical Engineers urged that 600 volts should be accepted as the low-pressure limit. It may be remembered that Dr. Hopkinson stated that, with the five-wire system, electricity was already being supplied in Manchester at a low pressure of 400 and 450 volts, without any serious consequence. The Electrical Committee of the London Chamber of Commerce advised that the low-pressure limit should be raised to 500 volts; and other experts considered that, in view of the advance made in electrical science, it was no longer necessary to draw any distinction between alternating and continuous currents.

NOTES.

An Unexpected Improvement of the Gas-Engine.

In connection with the revival of interest in mechanically driven road carriages, some prominence has been given in the engineering journals to the reported performances in America of the Kane-Pennington petroleum motor. Full particulars of this engine have not yet been published; but it is stated that an engine weighing only 17½ lbs. has developed 4¾ indicated horse power when run at a speed of 700 revolutions per minute. The motor has a cylinder 2½ inches diameter and 6-inch stroke; and it is capable of running at 2000 revolutions per minute, when it will develop 10-horse power. It is claimed that, under these conditions, it will run fairly cool without a water-jacket. The "Otto" cycle is employed; and the consumption of fuel—common kerosene—is stated to be after the rate of about 0·64 lb. per indicated horse power per hour. The oil is gasified inside the cylinder itself; and the charge is fired only when the crank has advanced 45° from the dead centre. The chief peculiarity of the motor appears to consist in the application to the charge of a "mingling spark" before the ignition spark proper—both, of course, being electric. The mingling spark is described as a long one, and does not fire the gases in the cylinder. It is reported, however, to have a wonderful effect in mixing them; and, if omitted, the engine loses power and the cylinder becomes hot. It is further reported that the same device applied to an ordinary gas-engine is equally beneficial. This last is a truly remarkable claim, which ought to be susceptible of easy verification, if tenable.

A New Pipe-Welding Apparatus.

The extensive employment of welded steel tubes for water, oil, and gas mains under high pressure endues with interest all devices for making and repairing them. Our contemporary *Engineering* reports favourably of the use for this purpose of the deflected arc system of electric welding, as perfected by what is called the *Zerener* apparatus. This process depends upon the well-known phenomenon of the deflection of the electric arc by a magnet, by which the carbon arc may be formed into something resembling a blowpipe flame, and capable of being so employed. By the use of an apparatus of this description, most extensive and otherwise difficult brazing and welding operations are easily and quickly performed. Steel pipes from ⅛ to ½ inch thick have been longitudinally welded at a rate of working comparing favourably with riveting. Extensive use of the system is expected to be made in the manufacture of the steel barrels which are to supersede wooden barrels in the petroleum trade. It seems to be expected also that, by taking advantage of this equipment, the proprietors of electric lighting plants will be able to lay themselves out for doing a paying amount of jobbing work during their unprofitably protracted hours of leisure; while portable welding apparatus can be extensively used for welding work *in situ* where ordinary methods are impracticable.

Hand Labour versus Machinery for Excavating.

A good deal is said occasionally in presidential addresses to engineering societies, and generally when people meet together to talk about the advanced methods of modern material civilization, as to the supersession of hand labour by mechanical appliances. To judge by manufacturers' catalogues and advertisements, it would appear that what with grab-hoists, steam-navvies, and appliances having the same object, the man with the spade and wheelbarrow has already become an anachronism. It is therefore worth the notice of engineers having much to do with earthwork that Mr. H. E. P. Cottrell, who has recently described the construction of the Corinth Canal in the pages of *Engineering*, sums up, as the principal lessons of this work, that no method is, on the whole, so satisfactory or so certain for dealing with such cuttings as the old-established way of pick-and-shovel work with locomotives and spoil-waggons. Preconceived ingenious plans and devices are foredoomed to fail, either in respect of adaptability or cost. These conclusions will be comforting to those well-wishers of the labourer with pick and shovel who may, for his sake, have looked askance at the various mechanical methods in use for shifting earth on the large scale.

The Durability of Iron and Lead Pipes.

In a series of articles appearing in the *Builder* on metals used in building, some observations occur respecting the durability of cast iron and other metallic pipes when laid in the ground. Unfortunately, the writer of these observations seems to be mainly dependent for his facts upon what has already been put upon record in books and the published transactions of engineering societies. Writing, for instance, of the rusting of cast-iron pipes in contact with earth, he remarks that when pipes are laid in rock excavations—not a very common circumstance—it is well to ram pieces of the same rock round the pipe. Also it is observed that if the pipes are buried in clay, they are likely to be always kept damp. In sand or gravel, it is stated that pipes may decay rapidly, so that on being dug up they are found to be often encrusted by compact stones and sand bound together by the iron derived for the most part from the destruction of the pipes. It is not stated what happens to cast-iron mains and wrought-iron pipes when buried in clinkers and furnace ashes; nor how the durability of lead service-pipes is likely to be affected by leaving them in contact with the lime mortar of new buildings.

Modern Lighthouse Equipment.

Information concerning recent improvements in lighthouse illumination has been published in *Nature*. It is stated that one of the most notable of these is the hyper-radiant apparatus of large radius introduced by Messrs. Stevenson to meet the requirements of the large gas-burners inaugurated by Mr. Wigham, and copied for petroleum lamps. With revolving apparatus of the old standard dimensions, it was clearly proved that much of the light, being ex-focal, escaped condensation, and hence the hyper-radiant apparatus was designed to utilize and condense the rays proceeding from the large radiant. The light from one of the lenses of a hyper-radiant apparatus is more intense with the same size of burner in the focus than that from two lenses of the older type. The hyper-radiant system is now largely used by all lighthouse authorities. Great stress is laid upon the new Stevenson spherical refractor with equiangular prisms. In the design for the Rathay Head apparatus, the equiangular prisms have been adopted, to enable the lens to be carried to 80° of a vertical angle—the prisms at this high angle of refraction still showing a good efficiency; whereas when lenses are carried to this high refracting angle by Fresnel's prisms, the lenses become very ineffective, owing to their great divergence for ex-focal light. In recent designs by Messrs. Stevenson, of optical apparatus for New *Z*ealand, lenses equiangular throughout have been introduced. The following figures give an idea of the power of some modern lighthouse apparatus. The Isle of Man light (electric) has a calculated flashing intensity of 26,000,000-candle power. Calculated on the same basis, the St. Catherine's Point light has an intensity in the beam of 5,000,000-candle power. The La Hève light is rated at 23,000,000-candle power. Bishop Rock (biform) oil-light with hyper-radiant apparatus gives a flash of 175,000-candle power. The Eddystone, with two six-wick burners and a first-order apparatus, gives a flash of 75,000-candle power. Skule Skerry, with one six-wick burner, and hyper-radiant apparatus, gives a flash of 74,000-candle power—that is, nearly as brilliant as the Eddystone, with only one-half the burner power.

The Installation of Carburetted Water Gas at Blackburn.—Messrs. Stevenson and Burstal, of Westminster, ask us to mention that the carburetted water-gas plant at Blackburn was constructed in consequence of a report which they, as Consulting Engineers, made to the Corporation; and that the whole installation, which has been so successful, is exactly in accordance with their recommendations.

Obituary.—Mr. Charles Thomas Lucas, the senior partner in the well-known contracting firms of Lucas Brothers, Lucas and Aird, and John Aird and Sons, died at his residence, Warnham Court, Horsham, last Wednesday. He was a Justice of the Peace of Surrey, and a Deputy-Lieutenant of Sussex, of which county he was High Sheriff in 1879. The partnership with Mr. John Aird, M.P., was formed in 1874. Deceased was in his 76th year; and he leaves a widow and three sons.——The death occurred last Tuesday of Mr. Robert Johns, Manager of the St. Ives (Cornwall) Corporation Gas-Works. Deceased, who was 41 years of age, was much respected in the town, where he had served as a member of the Burial Board, and was formerly captain of the Fire Brigade.

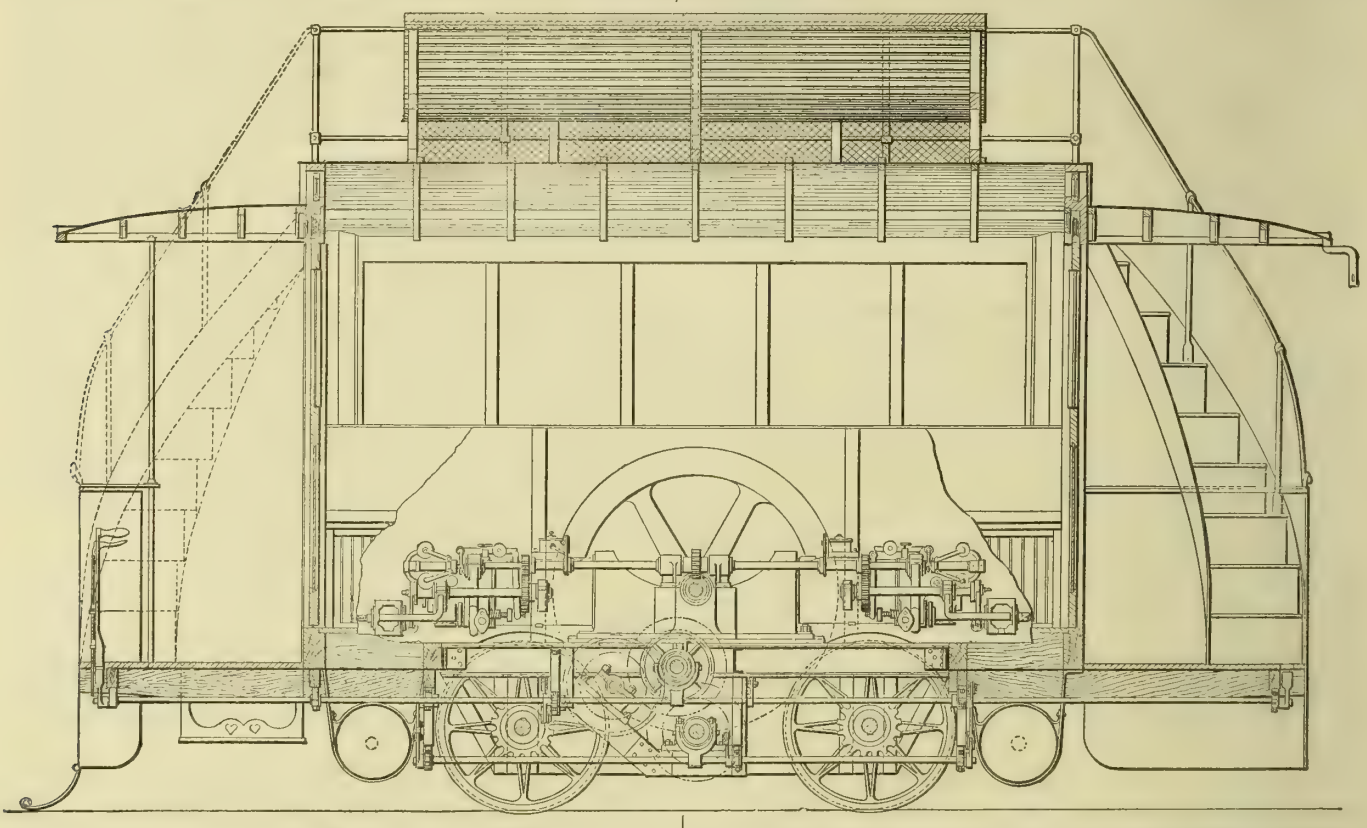
The London County Council and the Water Companies.—A long report from the Parliamentary Committee on the subject of the London Water Supply comes before the County Council to-day. The Committee recommend that Her Majesty's Government should be invited to constitute by Act of Parliament a Public Authority for the entire water area, such authority to have power to negotiate for the purchase of the respective undertakings of the Water Companies, "and, if thought fit, to seek parliamentary powers for the acquisition of the undertakings otherwise than by agreement," as well as for dealing with the whole question, including that of future supply. Pending the constitution of such authority, it is recommended that the Council should authorize negotiations to be initiated by the Parliamentary Committee with the Water Companies for the purchase of their undertakings. The Committee further propose that, with a view to the Council coming to a decision "on the pressing question of new sources of supply as compared with a scheme of storage reservoirs," the Water Committee be instructed to report their final conclusions without delay. This has obvious reference to the scheme for bringing a supply to London from Wales. In their report, the Committee suggest that the Water Authority should be composed of members nominated by the London County Council, the City Corporation, and the Home Counties, with the addition of nominees of the Local Government Board and of a sufficient number of co-opted members possessing special knowledge and qualifications. One recommendation is that, pending purchase, the Water Authority should be invested with certain powers relative to the Water Companies, "with a view to improved administration and efficient control." Possibly this is where the whole question will terminate.

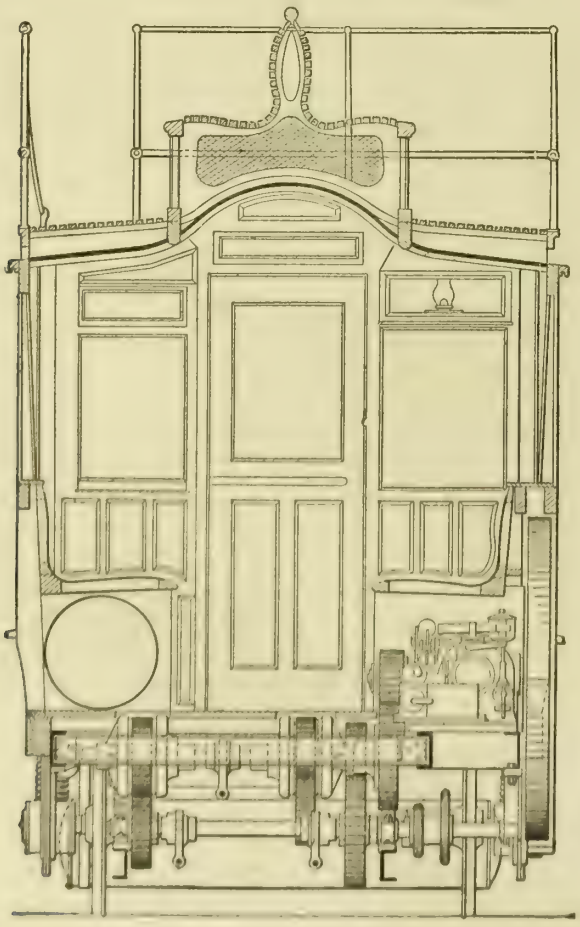
TECHNICAL RECORD.

GAS TRACTION FOR TRAMWAYS.

The publication of several articles on the above subject in the JOURNAL during the past two years has led to inquiries from various correspondents for further particulars in regard to the application of gas as a motive power for tramcars. Gas-motor cars, built on the Lührig system, have been in successful operation in Dresden since July last year; and the results have been such as to lead to the equipment of a line in Dessau worked entirely by means of gas cars. Coming nearer home, Lührig cars were about the same time placed upon the line running between Thornton Heath and Croydon. Accounts of these installations have been given in our columns; but it may be useful, in view of the inquiries above alluded to, to recapitulate the principal features of the Lührig system, which is now being worked by the Gas Traction Company, Limited, whose London offices are at No. 22, Chancery Lane, W.C.

The accompanying illustrations represent a sectional elevation and a cross section of a gas-motor car. It will be seen that it is self-contained, and of the ordinary type, with "garden" seats on the top. All the machinery is enclosed and concealed from sight; it is cleanly in working, and does not cause nuisance by vibration, heat, or smell. The motor is a double-cylinder gas-engine of the "Otto" model, so arranged that all parts can be easily reached. While on the road, the engine is completely under the control of the driver, who can reverse the car or reduce the speed at will. The gas is taken from the mains supplying the town, compressed to about 120 lbs. per square inch, and then delivered by an ordinary india-rubber tube to the car, where it is stored in reservoirs carried underneath, containing, when fully charged, about 300 cubic feet, or sufficient gas to enable the car to travel about eight miles without any risk of the store being exhausted during the journey. The refilling of the





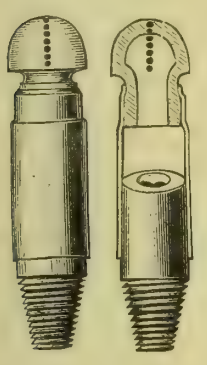
reservoirs usually takes about a minute and a half; and this can be done at the starting-place or at any convenient point on the road where a compressing plant can be erected. This plant is of a very simple and inexpensive character; and no noise, soot, or smoke is produced by it. At Dessau, the compressing station is only in use for three hours a day; and a compressor driven by an 8-horse power engine suffices to work twenty cars continuously. On the introduction of gas-driven tramcars in Dresden and Dessau, questions were raised in certain quarters as to a possible danger to the public from storage of compressed gas; and fears were entertained that explosions would result. Of course, these proved to be groundless. There is no light of any kind upon the car; the ignition necessary for starting the gas-engine being done electrically.

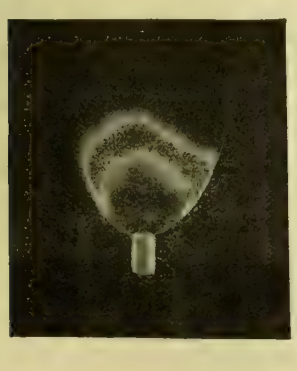
Professor A. B. W. Kennedy has reported to the Gas Traction Company on the installations at Dresden and Dessau; and Mr. Corbet Woodall, M.Inst.C.E., has done likewise in regard to the Croydon line. At Dresden, the line is not quite three miles long, with easy gradients. The cars carry about 25 passengers; and they run at the rate of 7·2 miles an hour, including stoppages. The total quantity of gas paid for in the first half of the present year, for all the purposes of the line, was 36·8 cubic feet per car-mile, the cost of which, at 2s. 6d. per 1000 cubic feet, would be 1·23d. But even these low figures, Professor Kennedy says, must not be taken as representing the best that can be done. At Dessau, the length of the two lines in use is not quite three miles each; and the gradients are not heavy—the cars taking them without reduction of speed. The curves, however, are trying. The total quantity of gas used in the four months ending April last (in which period the cars had run 54,500 car-miles, and carried 196,460 passengers) was 29·8 cubic feet per car-mile, which, at the above-named rate, would work out to just under 0·9d. per car-mile, instead of 1·23d. as at Dresden. At Dessau, the cars actually run about five miles per charge of gas; but this distance could well be increased. Mr. Woodall's report on the Croydon installation does not add very much to what appeared in the JOURNAL on the occasion of the trial of the Lührig system in June last year, at which time Mr. Woodall inspected the car and the auxiliary plant. He ran the car at the rate of about seven miles an hour; and he confirms the accuracy of Professor Kennedy's figures. He testifies to the

general comfort of the car; while as to the cost, with gas at 2s. 10d. per 1000 cubic feet (the Croydon figure), it works out to less than 1d. per mile run, as compared with 2½d. for electricity on the trolley-wire system, or 5d. for horse traction. Mr. Woodall thinks no other power for tramcar traction can be provided at so low a cost as gas; and he considers that the advantages of working by this system only require to be known to be generally appreciated and largely adopted. As he remarks, the days of horse traction for tramway working are admittedly numbered. The possible substitutes for horses are steam, cable, and electric power cars. The first of these are noisy, cumbersome, and so objectionable that their use is only endured in manufacturing districts. Cable and electric power cars (the latter involving the eyesore of overhead wires) are expensive to equip, and are only possible under certain conditions, which cannot be always secured. Gas-driven cars are free from most of the objections that apply to other mechanically-driven tramcars, and possess the enormous advantage of being available wherever a gas-main is to be found at any point of the line. Mr. Woodall thinks gas companies and local authorities owning gas-works may be confidently expected to lend every aid in their power to the development of a gas power tramway system, even by supplying gas at a very low rate, seeing that most of it would be required during the hours of daylight, and uniformly throughout the year. In many cases, they might possibly make special terms. He looks confidently for a rapid development of gas-power traction for tramways; and we leave our readers to ponder over such an expression of opinion from so high an authority.

WILLIAMS AND DEAN'S BURNER.

A new candidate for popular favour has to be chronicled in this burner, which for use under certain conditions as to gas pressure and lighting requirements will no doubt find its adherents. There is, of course, nothing very new in a "cap" burner, to be slipped on over an existing fitting, and some well-known examples of this type of burner are in very general use. The point of difference in Messrs. Williams and Dean's invention lies in the nature of the outlet for the gas. As will be seen from the annexed illustrations, the ordinary slit is done away with in this case; and its place is taken by a series of finely-drilled holes. It is stated—and various tests by competent authorities bear out the assertion—that the result of this arrangement is to improve the conditions under which the gas is brought to the point of combustion; the effect being to largely increase the size of the flame and the amount of light emitted. Careful tests with these burners, recently made by Mr. H. Leicester Greville, the Chemist to the Commercial Gas Company, have shown that the light from an ordinary No. 1 burner, consuming 3·1 cubic feet of gas per hour, was raised from 2·5 to 8·34 candles—an increase of light of no less than 233 per cent.; with a No. 2 burner, consuming 3·65 cubic feet per hour, it was increased 136 per cent.; while with a No. 3 burner the illuminating power rose from 8·52 to 14·04 candles—an increase of 64 per cent. It can hardly be denied that these figures are highly satisfactory; the more so when the simplicity of the burner and the absence of all requirement for expert attention in fixing and maintenance are taken into account.





In the accompanying illustrations, which are taken from photographs, is represented the change made in the flame of an ordinary No. 1 union-jet burner by super-imposing a Williams and Dean's 15-hole cap; and it is, of course, open to any of our readers to test the accuracy of these photographs for himself. Members of the Incorporated Gas Institute will no doubt note with interest that the sole licence in these burners, so far as gas undertakings are concerned, has been placed in the hands of their former Secretary, Mr. W. H. Harvey, of No. 17, Old Queen Street, Westminster, S.W.

MR. W. SUGG ON VENTILATION AND WARMING.

At the Meeting of the Society of Engineers on Monday last week—the President (Mr. W. G. Peirce) in the chair—Mr. W. Sugg read a paper on "Ventilation and Warming."

The author began by referring to the diversity of opinion existing among architects and scientific men on the subjects with which he was about to deal. He remarked that they do not, probably, differ as to the main fundamental principles of ventilation and warming; but they do very much on the methods of putting these principles into practice. He went on to point out that these differences result largely from the fact that every building has its own special requirements, arising out of its situation, construction, and the uses to which it has to be put. These render it impossible to lay down hard-and-fast rules of procedure suitable for all cases. It is, therefore, clearly necessary, before arranging any scheme, to make a careful examination of the conditions required to be fulfilled, taking into account the position of the building and the natural circumstances which may materially affect, either beneficially or prejudicially, the working of the system to be finally adopted. After mentioning various failures, pointing out the fact that, where electric lighting is adopted, ventilation and warming are largely neglected, the author described in detail the system at present employed at the Houses of Parliament.

The debating chamber, which is the most important part, has about 165,000 cubic feet of air space when empty; and the temperature has to be suitably maintained both day and night when the House is in session, and an ample supply of pure air has to be ensured. To this end, fresh air, previously cleansed, warmed, and moistened in an equalizing chamber beneath the floor, is supplied through a number of perforations distributed all over the area of the chamber. The floor is covered with a string-netted carpet, which does not obstruct the incoming air, and does not retain dust. By this means, fresh air is supplied in considerable volume, at an almost imperceptible velocity, and, therefore, without draught. The extraction of the vitiated air is effected by aspiration through a large number of concealed openings all over the ceiling of the House, so that it may be as regular and uniform as possible from every part of the chamber. The ingress of the fresh air is slightly assisted, so that there is never sufficient suction above the ceiling to encourage the entrance of air from the doors opening into the lobbies of the House; the air supply always entering through the proper channels.

The aspirating power which draws off the vitiated air is produced first by a number of Argand gas-burners which serve to light the House. These are placed over each one of a number of squares of glass which form the central longitudinal portion of the ceiling. Each piece of glass is 3 feet square; and as it does not set quite down into its frame, but is so placed as to leave an inch space all round it, there is a sufficiently large aggregate area in the ceiling panels and side panels of the roof to equal about 200 square feet, and to allow the vitiated air to pass into the roof chamber, whence it is drawn by aspiration into a large flue which descends into the basement and finally finds its way to the Clock Tower shaft. At the base of this shaft (which has an area of 64 square feet) is found the motive force which is capable of putting in motion a column of air more than 200 feet high, by about 64 square feet area, or a total of about 12,800 cubic feet, at a velocity of about 5 feet per second, more or less; the rate of speed varying with the increasing or decreasing of the fire as may be desired, according to the amount of work required to be done at the time.

This utilization of the powerful shaft of the Clock Tower to produce an upcast sufficient for the extraction of the products of combustion and vitiated air from all the rooms, offices, and chambers of the House of Commons, has been very simply and scientifically arranged. A large iron grill, rather less in area than that of the shaft itself, is fixed at about 4 feet from the ground, so as to allow of sufficient air passing under it to keep a layer of coke freely burning on it. The size of the coke fire regulates the velocity of the upcast. The heat of the burning coke (ordinary gas coke) produces an upcast more or less rapid as the fire is increased or diminished, or as the external atmospheric influences affect the draught either one way or the other. In cold winter weather, the draught with the same amount of fire is better than it is in summer, principally on account of the tendency of the enclosed court yards in hot weather to act as upcast flues, and to work in some degree against the Clock Tower upcast. This, when it does take place, is easily remedied by slightly increasing the fire in summer. By this extremely simple method, the whole of the heating power of the coke is converted directly into force. The saving of labour in looking after the fire, as compared with what it would cost supposing steam, gas, electricity, or other motive power were used in combination with a fan or other contrivance, is enough to render this method the cheapest and best way of putting so large a body of air at low velocity into motion, with the help of the Clock Tower shaft. If there were no such tower as there is at the Houses of Parliament, steam would have to be employed, with a more costly and troublesome arrangement to look after. One great advantage of the coke-heated shaft is that the lining of the furnace and shaft emits a great volume of heat for a very long time after the fire is out, while the upcast action of the shaft will continue until the walls are cold.

The author went on to say that, in any case, a coke fire is best for producing an updraught for ventilating purposes, in large asylums and buildings which are generally designed with large and high ventilating shafts, because it gives the least trouble to keep it going, and will not bring the whole system of ventilation suddenly to grief, as when a mechanical arrangement is suspended from any cause—such, for example, as a failure in the water supply to a boiler, &c. He said he wished it to be quite understood that he did not condemn the system of ventilation by fans or other mechanical contrivances. They must be used sometimes; but they are neither necessary nor suitable in a great number of cases. For instance, where electric fans are put into windows, one or more blowing fresh air into one side of a room and a like number supposed to be extracting the vitiated air (sometimes, if they can, against the wind) on the other side, it cannot be said that this is a satisfactory method of ventilation. That very old inlet ventilator—the whirligig—so familiar to visitors to old inns and smoking parlours, is probably an improvement on this method, because it does not produce such a disagreeable draught in letting in fresh air. The old high chimney-piece, with its arch reaching nearly to the low ceiling of these rooms, acts on a reduced scale very much as the shaft of the Westminster Clock Tower as an extractor of vitiated air.

The supply of air for the House of Commons is taken from the river-front, and passes down through the areas in front of the wall of the building. It is drawn by means of a revolving fan, into the basement gallery, where it is moistened or cooled, when necessary, either by jets of water or ice. This fan drives it forward at the requisite velocity—first through a screen of paperhanger's canvas, and afterwards through a filter having a surface of 1000 square feet, if the air is in any degree charged with fog. The filter is composed of two layers of cotton wool, each 3 inches thick, with about an inch of separation between each layer, so that the first or lower one takes out the principal portion of soot and smoke, and the upper one the rest. The wool shows unmistakable signs of its effectiveness as a filter in the course of a fairly foggy day. When fully charged with dirt, the wool has to be renewed. Having been cleansed, the air flows into the battery chamber above the filter chamber, and there it is warmed. The time required for the passage of the air from the terrace on the river front to the Clock Tower shaft, is very short. Passing in rapidly at first, and coming almost to rest as it goes through the chamber, into which it enters in a slow stream moving not faster at any time than 1½ feet per second, it increases its speed as it nears the ceiling-line, and attains its highest velocity as it rushes up the shaft.

The House of Lords and the Committee-rooms are warmed and ventilated on the same lines, except that in all cases the work is done much more regularly than in the debating chamber of the House of Commons. The author expressed the opinion that, for buildings used for legislative and similar purposes, the complete system he had described was eminently suitable. In planning the ventilation and warming of new buildings on the same lines, doubtless some useful improvements would, he said, suggest themselves; and probably the sites and construction of these buildings might more effectively favour the application of a different system than did the low-lying situation of the Houses of Parliament. But in the very important work of school ventilation, although it would not be possible, from the nature of the construction and general planning out of the buildings, to carry out so complete a scheme, the requirements of a large school were not so very different from those of the Committee-rooms and other chambers in the Palace of Westminster. The most important principle ruling the scheme in use there was equally, if not more, important in the warming and ventilation of schools —viz., that the vitiated air from the pupils must be induced to take a straight course up to the ceiling, and not have a chance of returning to be breathed over again.

In connection with the ventilation arrangements of the House of Commons, Mr. Sugg described an aspirator in use in some of the smaller chambers which are not connected with the Clock Tower aspiration. It is fitted at the upper extremity of the shaft with a ventilator, which creates a considerable updraught, without the assistance of heat, whenever there is a wind blowing across its top. In a still atmosphere, the gas-jet in it induces an upward current; so that under any conditions of weather a continuous updraught is secured. The top of the ventilator is composed of a number of tubes, surmounted by a flat plate raised up above the tubes to a height more than sufficient to allow all the air which can possibly pass up the shaft to get away. The passage of a very slight wind across the tubes aspirates the air out of the top of the ventilator, and consequently produces an upward current in the shaft. As an example of what may be done by such an apparatus, a 4-inch shaft, 8 feet long, will aspirate, with the help of a jet of gas burning ½ to ¾ of a cubic foot per hour, upwards of 1100 cubic feet of air per hour in a still atmosphere; and with the further assistance of a wind moving across the ventilator at a velocity of 4½ feet per second, it will aspirate 3126 cubic feet per hour. A 6-inch similar cowl, with a burner consuming 4 cubic feet of gas per hour, will, in a still atmosphere, aspirate about 2500 cubic feet of air per hour; and with the assistance of wind moving at the velocity of 9 feet per second, it will aspirate 6480 feet per hour. The author pointed out that these results would be more or less altered by changes in the barometric pressure and temperature of the atmosphere outside, as well as by the temperature of the room from which it was drawing the vitiated air. The gas-flame had to be guarded from the effect of vitiated air and uprush, by supplying it with an independent supply of fresh air.

The Egyptian Hall of the Mansion House affords an illustration of a method of carrying out the main principles of the system of ventilation and warming in use at the House of Commons, but in a less elaborate manner more suited to the requirements of the building. Mr. Sugg described the arrangements at some length. He said that, though the system of ventilation was not quite so perfect as that of the Palace of Westminster, because it was not possible to bring the fresh air in from the ground-level, and because, in the position in which the Mansion House was built, it would not be wise to do so, yet the system of changing the air was satisfactory to the guests. It could not be denied that a little of the vitiated air must become mixed with some of the fresh air; but it did not get a chance of descending anywhere near the guests, because as it combined with some of the cold air it warmed it, and at the same time contaminated it, and rose with it towards the ceiling, where it was carried off by the sun-burners.

The lighting and ventilation of billiard-rooms and churches was next dealt with; and then Mr. Sugg gave a description of a combined system he has carried out in the Board-room of The Gaslight and Coke Company. Here the heat of the burning gas used for lighting has been utilized not only to produce an upcast to carry off the vitiated air and the products of combustion, but at the same time to induce and distribute all over the room a sufficient inlet supply of fresh air, without perceptible draught, through the same pendant. The dimensions of the room are 58 feet long, 24 feet wide, and 16 feet high; the capacity being 22,272 cubic feet of air. There are three pendants fixed at equal distances apart; and one is placed by itself in an adjoining Committee-room. The latter room is 28 feet long, 24 feet wide, and 16 feet high. All four are precisely similar in construction. Each of these pendants consumes 20 cubic feet of gas per hour; and the volume of light given for this consumption equals that which would be afforded by more than 200 spermaceti candles of six to the pound, all burning at once at the rate of 120 grains per hour each candle. The total volume of light in the Board-room is therefore equal to fully 600 of such candles. This high duty per cubic foot of gas consumed is obtained by the author's "Cromartie" lamp. The air supply to the lamp is about 10 cubic feet per cubic foot of gas consumed; consequently it has about twice as much oxygen as would be necessary for the purposes of combustion. But the draught through the lamp is so rapid, that more than half the oxygen supplied to it is carried off with the nitrogen, which escapes up the chimney with the products of combustion. These are utilized in the pendant light to produce an updraught, much in the same way as the coke fire does in the Clock Tower shaft of the House of Commons. This rapidly moving current is directed into the middle of the funnel, and, acting as an ejector, sucks in with it the vitiated air from the surface of the ceiling, through the perforations in the lower part of the ceiling-rose provided for the purpose. The products then pass up into the Sugg ventilator, whence they are extracted by the effect of the passage of the wind across the mouths of the tubes in the crown. The heavier cool fresh air descends by its own gravity through the outside casing of the ventilator into a chamber, and is drawn into the room by the suction action of the heated column of vitiated air passing up the exit-flue. Trumpet-shaped tubes serve to distribute it all over the room at a reduced rate of speed that is not felt. As the room is heated by two large coal-fires, one at each end, it has been necessary to fit two so-called Tobin tubes to supply extra air in winter, to prevent the fires from drawing too much on the fresh-air inlets of the lamps, and so making the inflow of air too rapid. The annular inlet air-tube of the pendant is provided with a "hit-and-miss" arrangement, so that the quantity of cold air admitted in winter may be checked. In summer, when fresh air is not so heavy as it is generally in winter, the full inlet may be used.

The author next described another useful system of ventilation of which he has frequently made use for the temporary ventilation of ball-rooms, billiard-rooms, dining and drawing rooms, &c. It is totally different from the kindred systems described; depending for its success upon the well-known law of diffusion. In the application of this system, it is only necessary to fit a frame in the top half of a window, inside the room, and stretch over it a piece of muslin or silk, coarse canvas, or even fine perforated zinc or gauze; and then, opening the sash of the window to any required degree, allow the external air to diffuse into the internal air of the room. A very good ventilation without draught may thus be obtained. In summer, a large part of the entire area of the window opening may be safely used; and in winter, if it is very cold outside or a wind is blowing directly on to the screen, it may be necessary to hang a loose piece of muslin outside towards the wind, which will prevent, even under those circumstances, any feeling of draught or discomfort.

In conclusion, Mr. Sugg suggested that where it was possible to place in the walls of buildings a number of earthenware pipes glazed in the inside, and arranged so as to take off the vitiated air of chambers at the ceiling-level, and to supply fresh air drawn from the roof down other similar pipes, the inlets being provided with funnel-shaped openings distributed round the room, most of the difficulties of ventilation would disappear.

Of course, in all buildings surrounded with pure air, it might not be necessary to take the fresh air from the top of the building. If the openings for the admission of fresh air were sufficiently numerous, and not too large, no draught would be experienced, though pierced through the external wall of a room.

A New Method of Making Metal Pipes.—It is reported from Chemnitz, that Herr Laval, of Stockholm, has invented a machine for making pipes without the welded seam. The mandril inserted between two rotating rolls is fitted, at the point where the pipe is formed, with two opposite or adjacent right-angled, or nearly right-angled, corners, and the rolls are fitted to correspond. In this way, the form-giving parts of the rolls, when producing pipes of nearly the same thickness of material, are able to retain sufficient strength.

The Main Drainage of London.—For some time past, the Main Drainage Committee of the London County Council have had under consideration the state of the main drainage of London on the north side of the Thames. The Committee have now formulated a scheme, which will shortly come before the Council, for the addition of intercepting sewers on a large scale. In a report which has just been published, they enter minutely into the history of the present drainage of London; beginning with Sir Joseph Bazalgette's original scheme adopted by the Metropolitan Board of Works, and the joint report drawn up by Sir Benjamin Baker and the Council's Engineer (Mr. A. R. Binnie, M.Inst.C.E.). To give an idea of the increased quantity of sewage which has now to be provided for, it may be mentioned that Mr. Binnie states that since March, 1889, about 23 miles of new brick sewers have been constructed and 94 miles of pipe sewers of various dimensions, and that during the same period there has been an increase of 30,000 houses in London. Following the advice of the Engineer, the Committee recommend that extensive works should now be undertaken to improve the main drainage north of the Thames. They advise, first, that one additional outfall sewer 9 feet in diameter shall be constructed between Old Ford and Barking, together with the necessary bridges to carry another sewer of similar capacity. The two Engineers estimate the cost of these works at £450,000; but the Committee point out that, as the quantities have not been taken out, this estimate is only a preliminary one, and may have to be raised considerably. They next propose the construction of a new main intercepting sewer from Paddington to Old Ford, the cost of which has been estimated by the Engineers at £245,000, which, as in the case of the other proposal, must be considered as approximate only. By this sewer, they aim at preventing the frequent surcharging of the present sewers, by intercepting the storm water from the higher levels, and conveying it to the outfall, instead of its passing into the sewers, in the low-level areas, thereby causing the flooding of premises in the low-lying districts, and the discharge of sewage into the Thames. In addition, the Committee recommend the construction of certain relief works at Old Ford, Chelsea, and Fulham, at an estimated cost of £50,000.

Explosions of Domestic Boilers.—In the JOURNAL for the 26th ult., we published a circular letter on the above subject, addressed by the Board of Trade to water companies and local authorities having the supply of water, suggesting that they should place before the consumers "a concise statement of the safeguards that should be adopted," and inform the Board as to what they purposed doing. One of these circulars in due course reached the Secretary of a Water Company not far from London, who very promptly pointed out to the Board that his Company had no power, "except in the case of defective fittings causing waste, to interfere with the water-heating apparatus in private houses within the Company's parliamentary district;" and he therefore asked what "safeguards" or precautions the Board suggested should be adopted to prevent such accidents as those alluded to in their letter. He received a reply to the effect that, when the matter was first under the Board's consideration, they contemplated issuing a short circular indicating the precise steps that should be taken to secure immunity from boiler explosions. On further consideration, however, they came to the conclusion that, having regard to the varying requirements aud circumstances of different districts, it would be better to "leave the actual terms of the warning to be addressed to householders to the discretion of water companies and local authorities, whose practical experience must necessarily qualify them to decide what precautions were advisable, and also make them best able to judge what particular form of caution would be likely to be most effective in the respective districts under their control. It will thus be seen that the Board of Trade, while fully alive to the dangers attending modern domestic boilers, are unwilling as yet to formulate precautions so as to minimize the risk of explosions. It is to be feared that water companies and local authorities will have some difficulty in complying with the Board of Trade requirements, however willing they may be to do so, unless more power is conferred upon them than they now possess. The question is one of considerable moment; and therefore we shall be glad to have the views thereon of those of our readers who are specially interested. At all events, their thanks are due to the gentleman whose prompt communication to the Board elicited a definite pronouncement from that department.

THE CHEMISTRY OF THE OXIDES USED IN THE MANTLES FOR INCANDESCENT LIGHTING.

The following is a translation of an article by Dr. G. P. Drossbach in a recent number of the *Journal für Gasbeleuchtung*; forming the sequel to an article by the same author, of which an abstract translation appeared in the JOURNAL a few months ago (Vol. LXVI., p. 534).

Thorite has recently come into notice as a raw material, and appears in the market more often than it did. The supplies of Brevig, Arendal, Hitteroë, and Champlain appear to have been quite exhausted; but it has been found elsewhere, and now can be purchased, with a content of 40 per cent. of thoria, at £17 10s. and under. Among recent analyses of thorite, Nilson's are the most reliable; and he found that selected crystals of the Arendal mineral contained: Silicic acid, 17·04 per cent.; phosphoric acid, 0·86 per cent.; thorium oxide, 50·06 per cent.; uranous oxide, 9·78 per cent.; lead oxide, 1·67 per cent.; ferric oxide, 7·6 per cent.; oxides of the cerium group, 1·39 per cent.; lime, 1·99 per cent.; magnesia, 0·28 per cent.; and water, 9·46 per cent.

For preparing pure thoria, Nilson takes the impure thorium oxide prepared by Berzelius's method, and converts it into sulphate by warming with concentrated sulphuric acid. This he dissolves in five parts of ice-cold water; and on warming the solution to 20° C., a copious deposit of snow-white thorium sulphate is thrown down. This operation is repeated until thoria of constant molecular weight is obtained. A single recrystallization may not be sufficient. The sulphates of the cerium group are soluble with difficulty in hot water; and are partially deposited with the thorium sulphate. The solubility of thorium hydrate in alkaline carbonates affords a rapid means of separation; care only being taken that the cerium is present as oxide, which is insoluble in dilute alkaline carbonates.

Recently an intermediate commercial product, known as thorium-precipitate, has begun to compete with thorite. It is technically a hydrated thorium oxide, containing from 86 to 88 per cent. of the oxide, and is dealt in at about £14 10s. per pound, or £16 10s. per pound of thorium oxide. Compared with other commercial products, this hydrate is very pure; and it is therefore very easily worked up. A pure oxalate is obtained on precipitating a hydrochloric acid solution of the salt; and, by ignition, the oxalate is very easily converted into pure thoria.

Monazite still, however, is the most important mineral, and has only the above-named hydrate as an active competitor. The most varying qualities are found in commerce. Many dealers sell according to sample, but deliver very different materials; while others sell according to the percentage of monazite, trusting to the latter being estimated by the content of yellow nodules, which are not, however, all monazite. One Dutch tender is for 70 per cent. monazite at 8 cents per pound; but actually the sand often contains only 50 per cent. As methods of estimating the percentage of monazite are not established, I propose the following means of valuation.

The very finely powdered monazite sand is heated in a platinum crucible, with three times its weight of sodium potassium carbonates, until in a state of steady fusion. The melt is extracted with water; and silica separated from the aqueous solution in the usual way with hydrochloric acid. The insoluble residue is treated with concentrated sulphuric acid, and the sulphates dissolved in ice-cold water. [It is not practicable to dissolve the monazite in sulphuric acid at an earlier stage, as one treatment with the acid does not always break up all the monazite.] The residue is taken as chrome ironstone. Excess of oxalic acid is added to the sulphuric acid solution; and the precipitate formed is carefully washed, filtered, dried, and ignited. One hundred parts of the oxides obtained correspond to 142 parts of monazite, as selected monazite crystals constantly yield 69 to 70 per cent. of the oxides. The filtrate from the oxalic acid precipitation is treated with ammonia, and the precipitate taken as foreign oxides. It is evident that the determination of the oxalic acid precipitate is sufficient; but it is useful as a check to know the impurities also. The sum of the constituents usually amounts to 102 to 103, instead of 100, because by ignition a portion of the cerium sesquioxide is converted to cerium dioxide. In order that no didymium may remain in solution on the precipitation with oxalic acid, it is necessary that the original solution should not be very strongly acid, and especially that it should not contain a considerable amount of nitric acid.

Now that thorium oxide is very commonly dealt in according to its percentage, in which variations occur, it is desirable that there should be a recognized method of estimation. This must be based on the composition of monazite. According to Penfield, the thorium of monazite is derived from admixed thorite. He comes to this conclusion, because there is about the same proportion of silica to thoria in monazite as in thorite. But my own experiments show that the whole of the thoria cannot be extracted with hydrochloric acid from very finely powdered monazite, as would be the case if it were present exclusively as thorite. According to Hidden, Kerr, Geuth, and others, North American monazite sand contains the following minerals: Monazite, tetradymite, brookite, quartz, chromite, anatase, beryl, tourmaline, pyrope, zircon, epidote, fibrolite, columbite

samarskite, xenotime, montanite, fergussonite, rutherfordite, talc, tremolite, magnetite, limonite, menacanite, hematite, tellurium, asbestos, cyanite, corundum, rutile, and actinolite. But as far as I have observed, only quartz, albite, chromite, magnetic iron ore, garnet, samarskite, aeschynite, and zircon are present, though, of course, often in a state of impurity.

A complete analysis of so complex a mineral substance is not desired, and, indeed, is scarcely practicable. Beyond the impurities of Brazilian monazite—consisting chiefly of quartz, chrome ironstone, magnetic iron ore, and zircon—the estimation of the chief constituents must generally suffice. I propose the following as a method for general acceptance; it has proved atisfactory in more than a hundred analyses. The same course is pursued as in the estimation of the monazite; and the mixture of oxides of the cerium group is taken for further examination. Too high results would be obtained if the thoria in this mixture were estimated by Lecoq's method, as a portion of the cerium would be separated with it on precipitating from a neutral solution. It is better to proceed thus: The mixture of earths is intimately mixed with lamp-black, and heated in a stream of chlorine. Thorium tetrachloride volatilizes, while the metals of the cerium group remain as difficultly volatile chlorides. The thorium chloride so obtained (20 to 50 grammes of monazite are taken) is dissolved in water, acidified with hydrochloric acid; the solution is neutralized; and the thorium oxide is precipitated by Lecoq's method, by boiling with hydrated cuprous oxide. By again taking up in dilute hydrochloric acid, precipitating traces of copper with sulphuretted hydrogen, and then precipitating the thoria with oxalic acid, and filtering, washing, and igniting, pure snow-white thorium oxide is obtained. If the remaining oxides in the monazite are to be determined, the filtrate from the thoria precipitate is precipitated with oxalic acid, and the precipitate is purified with the bulk of the oxides of the cerium group; the oxalates being converted to oxides by ignition.

It is commonly supposed that the oxides of the cerium group may be separated from those of the yttrium group by precipitation with a concentrated solution of potassium sulphate. But Popp has proved that this separation is not only incomplete, but that oxides of the yttrium group are found in the precipitate of double sulphates. He was led by this to the erroneous conclusion that erbium is identical with didymium. In reality, nearly all the erbium goes into the precipitate on treatment with potassium sulphate; and the subsequent treatment leads to its inclusion with the didymium. A similar fate befalls scandium, terbium, and the yttrium group metals with absorption spectra—particularly decipium, samarium, Marignac's $Y\alpha$ and $Y\beta$ oxides, as well as thulium and holmium. It is not surprising that Krüss suspected the presence of a dozen metals in crude didymium. The solubility of the yttrium metals (as distinguished from cerium, lanthanum, and didymium) in alkaline carbonates, was tried as a means of separation; but it was found generally that they remained in solution for a short time only, and were again thrown down tolerably soon.

My experiments indicate that these oxides may be retained in solution by using a very large excess of very concentrated potassium carbonate, in the presence of salts of ammonium. On acidification and addition of oxalic acid, the oxalates are thrown down. After careful washing, these oxalates are brought into a boiling saturated solution of ammonium acetate containing a surplus of undissolved salt, filtered while hot, and washed with a hot concentrated solution of ammonium acetate. The filtrate is very greatly diluted; and hydrochloric and oxalic acids are added for precipitation. There are thus separated from the filtrate a great quantity of oxalates of elements giving absorption spectra; while the residue on the filter contains, besides didymium, no oxalates giving absorption spectra. Let us call the residue on the filter Y, and the precipitate from the filtrate E. The first contains, besides cerium and a little didymium, a number of oxides of the yttrium group without absorption spectra; the precipitate E, all the elements yielding absorption spectra, besides traces of didymium, which, however, may be absent. Y and E contain a series of new elements, which may be traced by the recrystallization and fractional precipitation of some kilogrammes of these fractions, and amount to 20 to 30 per cent. of the mixture. Work on a very large quantity of these fractions (about 30 kilogrammes) is now in hand; and I would ask that this investigation should be left to me.

Schottländer has published some exhaustive work with regard to the separation of cerium, lanthanum, and didymium. He states that the separation of cerium from lanthanum and didymium is best effected by Auer's method. I cannot confirm this, as I found Popp's system to excel it in simplicity and certainty. The neutral solution of the mixed chlorides is largely diluted, and sodium acetate and sodium hypochlorite added. As the cerium dioxide separates, the free acid must be neutralized. In this manner, it is easy to obtain all the cerium. The separation of didymium and lanthanum is best carried out by Frerichs' (*Deutsch. Chem. Ges.*, Ber. VII., p. 798) or Auer's (*Monatsh. Chemie*, IV., p. 630; V., p. 508) method. It would seem that, in all reported analyses of monazite, everything soluble in alkaline carbonates has been taken as thoria; everything not precipitated by potassium sulphate, as yttrium and erbium oxides; and the residue stated as oxides of the cerium group.

A large number of minerals, of which, until recently, few collections boasted specimens, are now found on the market in considerable quantities. For instance, I have in hand a quantity of auerlite—a mineral discovered by Hidden and Mackintosh. I believe it is a very pure orangite, as the proportion of phosphoric acid is not constant. Very large quantities of tscheffkinite lately came on the market from Virginia. This is a mineral of very complex composition, containing titanates of the rare earths. Gummite, containing thorium, is said to be found in Carolina; but, as far as I am aware, it is only obtained in Texas. Uranite containing thorium (and helium) is brought from Connecticut, and has recently been found in Bohemia very rich in thoria. Gadolinite is not in demand, and is very cheap. Yttrialite, with 8 to 10 per cent. of thoria, is obtainable in considerable quantities; and fergusonite, containing 3 per cent. of thoria, comes to the market in very large amounts.

Though sufficient to meet the demand, the quantity of thoria produced is still relatively small. Since thorite has again entered into commerce, very few firms work up monazite; and the price of it has steadily declined. The cargoes of monazite mentioned by E. Glinzer, which arrived at Hamburg, were for Vienna. All the Welsbach Companies procure their fluid from the Vienna firm for £5 per kilogramme nominally, and an additional payment of £2 per kilogramme until lately. The fluid (which is a nitric acid solution of the oxides) contains 280 grammes of nitrate per kilogramme, which is sufficient for 250 mantles. One kilogramme of the nitrate costs the Companies therefore £22 10s. to £25; while in the open market pure thorium nitrate still costs £27 10s. to £30 per kilogramme. One kilogramme of the nitrate will produce 900 to 1000 mantles; so the cost for material is about 7d., and the total cost about 10d. per mantle.

The stoutness of the threads and the size of the mesh in proportion to the mantles, is important in the manufacture of the latter. In good specimens, the thread is 0·2 mm. (0·0079 inch) in thickness; and it should be of absolutely pure cotton, as free from ash as possible. Mantles which come on the market at a price of about 1d. are quite unsuitable for use. Their content of ash is far too great; and filaments purified with hydrochloric and hydrofluoric acids cannot be made at the price. For really durable mantles, fulfilling the highest claims, a thorough preliminary purification of the filament is indispensable. Absolutely pure thorium nitrate occurs in commerce; and may be mixed with one-fourth to one-fifth of terbium and yttrium nitrates, and applied as a 30 per cent. solution. For a greenish light, an addition of 5 per cent. of erbium nitrate is necessary; for a yellow light, lanthanum nitrate. Moreover, the kind of burner has a considerable influence. The original Welsbach burners are, perhaps, the most unfavourable to the light. The mantle only is far superior to all others. The Welsbach burner gives, with good gas, a flame only partially luminous if the chimney is removed. Many burners considerably raise the efficiency of the Welsbach mantle. It is only a technical question how to increase the intensity of the development of heat sufficiently for the employment of the cheaper oxides allied to zirconia for incandescent lighting.

The German Welsbach Light Company.—The *Zeitschrift für Beleuchtungswesen* for the 30th ult. reported the reduction in price of the Welsbach burner, complete for use, from 10 to 5 marks—10s. to 5s. nearly.

Direct Pumping by Gas-Engines.—The River Wear Commissioners report very favourably of their experiments with Tangye gas-engines at Sunderland for the purpose of direct pumping. Several engines have been coupled direct, without any intervening gearing or belting, to centrifugal pumps; and the work has progressed in a very satisfactory manner.

Lamp Accidents and Legislation.—The attention of the Home Secretary having been called to the fact that during the six months ending in September there were in London 211 lamp accidents, 23 of which proved fatal, he has informed a correspondent, who asked whether the sale of cheap lamps could not be prevented by Act of Parliament, that he hopes to be able, when Parliament re-assembles, to secure the re-appointment of the Select Committee which has sat in previous years with a view to legislation on the matter.

Mr. Harrison Veevers and his Appointment at Dukinfield.—According to a paragraph in the *Ashton-under-Lyne Reporter* last Saturday, no reason was assigned, at the meeting of the Dukinfield District Council on the previous Monday, for depriving Mr. Harrison Veevers of his appointment as Surveyor, to which reference was made in the JOURNAL last week. "This silence," our contemporary remarks, "is liable to be misconstrued unfavourably to Mr. Veevers; and, in our opinion, it was the bounden duty of the Chairman to take the ratepayers into the confidence of the Council, and explain the reason for the new departure. The subject has been much discussed in many quarters, and adverse comments have been made, and expressions used not at all complimentary to the Council. Their action is stigmatized as shabby and mean; and, in the absence of any explanations why this course has been pursued, we are inclined to say ditto." It seems that a councillor fully intended to raise the question; but the minutes were moved, seconded, and confirmed before he had time to rise. We hope, with the *Reporter*, that the matter "will not be allowed to slide in this easy and perfunctory manner, but at some future meeting the whole transaction will be re-opened."

REGISTER OF PATENTS.

Indicating and Registering Apparatus for Meters and like Mechanism.—Thompson, W. P.; a communication from Paul Marix, of Paris. No. 20,046; Oct. 20, 1894.

Counting apparatus or meters of all kinds (the inventor remarks), such, for instance, as instruments for measuring time, meters for measuring water, gas, and the like, machines for counting revolutions, &c., as well as registering apparatus of all kinds, are designed to effect measurements of continuous working over indefinite periods. For instance, the watch indicates the continuous passage of hours, minutes, and seconds; the gas-meter shows in the same way the continuous passage of cubic feet of gas—the volume passed from the moment it is started to work, up to the moment at which it is inspected. When it is desired to determine the amount of the operations, during a given period, the operator has to note down the amount indicated by the meter at the commencement and at the end of the period; and the desired result is obtained by means of subtraction.

Now that mechanical action is replacing more and more individual labour, it is desirable to obtain this estimation of the amount automatically by mechanical means. The researches of the communicator of this invention, therefore, have led him to recognize that the automatic indicating aforesaid cannot be conveniently obtained if the stopping, returning to zero, and re-starting of the machine necessary for taking an indication and the measurement of any operation whatsoever, be effected by more than two distinct mechanisms. To carry out this system, ordinary measuring devices are specially changed into "block indicators" or registers, so that a reading of the indication, or of the registering of the measurement of partial operations from the commencement, can be automatically obtained. Owing to the similarity of the present system with the railway "block system," this system is called the "block control" system. The block indicator-registers consist of measuring instruments or apparatus—such as watches, clocks, gas and water meters, &c., controlled by two distinct mechanisms described in connection with a series of drawings, without reproducing most of which the invention could not be intelligibly described.

Electrical Prepayment Gas-Meter.—Villiers-Stead, Frank, of Gutter Lane, Cheapside, E.C. No. 20,946; Oct. 30, 1894.

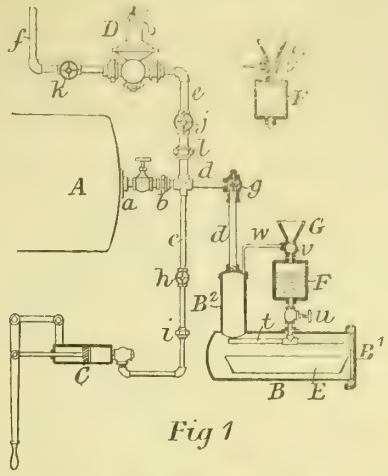
This invention applied to either wet or dry prepayment gas-meters renders them entirely automatic—requiring no plug to be pulled, no handle turned, or any attendance whatever. The requisite coins (of any selected value) are inserted into a slot provided for the purpose, when the meter is ready for work; and until the last coin in the shoot is used, it acts automatically and supplies gas. When the last coin is deposited in the cash drawer, the gas-lights are lowered for a few minutes, as a warning that there is no coin in the shoot; then, if no coin is inserted, the gas is automatically shut off, and no gas can be obtained.

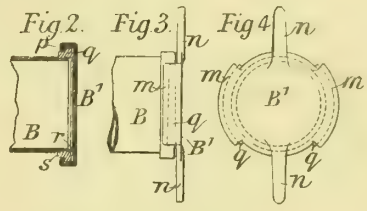
The inventor uses a grooved shoot, preferably of perforated metal—the groove made the size of the coin required to operate the meter. The back of the shoot is open, so that coins of a smaller size than the one fixed upon fall through, and do not pass down the shoot. The coin when inserted travels down the shoot, and falls upon an electric contact-holder, causing it (by the weight of the coin) to fall a certain distance and make upon a spring, by means of a cam, an electric contact. It breaks that contact by the cam passing the contact-spring, when the cam and holder are checked by a stop, upon which the coin and holder rests. A current is therefore sent from a battery through an electro-magnet, which actuates an armature, to which is attached a moveable jointed rod, carrying a double toothed ratchet, and connected with the gas-valve, which its opens—being kept open by means of the toothed ratchet. The coin remains upon the stop until a wheel connected with the usual wheels of the meter revolves, so that a pawl fixed upon it catches an arm of the coin-stop, and releases the coin. Attached is a pin, which, as the coin is being gradually released from the stop by the wheel, intervenes between the coin resting on the stop and the next coin in the shoot, preventing it falling until the first coin is released. The coin-stop, when this takes place, returns to its normal position; withdraws the pin; and allows the next coin to fall upon the contact-maker. The contact-maker and cam-holder, while the coin remains against the stop, presses against a spring cutting out the battery; but when the coin is released, connection between the battery and the electro-magnets is made by the spring returning to its normal position. Fixed upon the wheel before mentioned are two platinized points, one of which, after the last coin is deposited in the cash drawer, and connection made with the battery, is brought into contact with a spring in connection with an electro-magnet, causing an armature carrying a catch to slip one tooth of the double toothed ratchet which is connected with the gas-valve, and half closing the valve. The wheel still revolving, brings the second point in contact with the spring, and sends a current through the electro-magnet, causing the armature to slip the remaining tooth of the double ratchet and close the valve, so as to extinguish the gas.

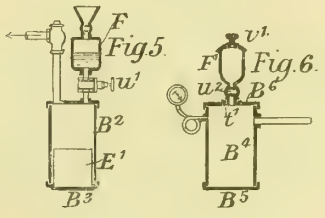
Production and Utilization of Acetylene.—Willson, T. L., of New York. No. 21,222; Nov. 5, 1894.

In the course of his lengthy specification, setting out in much detail the various objects aimed at, and the means proposed for attaining same, the patentee claims that he has succeeded in producing acetylene or like gases in large quantities, and at such moderate cost, "as opens up commercial uses for this gas which have been hitherto impracticable, because of the great cost of its production." The method of manufacture consists, briefly, in first treating calcium oxide (or some other suitable metallic oxide or compound) in the presence of carbonaceous matter—such as carbon or hydrocarbon—to the intense heat generated in an electric furnace, whereby the oxygen is withdrawn from the calcium, and its place taken by carbon, forming calcium carbide (CaC_2); and, secondly, combining water with this calcium carbide, thereby bringing about a mutual decomposition, wherein the hydrogen of the water unites with the carbon of the carbide to form dihydrogen dicarbide, or acetylene, which escapes as gas.

To produce gas according to this invention, it is only necessary to mix with the acetylene a suitable proportion of air—preferably equal parts of air and gas, although widely different proportions may be used. The mixture may be made by allowing the generated gas to pass into the holder or reservoir until it is approximately half full, and then raising the holder in any suitable way so as to extend it to its full capacity, while at the same time opening an air-inlet, so that a mixture is made of one-half acetylene gas and one-half air; or, if desired, the holder may be preliminarily one-half filled with air, and then completely filled with the gas.







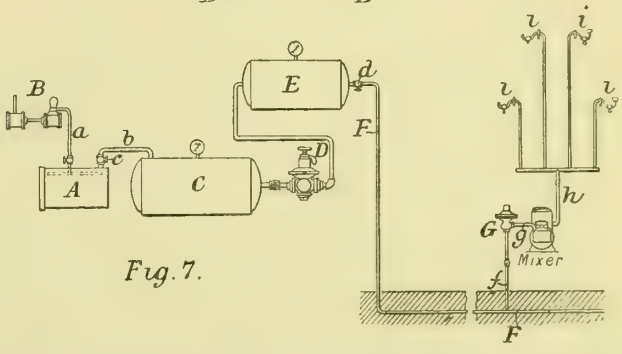


Fig. 1 is a side elevation of the apparatus employed, partly in vertical mid-section. Fig. 2 is a horizontal section of one end of the reaction chamber; fig. 3, a side elevation; and fig. 4, an end view. Figs. 5 and 6 are sectional elevations of two modified constructions of the reaction apparatus.

In fig. 1, A is the reservoir or storage cylinder; and B, the generating or reaction chamber. C is an air-pump; and D is a reducing-valve. The receiver is fitted with a valve *a* and coupling *b*, to which are coupled pipes—*c* leading to the pump, *d* leading to the generator, and *e* leading to the reducing-valve. From the latter, a pipe *f* leads to any point where the gas is to be used. In the pipe *d* is introduced a self-closing valve *g*, to prevent back flow of gas from A into B. From the pump C, air may be forced into the receiver through the pipe *c*. A valve *h* is introduced in this pipe, to enable it to be shut off in case the pump is to be disconnected on unscrewing the coupling *i*. From the receiver A, the gas may pass out through the valve *a* and pipe *e* to the pressure-regulator D; the flow being, if desired, controlled or restricted by adjusting a valve *j*. If necessary to disconnect the pipe *e*, this can be done by uncoupling it at *l*. From the pressure-regulator D, the gas flows under reduced pressure through the pipe *f* to the place of use; the flow being regulated by adjusting the valve *k*.

The reaction chamber B (in the construction shown in fig. 1) consists of a horizontal cylinder, into which the carbide is introduced at one end, preferably by placing it in a pan or dish E, which is then slid into the chamber. To enable this to be done, one end of the chamber is constructed to open, being formed with a removable cap B^1. Above B is mounted a closed water-reservoir F, from which a discharge-pipe extends down into the chamber, and terminates preferably in a sprinkler or perforated pipe *t*, for introducing water upon the carbide subdivided into jets. In this passage is a valve or cock *u*. For filling the water reservoir F, a hopper G is provided; the communicating passage being closed by a three-way cock *v*.

In operation, if it is desired to produce a mixture of acetylene gas

with air, the air is first admitted to the reservoir A, or forced in under pressure by the pump C. The reaction chamber is then charged with the required amount of calcium carbide; and the water reservoir connected with the sprinkler is filled with water. The reaction chamber being securely closed, the valve *u* is opened so as to permit the water to flow to the sprinkler; and the generated gas then flows through the outlet-pipe *d* to the reservoir—the check-valve *g* preventing any back flow. To introduce the same gaseous pressure on top of the column of water as beneath it, a pipe *w* admits the pressure of gas to the top of the water reservoir F. This pipe *w* preferably communicates with the valve *g*, so that it is closed when the valve is turned for refilling the reservoir with water. The generation of gas will continue until all the carbide and water have been mutually decomposed; no further attention being necessary until the recharging of the apparatus, when gas is again required. The only residue left is a quantity of lime resulting from the oxidation of the calcium carbide by the decomposition of the water.

To permit the introduction of fresh carbide, and the removal of the spent carbide or residual lime, the reaction chamber is constructed with one end B^1 removable; this head being preferably formed with spirally inclined ribs *m*, engaging spirally inclined faces on flanges *q*, on the exterior of the chamber, as shown in figs. 2, 3, and 4, so that by a partial turning of the cap, it is drawn into tight contact with the end of the chamber—a packing or luting ring *r* being preferably applied and held by screwing on the terminal flange *s*, on which the lugs *q* are formed.

Fig. 5 shows a modified construction of vertical gas-generator B. The generating chamber B^2 is a vertical cylinder, with a removable cap B^3 screwing upon, or otherwise attached to, its lower end. The carbide is placed in an open-topped vessel E^1, which rests on the cap B^3. The water chamber F is unchanged, except that the gas-pipe *w* is omitted; this being possible since the valve u^1 is made a straight-way or gate valve, so as to afford (when open) a clear passage vertically downward from the water chamber, so that the water may flow out as from an inverted bottle—the gas ascending by the same passage.

Fig. 6 shows another modification, in which the gas is generated in a vertical chamber B^4, having a lower head B^5 and an upper head B^6. To introduce the carbide, the lower head B^5 might be removed as in fig. 5, or the upper head B^6 may be removed. The water chamber F^1 is formed integrally with the shell of the bottom valve u^2; and beneath this is formed a screw-plug t^1, screwing into the head B^6. For introducing carbide, the water vessel F^1 may be unscrewed, whereby a sufficient opening is formed for inserting the carbide, after which the water vessel is screwed back into place. To fill the water vessel, the screw-plug v^1 is removed from its top, and the water poured in, after which the screw-plug is replaced. Then by opening the cock u^2, the water is permitted to descend. For cleaning out the residue from the chamber B^4, the lower cap B^5 may advantageously be removed.

Another part of the invention relates to a mode of transmitting and using acetylene or other similar gas for illuminating or heating purposes. To avoid the possibility of an explosive mixture of gas and air being formed in the storage reservoir or the distributing-mains, the patentee proposes to generate and transmit the acetylene in a pure condition unmixed with any other gas. The gas generated in this condition is raised to a high pressure as compared with the pressures at which gas is ordinarily transmitted through mains. The gas may be generated at considerable pressure, or, if the pressure thus attained is insufficient, it may be raised to a higher pressure by pumping. The pressure may vary from a pressure of several inches of water up to (say) approximately 20 lbs. per square inch. At such pressure, the gas is transmitted through the street-mains to the places where it is to be used. Being a fixed gas, it suffers no condensation in the pipes; and being free from admixture with other gases, there is no liability of explosion. On arriving at the place of use, the gas is first reduced in pressure by means of any suitable pressure-reducing valve, from which it emerges at a pressure suitable for supplying gas-burners—from 1 to 3 inches of water. The gas is then, if desired, mixed with air in such proportion as may be wished, which mixture is formed as close as possible to the points of consumption of the gas. For this purpose, any mixer may be employed; being conveniently constructed in combination with a gas-meter. The mixed gas is then passed through pipes to the several burners.

Fig. 7 sufficiently illustrates this improved system. A is the chamber in which the gas is produced by the reaction of water with calcium carbide; the water being introduced through a water-pipe *a* under considerable pressure from a pump B. The generated gas passes off through a pipe *b*, past a check-valve *c*, into a reservoir C—a steel tank capable of withstanding the highest pressure generated by the gas in consequence of the reaction. If this pressure is higher than is desired in the mains, the gas may be passed from the tank through a reducing-valve D into a storage tank E, from which it is discharged into the mains F—the flow being controlled by a valve *d*. The main F will be extended underground, as is usual with gas-mains, differing therefrom only in two respects—first, that it is a stronger pipe, capable of withstanding a higher pressure; and, second, that it need not be nearly so large as ordinary gas-mains, for two reasons, (1) that the gas is of much higher illuminating power than ordinary street gas, and (2) that it is conducted at much higher pressure. The difference in illuminating power is approximately 10 to 1; and if the pressure be only ten times greater than that at which illuminating gas is ordinarily transmitted, the mains would require theoretically only $\frac{1}{100}$ of the area of gas-mains as ordinarily employed, and of ten times the strength. Practically, however, a small pipe (say, $\frac{1}{2}$ inch) will be employed for ordinary street-mains; being an iron pipe of a thickness in proportion to the pressure, and of separate lengths, united by screw nipples or couplings, applied so as to make tight joints.

At the consumer's building, a branch-pipe *f* is taken off from the main in the usual manner, and leads to a pressure-reducing valve G (of any suitable construction), adapted to reduce from the high pressure of the mains to the low pressure required at the burners. From the outlet of the reducer, the gas passes by a pipe *g* to the mixer H. From the mixer, a pipe *h* leads, and is divided into, branches extending to the several burners *i*. These burners may be of any usual construction, except that for this gas they should be much smaller—a one-foot burner affording the same degree of illumination with equal parts of acetylene and air as is attained approximately by a 5-foot or larger burner with ordinary coal gas.

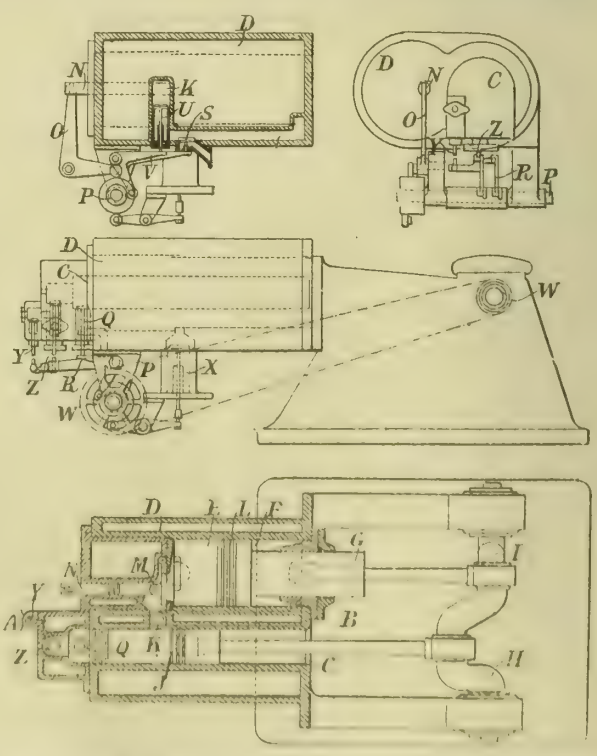
The patentee claims that his improved system has the advantages: First, of greatly cheapening the laying of gas-mains, since a pipe so much smaller than that ordinarily required may be used. Second, it avoids all danger of explosion. Third, it avoids all condensation in the mains, and the consequent necessity of providing drips for tapping the condensation from the mains. Fourth, it admits of supplying gas at uniform pressure at the burners at any distance from the works. Fifth, it admits of providing different consumers with gas at different pressures, to suit varying conditions—such as the lighting of theatres or factories on the one hand, and private dwellings on the other. Sixth, it admits of serving different consumers with gas of different richness, which may become advisable by reason of different conditions—as for example, for use as illuminating gas in one instance, or for the generation of heat in another.

A further part of the invention relates to the automatic control or regulation of the production of gas. For this purpose, the admission of water to the reaction chamber is controlled by means of the variations in pressure of the gas. When the generated gas falls below a certain normal pressure, water is admitted to the reaction chamber; and by reacting with the calcium carbide, it generates a further quantity of gas, and as the pressure of this gas rises above the normal, it acts to prevent the further admission of water. To this end, according to a first mode of regulation, the water may be admitted to the reaction chamber under a definite hydrostatic pressure from an elevated reservoir; so that whenever the pressure exceeds this hydrostatic pressure, the water will automatically cease to enter, but when by the drawing off of the gas the pressure falls, the water will again enter the chamber. A second mode of regulation is by a float-valve operating by the rise and fall of the level of water, in consequence of the varying ratio between the hydrostatic pressure and the gas pressure. A third mode is by the use of a gasholder which rises and falls as the volume of gas varies, with a valve in the water-supply pipe arranged to be opened by the holder when it descends to a certain point, and again closed when the holder in ascending reaches a certain height. Or by a further mode of regulation (applicable in the case of gas stored under pressure in a reservoir), a diaphragm exposed to the gaseous pressure may, by its motion, control the opening and closing of the water-valve. In either case, the production of gas is automatically controlled and regulated in proportion to the consumption, so long as any uncombined carbide remains in the reaction chamber.

Gas-Engines.—Clerk, D., of Sutton Coldfield, and Lanchester, F. W., of Bedford Row, W.C. No. 22,946; Nov. 27, 1894.

The object of this invention is to reduce the loss of heat to the sides of the engine-cylinder, and so increase its economy.

In compression gas-engines as at present constructed, the patentees remark in their specification, the cylinder is charged with a mixture of gas and air at or near atmospheric pressure, and the piston compresses the mixed gases into a clearance space at the end of the cylinder. This compressed mixture is ignited, and furnishes the motive power. It has been proved by Clerk and others that the theoretical efficiency



of a gas-engine of this type depends upon the ratio of the compression space to the total volume of the cylinder and space. They have discovered that this theoretical efficiency is constant (given a certain ratio between clearance space and cylinder), whatever the atmospheric pressure be, before the piston begins to compress the charge into the clearance space; and they have also found by experiment that the loss of heat to the sides of the cylinder is approximately the same in a given space, whether the mixture be compressed or not, and that at high pressures of compression the proportional loss of heat is much less than at low pressures.

Part of the present invention therefore consists in charging the cylinder end of a gas-engine with mixture at a higher pressure than the atmosphere to begin with, so that, while the piston is at or near

the end of its stroke, the contents are at a higher pressure than the atmosphere. After the piston has compressed the gases into the space at the end of the cylinder, the pressures obtained are thus much greater, and the pressure of explosion is also greater. The patentees find that, in an ordinary "Otto" cycle engine, the economy of gas consumption and the power exerted may be greatly improved by displacing all the exhaust products, and by charging the cylinder while the piston is at the out-end of its stroke with gases compressed to a notable extent above the atmosphere. They also find that in a compound engine having the compression space and cylinder of about the ratio at present used in ordinary "Otto" cycle engines—viz., the compression space about one-third of the volume swept by the piston—they can advantageously super-compress to about 15 lbs. above the atmosphere, so that the atmospheric pressure, as it may be called, existing in the cylinder to begin with is about 30 lbs. instead of 15 lbs. By so super-compressing, maximum explosion pressures of 600 lbs. per square inch are obtained—giving an average available pressure throughout the stroke of about 200 lbs. per square inch, and providing heavy exhaust pressures to be utilized in the second cylinder.

The illustration shows a part sectional elevation of the engine, together with a side elevation, a sectional plan, and a partial end elevation. The high-pressure cylinder C is single acting, on the "Otto" cycle; the other, or low-pressure, cylinder D is double acting—its inner end E serving as the low-pressure motor cylinder, while the outer end F serves as a pump to supply air for scavenging when used, and super-compressing.

The end F, through which the piston-trunk C passes, is preferably the pump end. The high-pressure crank H leads (by a right angle or a little more) the low-pressure crank I; and as the high-pressure piston J approaches the ends of its working out-stroke, it runs over a port K leading into the motor end E of the low-pressure cylinder, in which the low-pressure piston L is just beginning its out-stroke. The intercepting-valve M, which may be a rotating or a straight-way valve as shown (preferably operated by the rod N and lever O from the cam-shaft P), is held open at this time; and the gases are thus allowed to expand into the low-pressure cylinder and perform work. This takes place while the high-pressure piston J is crossing the port K to open it, and returning to close it. The high-pressure exhaust-valve Q (preferably operated by the lever R from the cam-shaft P) is now opened; and the piston J returns, discharging the exhaust gases. The high-pressure piston J now proceeds in its out charging-stroke, and draws into its cylinder C a mixture of gas and air—preferably rich in, or even overcharged with gas. The intercepting-valve M is kept closed except when the piston L is making its working out-stroke, expanding the hot gases from the high-pressure cylinder.

The pump side F of the low-pressure piston L is charged with air through the air-valve S, by way of the port T, during its exhaust-stroke; and just as the high-pressure crank H is crossing the out-centre, after drawing in its charge of gas and air, the piston L delivers the air charge by way of the port T and through the valve U, which is lifted at the proper time (by a lever V from the cam-shaft P) into the high-pressure cylinder C. The charge in the high-pressure cylinder is thus super-compressed, and may be raised to any pressure desired, depending on the relative dimensions of the pump and motor cylinders. The high-pressure piston J then proceeds in its compression stroke, and further compresses the charge into the compression space. The ignition is caused in any usual manner; and the expansion high-pressure stroke follows the ignition, succeeded by the expansion low-pressure stroke of the low-pressure piston as the high-pressure crank J crosses the out-centre.

The valve-gear used in this engine is preferably operated by a two-to-one gearing from the crank-shaft. In the engraving, a two-to-one chain-gear W is shown. The inner end of the low-pressure cylinder is exhausted on the completion of its working stroke by the exhaust-valve X; this valve being actuated by a cam and lever from the cam-shaft P. On the idle stroke of the low-pressure piston L at the inner end, it sucks in air and discharges it again.

The gas and air feed-valves for the high-pressure cylinder are: Y, the gas-valve; and Z, the air and gas feed-valve. These are actuated from the cam-shaft P. The governing of the engine may be accomplished in the usual manner by cutting off the gas; the high-pressure and low-pressure cylinders and cranks being, of course, proportioned to take the high pressures.

Such an engine will, it is asserted, give an advantage of about 30 per cent. in gas consumption.

Oil-Feeding Apparatus for Gas-Generators.—Guldlin, O. N., of Fort Wayne (Ind.), U.S.A. No. 23,455; Dec. 3, 1894.

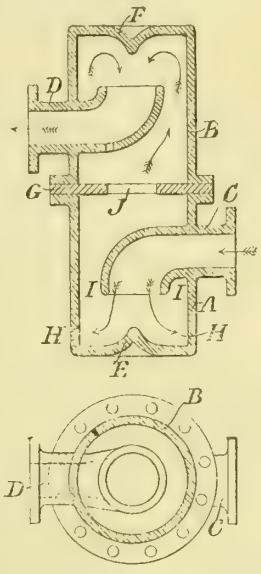
Alluding to his invention—for feeding hydrocarbon oil in automatically controlled and measured quantity under substantially uniform pressure, to the superheating or other chamber of a water-gas generator—the patentee remarks: "It is now the common practice, in supplying hydrocarbon oil to the carburetting chamber or superheater of a water-gas generator, to first pump the oil from the storage tank into an oil measuring-tank having a scaled index, and at the end of each 'run' make a record of the oil used, as shown by the fall of the oil-level in the measuring-tank. The height of the oil must be recorded before starting the 'run;' the difference in the level being the amount of oil used. This arrangement requires two or more operations at each 'run,' in order to keep the record, and is laborious and inaccurate. It is also the practice, in connection with the above arrangement, to inject the oil supplied to the superheater by a jet of steam. This plan was never successful, since it was wasteful of oil, and the steam present deteriorated the gas by causing the production of carbonic acid, and also interfered with the proper fixing of the hydrocarbon gas or vapour."

One of the particular objects of the invention, therefore, is to supply liquid hydrocarbon under pressure automatically regulated to the requirements of the apparatus by a governor on the steam supply-pipe; so that a uniform pressure is maintained on the steam-piston, and, consequently, in the oil delivery-pipe; the pump starting automatically when the pressure falls, and stopping when the pressure exceeds that to which the governor-valve is set. Another object is to automatically register the quantity of oil delivered by means of a meter—doing away with the necessity of taking records of the quantity of oil used from a measuring-tank, and also the necessity of intermediately filling the tank by a pump, as is now the usual practice. A further object is to provide for heating the oil by steam, and to automatically control the supply of steam to the heater by means of a governor-valve, so that absolute economy in the use of steam is secured, and also uniform pressure of oil or oil vapour maintained.

In connection with his apparatus, the patentee provides a safety relief-valve in the pipe-connection from the inlet of the meter to the suction-pipe of the oil-pump, below the check-valve of the latter. This provides for returning oil to the storage tank whenever a higher temperature, and resultant pressure, occurs in the oil-heater than is desired. By means of this arrangement, the meter will record oil returned by registering backward. The oil is heated by exhaust steam from the engine used in driving the blower or fan which supplies air to the generator; and, in practice, such steam has been found to be not only sufficient to heat the oil to a suitable temperature, but a portion of the steam has also been used to heat feed-water to the boiler.

Reducing the Noise of Gas-Engine Exhausts.—Serret, F. L., of Marseilles. No. 1884; Jan. 26, 1895.

This apparatus—as shown in the engraving—is arranged in such a manner as not to reduce the speed of the escaping gases in the exhaust-pipe which comes from the motor, but "to reduce their speed, after they have entered into the apparatus, by diverting the current without offering resistance thereto, and in prolonging the period of the discharge of the gases into the open air."



There are two cylindrical portions A B, each closed at one of its extremities, and combined together so as to present a completely closed receiver. Each of them bears a bent piece C D, the diameter of which increases towards the interior of the apparatus; and they have at their end a cone-shaped projection E F, on which the current of gases impinges. An annular disc G is interposed between the two cylindrical portions. This disc constitutes a diaphragm intended to break the current of the gases passing through the apparatus. The gases coming from the escape-pipe of the motor enter the apparatus by a bent tube C. When the current of gases, the speed of which commences to lessen, arrives opposite the conical projection C, this divides it over the whole surface of the bottom of the apparatus without opposing resistance to it, because the diameter of the cylindrical piece A is very large relatively to that of the bent tube C. The current then strikes against the circular portion H, and rises upwards, passing from the space I, which is also relatively large. The gases then strike the central diaphragm G, which produces a contraction of the gaseous current; and it passes from the orifice J, and enters the upper cylindrical portion B. The current of gases then strikes the curved side of the bent outlet-tube B, turns around this bend, and passes through the annular aperture which encircles it, strikes the upper part of the apparatus, and, following the upper conical projection F, flows into the outlet-pipe D.

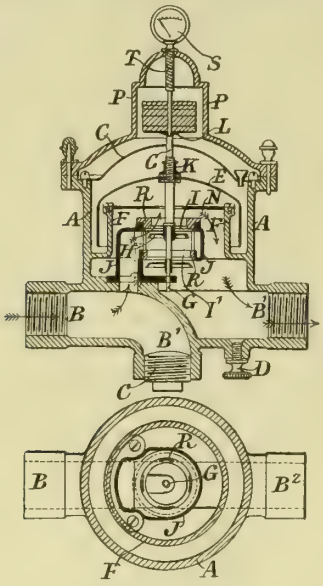
Oil Atomizing and Carburetting Apparatus.—Guldlin, O. N., of Fort Wayne (Ind.), U.S.A. No. 16,927; Sept. 10, 1895.

This invention of apparatus for carburetting or enriching water gas with hydrocarbon vapour, relates more particularly to a device for atomizing hydrocarbon oil, and injecting it into, and mingling it with, the water gas in the carburetting chamber or the superheater of a water-gas apparatus. The objects aimed at are: (1) To provide for more perfectly and economically carburetting the water gas with finely divided hydrocarbon oil, and doing away with the jet of steam usually employed for injecting and spraying oil, and thereby effecting the saving of a large percentage of the oil required for carburetting water gas to the desired candle power; (2) also to provide a simple, durable, and efficient device for atomizing liquid hydrocarbon, and injecting it into, and intimately mixing it with, the water gas in the carburetting and fixing chamber of the superheater, so as to thoroughly carburet the gas without diluting and deteriorating it with steam; (3) also to provide a device so constructed and arranged that the various parts may be readily detached and cleaned or repaired, and quickly assembled for operation.

Gas-Regulators.—Tobler, A. C., of Paris. No. 17,849; Sept. 24, 1895.

As shown [p. 1200] this regulator consists of a casing A provided with gas-inlet orifices B B^1—one or other being closed by a screw-plug C, according as the regulator is placed upon or beside the meter—and with a gas-outlet B^2; an outlet closed by another screw-plug D being

also provided for the condensation in the pipes. Within the casing, a bell-chamber E (preferably of aluminium) dips into an annular mercury trough comprised between the side of the casing and the inwardly and upwardly projecting flange F. The bell is affixed by a nut K to a central vertical rod G, carrying a balanced or double-beat valve



H H¹, closing against seats I I¹ of a box R, screwed into the central chamber J, which communicates by a passage J¹ with the gas-inlet B or B¹. The lower end of the valve-rod works in a suitable guide, and the valve-rod is loaded by weights M resting on a collar L; the load being adjusted to prevent gas in excess from passing into the bell, and thus avoiding any increase in consumption due to too great pressure.

Upon the inner wall F of the mercury trough is fixed a diaphragm N, with a central aperture to give passage to the valve-rod and access of the gas to the interior of the bell; and the casing A is enclosed by an inner domed cover O (to prevent the admission of dust), provided with a filling orifice above the mercury trough, and with a central aperture for the valve-rod to slide through. This cover is in turn enclosed by the outer cover P, provided with a chamber in which the weights M are enclosed. It carries the downwardly projecting guide-socket T, and is surmounted by a pressure-gauge S, whose index is actuated by the upper end of the valve-rod G bearing against the spring contained within the socket.

APPLICATIONS FOR LETTERS PATENT.

22,537.—Smith, R. H., "Gas-stoves for heating purposes." Nov. 26.

22,604.—Thompson, W. P., "Governor or pressure-reducing device for steam, gas, and other fluids." A communication from F. Kaeferle. Nov. 26.

22,648.—M'Millan, J. A. R., and Blair, J., "Filter attachment for water-pipes and such like." Nov. 27.

22,686.—Abel, C. D., "Automatic electro-magnetic interrupter, for protecting electrical installations." A communication from the Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. Nov. 27.

22,690.—Marks, G. C., "Gas, oil, and like engines." Nov. 27.

22,705.—Smaldon, T. H., "Holder for bells and reflectors for gas or lamp brackets." Nov. 27.

22,726.—Thomas, T. C. J., and Still, W. M., "Gas-lamps." Nov. 27.

22,733.—Prew, E. H., "Fastening glass globes, funnels, or shades to lamps, gas-brackets, or similar supports." Nov. 28.

22,754.—Love, J., "Gas lamps or burners." Nov. 28.

22,763.—Cowan, W. & W. H., "Prepayment gas-meters." Nov. 28.

22,811.—Peterson, M., "Bye-pass burners." Nov. 28.

22,867.—Thomas, J., "Gas-burners." Nov. 29.

22,923.—Godfrey, R., "Mercurial gauge for indicating the depth of water in service-tanks of every description." Nov. 30.

22,937.—Stevens, J. H., and The Tourtel Gas and General Engineering Company, Ltd., "Gas or other measuring or delivering mechanism to be set in operation by the pressure of a coin or coins." Nov. 30.

22,975.—Rowbotham, W., "Gas and such like heat-generating engines." Nov. 30.

The Disputed Contracts for the Lighting of Killarney.—In previous volumes, references have been made to the curious state of affairs which existed at Killarney in 1894, in regard to the public lighting of the town. The streets were then illuminated by both gas and electricity. A resolution had been passed by the Town Commissioners giving the contract to the Killarney Electric Light Company; but the Gas Company received no official intimation that their contract had been rescinded. The matter was brought to the test at the Killarney Quarter Sessions last April, when the Gas Company were successful in an action against the Commissioners for the payment of a half-year's account for the public lighting of the town. We have now the sequel to the matter. The Local Government Board Auditor (Mr. Calvert) has recently perfected his audit of the Commissioners' accounts; and as to the charges for public lighting, he holds that the tender of the Gas Company's Manager (Mr. M. J. Santry) was legally accepted. He therefore considers that any other contract for the lighting of the town was illegal and unwarranted (though the town was lit by electricity for about twelve months). He accordingly surcharged in three cheques—(1), John Duckett, Daniel O'Sullivan, and John Kelley, £17 10s; same (2), £41 17s. 6d; same (3), £25 14s. 3d. These he has ordered them to pay to the Munster and Leinster Bank, to the credit of the Commissioners.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Suggested Amalgamation of the Southern District Associations.

Sir,—In your issue of the 19th ult., there appeared some very strong criticisms upon the South-West Association, and those responsible for its management. While I do not feel myself called upon to reply to your general remarks, I think it is due to the Committee of the South-West Association that some explanation should be made both with respect to the discussion upon the subject of amalgamation at the meeting of the Southern Association held in London on the 14th ult., and your comments thereon. There is a remarkable silence in the report of the discussion, and also in your editorial, of any reference to the preliminary interchange of opinion that passed between the Committees of the respective Associations.

There are no two District Gas Associations in England that overlap geographically, or in actual working, to the extent of the two Southern Associations. During the past year, the President of the Southern Association contributed a paper to the South-West Association; and the President of the South-West Association contributed a paper to the Southern Association—both gentlemen being active members of the South-West. There are other active members of the South-West Association who are also members of the Southern. Under these circumstances, it was suggested that the two Associations might amalgamate, with profit and advantage to all concerned. At a meeting of the South-West Committee, a proposal for amalgamation was considered; and overtures were made to the Committee of the Southern Association. The suggestion was most favourably received by them; there not being a dissentient voice.

Relying upon these assurances, the proposal was duly submitted to a general meeting of the South-West Association; and a resolution was passed appointing three members to confer with the Committee of the Southern Association, and arrange terms. The two Committees have now been appointed; and, without pretending in any way to forecast the result of their deliberations, I may express an opinion that with anything like the friendly feeling shown during the preliminary stage of the negotiations, there are no difficulties in the way that cannot be surmounted, and an arrangement made that will be mutually acceptable.

With regard to the rule of the Southern Association excluding Secretaries, that has been mentioned perhaps for want of a better argument. It does not, as far as I know, affect any member of the South-West Association. Nevertheless, I regard the rule as unwise. Such a rule would have excluded the late Mr. Denny Lane; and I feel sure there is no member of the Southern Association would have had any doubts as to his qualifications or fitness for membership had he happened to have resided in London instead of Cork.

In conclusion (and speaking only for myself), any arrangement made for amalgamation must, as a matter of course, include every present member of the South-West Association.

D. Irving.

Stapleton Road Gas-Works, Bristol, Dec. 6, 1895.

The Case of "Bromley Gas Company v. Bennett."

Sir,—In your "Legal Intelligence" of Nov. 26, your report of the action *Bromley Gas Company v. Bennett* is scarcely correct. Your report says I was given £12 in lieu of notice, and the cost of removing my furniture to Manchester. The facts are I was given £2 in lieu of notice, and £10 for something else. I wish it to be known that I never asked for anything. The Engineer asked me on Sept. 14 what sum would compensate me. I said I should consider the matter. Once the same night, and twice the following day, he sent one of the clerks to see if I had fixed on a sum. Ultimately I sent in a claim equivalent to £50, including £16 for removal. I may say my furniture had been here five months. £12 was brought to me; and with it a paper binding me to waive any further claims against the Company, There was nothing mentioned about going to Manchester. Halifax was mentioned by the Engineer. I never said I was going there. My assent was neither implied nor expressed. I signed the paper as I had no means to go to litigation with a Company or rather their Engineer. Your report does not say that I offered, through the clerk, the £10 back, if they would give up the paper I had signed.

Robert Bennett.

Bromley, Dec. 8, 1895.

LEGAL INTELLIGENCE.

CROYDON QUARTER SESSIONS.—Saturday, Dec. 7.

(*Before Mr.* R. G. Glenn, LL.B., *the Recorder.*)

The Assessment of the Croydon Gas Company's Works.

At a special sitting of the Court to-day, the learned Recorder delivered judgment in the appeal of the Croydon Gas Company against the raising, by the Assessment Committee, of the rateable value of their property in the borough from £11,717 to £18,343. The evidence in the case was heard in July and November; and reports were published in the Journal at the time (see pp. 293, 1040).

Mr. Balfour Browne, Q.C., Mr. Danckwerts, and Mr. Barnes appeared for the appellants; Mr. Littler, Q.C., and Mr. E. Page represented the respondents.

The Recorder, in delivering judgment, said that in this case he proposed to pursue a course which probably he should not adopt on a future occasion; and therefore it must in no way be taken as a precedent. That was, he intended to hand to each side a copy of the figures deduced from the evidence on which he based his decision and arrived at his facts. His reason, he explained, for so doing was that it might afford some clue as to the view he took of the matter; so that probably in the future it might be taken as a basis for the settlement of

disputes in matters of assessment without necessitating going to appeal. With regard to the rateable value of the buildings and land, if he had to find that, he must have more evidence——

Mr. PAGE: There is hardly any difference between each side on that matter, so we have agreed upon £6400. I presume your figures are founded upon the receipts for the year ended Dec. 31, 1894.

The RECORDER acquiesced. On the last occasion, the question was discussed as to the true meaning of the word "average." He did not mind informing Counsel that he interpreted this as meaning the average up to the time when the works would be required to be renewed altogether. Continuing, he said he based his judgment on the following figures: The gross receipts, less bad debts, amounted to £78,707. The disbursements were coals and purifying, £41,377; and residuals realized £26,464—leaving the cost of manufacture at £14,913 net. Salaries of Engineer and officers were £1743; and wages and gratuities, £8335. Distribution cost £1034 in salaries of officers and clerks, and £2474 in repairing and renewing meters and stoves; and the lighting and repairing of public lamps absorbed £1555. Management expenses were: Secretary and clerks, £1347; collectors, £835; Directors, £726; and Auditors, £95. General expenditure included £297 for stationery and printing, £556 for general establishment charges, £48 for law charges, £217 to workmen's sick fund, £74 for workmen's superannuation fund, £354 for other superannuations, and £4000 for repairs to tools and chattels. This made a total of £38,603, which, deducted from £78,707, left a balance of net receipts of £40,104. Then the occupiers' share he put at: Meters, £13,840; stoves, £6933; fittings, £1200, tools and locomotive, £2000; stores, £700; coke and breeze, £589; tar, ammonia, &c., £1175; coal, 5-12ths of total cost, less residuals, £6214; 6-52nds of total cost, £4774; working expenses, 5-12ths excluding coal, £9871; rates and taxes, £1000. This totalled altogether to £48,296. Then with 17½ per cent. tenant's allowances £8451, *plus* 5 per cent. on £3000 capital at bank which gave £150, these figures gave a gross estimated rental (and rates) of £31,503. Regarding statutable deductions, he had allowed for repairs and maintenance of works, machines, mains, retorts, and pipes, £14,200, less £4000 for repairs of chattels—leaving £10,200, to which must be added £125 for insurance; leaving the rateable value of the whole works (and rates) £21,178. The gross estimated rental (and rates) being £31,503, deducting rates at 5s. 4d. on £16,719, represented £4459, which left a gross estimated rental of £27,044. Deducting from this £10,325 for statutables, there remained a rateable value of £16,719. Consequently, these figures worked out, for the borough of Croydon only, to a gross value of £24,305, and a rateable value of £15,305. His judgment therefore fixed the rateable value of the gas-works property within the borough at £15,305, instead of £18,343 as fixed by the Assessment Committee, to which it had been raised from £11,717. On the question of costs, he said that a sensible reduction had been made in the assessment; and there was no other way in which the appellants could have obtained that reduction. On this ground, therefore, it seemed to him that they were entitled to their costs.

Claim for the Supply of Filter-Pumps.

In the Queen's Bench Division of the High Court of Justice last Tuesday, before the Lord Chief Justice and a special jury, the Berkefield Filter Company sought to recover from the Rural District Council of St. Neots the sum of £75 for five filters supplied to the Council. The claim was disputed on the ground that the filters did not answer the purpose for which they were required. Mr. Pike, Q.C. (with him Mr. O. Hodges), for the plaintiffs, stated that in 1892 the Local Government Board were pressing the St. Neots District Council to provide a better water supply to the area under their authority; and, in consequence, Dr. Wright, the Medical Officer of Health for the district, communicated with them with reference to a supply of pumps and filters for the purpose of carrying out the Board's requirements. The contract for the supply of the pumps was contained in the correspondence, which was very voluminous. The pumps were so constructed that, by turning a handle, either filtered or unfiltered water could be obtained, there being a dial which indicated the kind of water that might be expected Witnesses were called to testify to the efficient working of the filter. Before the plaintiffs' case was closed, Mr. Cock, Q.C., for the defendants, said he had given his consideration to the case; and, under the circumstances, with the consent of Mr. Pike, he thought the proper solution was that a *stet processus* should be entered. The Lord Chief Justice assented; remarking that a juror would be withdrawn.

Curious Gas Account Disputes at Malvern.

At the Malvern Police Court last Wednesday, Mr. R. E. Lyon, Assistant-Master at Malvern College, was summoned for non-payment of gas-rental amounting to £38 6s. 8d. It appeared that, for the quarter ending March 25 last, the meters in defendant's two houses (his private house and boarders' house) registered 230,000 cubic feet of gas; while the amount consumed in the corresponding quarter of 1894 was 111,700 cubic feet. New mains, it was stated, had been laid in the neighbourhood of the college, causing large quantities of air to get into the pipes, and leaving defendant and others without gas for some few hours on several occasions. The conditions under which the gas was used were practically the same; only seven extra burners having been added. The Bench considered the charge made excessive, and ruled that the same amount should be charged as in the corresponding quarter of the previous year, which was £18 12s. 4d. The District Council had offered defendant an allowance of £5 in respect of the air which found its way into the mains. This he would not accept, but had offered to pay £22, which the Council declined. Mr. Vines, of Cherborg House School, Malvern, was on the same day summoned under similar circumstances. He was charged £4; and the District Council offered an abatement of £1 15s. 8d. It was asserted that defendant had been unable to get gas without pouring some 4 gallons of water into the meter; and this had to be done almost daily. It was not known where the water went to, as the meter did not leak, and had been tested and reported correct by the Council's employees. The Bench decided that defendant should pay £2 17s.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The London County Council and the Standard of Light.

The *agenda* for the meeting of the London County Council last Tuesday contained the following report from the Public Control Committee on the subject of the standard of light: "We reported to the Council, on the 21st of May last, that the representative Committee appointed by the Board of Trade in 1891 to recommend a standard for testing the illuminating power of gas in substitution of the present candle standard, had come to a unanimous decision in favour of the adoption of the 10-candle pentane Argand standard; and that they had further recommended, with a view to possible future improvements and requirements, that the Gas Referees should be authorized to approve and certify, with the consent of the Board of Trade and the Gas Companies, any other flame based upon the above 10-candle standard for use in gas testing. A recommendation was also made with regard to the method of recording the illuminating power of gas and the rate of consumption to be prescribed for testing purposes. The necessity for a more exact standard of light had been admitted for years; and the Council caused a letter to be addressed to the Board of Trade, urging the immediate introduction of a Bill to give effect to the recommendations of the Committee. Our Chairman (Mr. W. J. Collins) and the Clerk of the Council (Mr. De la Hooke) subsequently had an interview with Sir Courtenay Boyle, the Secretary of the Board of Trade, who desired to ascertain whether the Council would not itself introduce a Bill. It was pointed out to him that there would be a greater probability of success if the Bill were introduced by the Board of Trade with the agreement of all parties; and Sir Courtenay Boyle was understood to intimate that this course would probably be taken. The dissolution of Parliament, however, occurred shortly afterwards; and we are of opinion that, in view of the change of Government, it is desirable the Board of Trade should again be communicated with." The Committee accordingly recommended—"That a further letter be addressed to the Board of Trade, urging the Board to promote in the coming session a Bill for the purpose of giving effect to the recommendations of the Standards of Light Committee."

THE LIVERPOOL CITY COUNCIL AND THE GAS COMPANY.

The Competitive Gas Supply Resolution Rescinded—Alderman Smith and the Sub-Lighting Committee.

At the Meeting of the Liverpool City Council last Wednesday,

Sir A. B. FORWOOD moved that the following resolution, passed on Oct. 2 last, be rescinded: "That in view of the high price paid for the coal, &c., used by the Liverpool United Gas Company, and the consequent high price of gas and coke, the Town Clerk be and he is hereby instructed to do all that is necessary to enable the Council to promote a Bill in the forthcoming session of Parliament to obtain powers to establish and maintain a competitive gas supply, and that Standing Order No. 61 be suspended accordingly." Sir Arthur pointed out that the Town Clerk had declared the resolution to be *ultra vires*; and it was unwise to have invalid resolutions standing upon their minutes. The new Lighting Committee were anxious to commence with a clean sheet of paper, unprejudiced by anything that had gone before.

Mr. PETRIE seconded the motion.

Alderman F. SMITH saw no objection to Sir Arthur Forwood having his own way in this matter, because it was highly desirable that he should have a clean sheet of paper so that he might write something good upon it for the city. Sir Arthur had an opportunity of doing something more advantageous for the public than had been done for many a long day; and it was important that he should be given every facility. The Gas Company were piling together a large amount of money which would enable them to make most substantial concessions; and it would be deplorable if anything were allowed to stand in the way of a speedy settlement of the question. Hitherto they had been unable to learn the new policy of the Lighting Committee; but there was no hurry for it, because the only persons to be hurried were the Directors of the Gas Company, in the hope that they might deal with the matter before their annual meeting in February.

The resolution was carried without dissent.

Alderman M'ADAM complained that Alderman Smith had been omitted from the Sub-Committee which had been appointed by the Lighting Committee to deal with the gas question; and he moved that he be added.

Mr. WATTS seconded the motion.

Sir ARTHUR FORWOOD urged the Council to approve the action of the Lighting Committee. Alderman Smith was not left off the Sub-Committee because of any personal reasons. It would, however, be idle for them to ignore the circumstances and difficulties which had already happened; and he thought it was undesirable from that point of view that Alderman Smith should be a member of the Committee, which might have to conduct delicate negotiations that could not be carried out, he had reason to believe, if Alderman Smith were continued as a member.

Alderman SMITH hoped that Alderman M'Adam would not persevere with his motion. At the same time, he denied that any difficulties over this question emanated from the Lighting Committee, who always treated the Directors of the Gas Company in a perfectly respectful and proper manner. These gentlemen declined to give the Committee any information; and hence the unpleasantness.

The amendment was withdrawn; and the proceedings of the Lighting Committee were confirmed.

THE EXTENSION OF THE PLYMOUTH GAS-WORKS.

Inauguration of a New Gasholder.

The affairs of the Plymouth and Stonehouse Gas Company have always been regarded with peculiar interest in the gas profession, doubtless from the fact that—notwithstanding that the Company are so far distant from the coal-fields from which the bulk of their supply is obtained—they have for years been in a position to supply their somewhat straggling district with gas at the extraordinarily low price of 1s. 9d. per 1000 cubic feet. The cheapness of supply, in the natural order of things, prompted a liberal demand for gas by the consumers; and, in all probability, no place in England could be named in which a freer use of gas, both in the daytime and at night, is indulged in. In consequence of this, frequent extensions of manufacturing facilities have been called for—the latest completed work being a two-million cubic feet holder, which was formally brought into use on Thursday last. Before, however, describing the holder, and the inauguration ceremony, some particulars may be given of the Company's affairs, from notes made during a visit to the town and from incidents referred to by speakers taking part in the interesting function.

In the persons of Mr. George Henderson, J.P.—now the Chairman of the Company, but formerly Secretary—and Mr. John Thomas, who succeeded Mr. Henderson in the office of Secretary, the Company are indeed fortunate in having two gentlemen whose whole energy, tact, and vast experience have been at the service of the gas consumers of Plymouth for (in the case of Mr. Henderson) more than fifty years. Unfortunately, at the present time, the Chairman is invalided; and this circumstance was the only sorrowful incident mentioned during last week's proceedings. The Company some years ago went to Parliament for further powers, and were then put under auction clauses and the sliding-scale, with 2s. 6d. per 1000 cubic feet as the standard price, though then (and ever since 1887) they were actually supplying gas at 1s. 9d. per 1000 feet. The parliamentary standard illuminating power was then fixed at 14 candles. On again going to Parliament two years ago, it will be remembered that one of the conditions attached to the authorization of further capital was that the standard quality should be raised to 15 candles; though Parliament refused to listen to appeals by the opponents of the Company's Bill to lower the standard price formerly fixed. Situated as the Company are, the extra candle imposed, and the more stringent testing permitted, were a sufficiently serious tax on the resources of the concern. It means an additional cost of at least 2d. per 1000 feet, consequent on the high price of the cannel the Company have to use in connection with their ordinary Newcastle coal. Hence the present supply is equivalent to selling at 1s. 7d. per 1000 cubic feet compared with the former supply of 14-candle gas. The Corporation also opposed the Company's Bill with a view to get embodied in it compulsory clauses for purchasing the undertaking; but the House of Commons Committee did not grant their request—believing that a Company who had served the consumers so well, and so long, should still continue to do so.

It will be in the recollection of many of our readers that the present Company was originally promoted as a "Consumers' Company;" and, as such, Mr. Henderson was at its head. To him certainly was largely due the credit of effecting the economy that resulted from the purchase of the old Company, and the placing of all the works under one control. For unlike the history that might be written of some other places somewhat similarly circumstanced, the capital of the Plymouth Gas Company has been kept very low—not by starving the works by any means, but by carefully husbanding the available resources. At the same time, it has been possible to build up a good reserve fund to meet any contingencies that might arise. This fund, it may be remarked, has already stood both the gas consumers and the shareholders in good stead—more especially when, during the bad years of 1890-93, the Company were able to retain their low selling price and yet pay full dividends by taking a large sum (£8000 odd, we understand) from their undivided balances.

For some years, not much money had been spent by the Company on extensions; and it was generally and naturally expected by on-lookers that, when the Company were forced to face the necessity for extensive alterations and improvements of works, some interference with the dividend-earning capacity of the Company would be evidenced from the fact of the capital required to be raised for the purpose not all at once coming into full earning power. Such an untoward event has not, however, yet occurred; and it is not now likely that there will be any such radical disturbance with the relative positions of the shareholders and consumers. Consequently, in all recent additions to the plant, real economy of working has been the first consideration; so that savings in one direction might balance increased outgoings in the way of dividends under the sliding-scale.

When, some three years ago, the Directors began their present series of enlargements, everything of the most modern description was arranged for. The extensions were made on a piece of land adjoining the old works though almost separated from them; and they comprised a new retort-house and coal-store, new exhausters and boiler, a Livesey washer, Cutler's condenser, tar-tanks, and finally the gasholder to which special reference is about to be made. In the carrying out of this work, the Directors consulted Mr. John West, M.Inst.C.E., of Manchester; and they gave him a tolerably free hand in the matter of meeting their requirements.

Mr. West first turned his attention to the provision of a new retort-house—the opening of which was reported in the JOURNAL for Sept. 25, 1894—fitted already with twenty two settings of regenerative furnaces, heating eight through retorts each, or 352 mouthpieces in all; and to this house Mr. West applied his most modern stoking machinery worked by compressed air. The new retorts are so satisfactory in their working that they produce more gas than the 720 retorts in the four old houses; and, moreover, the Company are now selling 2 cwt. more coke per ton of coal carbonized than was formerly the case. In addition, the coal-stores and retort-house are provided with coal breakers and conveyors for feeding the charging machinery. It must be noted, however, as a great drawback, that the Company, getting their coal from Newcastle, have to cart the whole supply from the ships to the works, some mile or more, in bags on lorries; and this and the harbour dues they have to pay, cause a serious addition to the cost of their coal supply. For dealing with the coal when delivered on the works, a large specially devised elevator and conveyor has been arranged. It elevates and stores the coal at the present time at the rate of 600 tons per day of ten hours; but it has been worked up to 800 tons during a like period. The whole of this plant has worked smoothly and without a hitch of any kind from the time of its first starting; and it has given the utmost satisfaction to the employees who are told off to manipulate it.

Now that the Company are well provided for in the matter of gasholder power, attention will have to be directed to other parts of the plant. Notably the scrubbers, which are only about half the size they ought to be, will need early alteration; the "Standard" washer-scrubber, of 2 million cubic feet capacity, is now pressed up to dealing with nearer 3 millions; the station meter, rated to pass 100,000 cubic feet per hour, is being used to register (?) up to 130,000 to 140,000 cubic feet; the governors, of very antiquated type, are dotted about the works in a most confusing way; and lastly the purifiers are too small, though enabling the sulphur compounds to be kept down to 10 grains, although the Company are not under any restrictions in this respect. Of course, it costs extra to do this; but the policy pursued at Plymouth is to supply pure gas as well as cheap gas.

Turning now to the holder started last Thursday, it may be noted that it is a four-lift one, 150 feet in diameter. Each lift is 30 feet in depth; and as the dome rises 10 feet, the total height of it, when fully inflated, is 130 feet clear of the tank. The tank was hewn out of the solid rock, 50 feet deep from the landing-stones; and it contains about 2¾ million gallons of water. There are eighteen trellis standards, constructed of 12-inch channels, braced with flat steel bars, and connected together with four tiers of latticed girders. The upper tier is of box design; and the intermediate tiers are formed of steel angles braced and erected flat the full width of the standards. There are 72 girders in all, strongly braced with wind-tie bars throughout. The entire structure is made of Bessemer steel; and it is of a total weight of about 800 tons. There are 216 guide-carriages; the 72 upper carriages being made with adjustable screws—a novel arrangement, dispensing with the older method of slotted bed-plates, and permitting any adjustment being made almost instantaneously. The whole of the rollers are specially made of cast steel, thus embodying strength and lightness. The top curb is constructed of double steel angles, connected together with ½-inch steel plates, and secured to the hanging row (also ½ inch thick) with steel gusset-plates. The whole of the rivets are of steel throughout the structure; and in this section they are ¾ and 1 inch in diameter. The crown of the holder is untrussed, and is constructed of rectangular plates, all joints being broken. When out of action, it rests upon a massive wood-framing permanently erected by Mr. W. T. Jinkin, who completed the tank last year. "Livesey" improved manlids give access to the 36-inch wrought-steel inlet and outlet pipes. The sides are panelled with 144 steel plates, 15 inches wide, which extend in one length, vertically, the entire depth of holder.

The holder, owing to its altitude and exceptionally exposed condition facing the Plymouth Sound, had necessarily to be strong and massive; but the design of the framing lends to it a light and pleasing appearance, on which both Mr. West, who prepared the plans and specification, and Messrs. Willey and Co. of Exeter, who erected it in the short space of ten months from the date of order, were heartily and deservedly congratulated by the numerous party who witnessed the short inauguration ceremony.

Among those present at the works to witness the turning on of the gas from the new holder into the town were Mr. R. H. Snow, the Deputy-Chairman of the Company, Messrs. T. Pitts, jun., J. H. S. May, W. Radford, J. Wills, G. Cox, H. S. Wilcocks, and T. Wolferstan, Directors, Mr. John West, Consulting Engineer, Mr. A. Wharton, the Manager, Mr. Percy S. Hoyte, the Assistant Manager, Mr. H. A. Willey and Mr. S. J. H. Willey (Messrs. Willey and Co., of Exeter), and Mr. W. T. Jinkin, the Contractor for the tank.

Mr. WEST, in commencing the proceedings, said his simple duty was to report to the Board of Directors that the undertaking which had been such a marvellously short space of time in hand was now completed. It had been done in a manner which gave entire satisfaction to himself, who had been somewhat responsible for its construction, or at any rate for the design. Out of the many large works—especially large gasholders—with which he had been identified, he had never had the pleasure of seeing one so satisfactorily constructed in every way as this one was. It was not always that the plans were followed with such perfection as in the present instance. All the seventy-two girders fitted as tightly in the standards as it was possible to make them; and no packing at all was required in any one of them. Owing to the exposed position in which the holder was placed, it was necessary to make it so that it would throw as little pressure as possible on the standards, and so that it would stand the stress of the severe gales to which it was exposed. He had to put in exceptionally strong tie-rods, and yet combine strength with lightness; and though the holder did not look very massive, it was exceptionally strong. On the previous night, it was given a severe test; and it did not swerve in the least degree. A gasholder of this size had, he felt positive, never been built in so short a time; and it was very gratifying to the Directors and to himself to have had their wishes met in such a manner. Last winter some trouble was caused by the want of gas in the town; but he did not anticipate that this difficulty would recur now that they had so much more storage accommodation.

Mr. SNOW then turned the gas from the holder into the mains supplying the town, and expressed his great regret that the Chairman, Mr. G. Henderson, was not present to perform the ceremony.

In the evening, the company dined together, at the invitation of the Gas Company, at the Duke of Cornwall Hotel. Mr. SNOW presided. After the usual loyal toasts had been honoured, the health of the Chairman of the Company was cordially drunk.

Mr. SNOW then proposed the health of Mr. John West. He said it was a great pleasure to him to know that the holder was completed. The growth of the town, and the lowness of the price charged for their gas, were sure to lead to the need for large extensions of plant to meet

the requirements. On one day the previous week, the Company sent out no less than 3,200,000 cubic feet of gas.

Mr. West, in responding, referred again to the expedition and the satisfactory manner in which the work had been carried out by Messrs. Willey and Co., and said that, although the plans were prepared at very short notice, and at express speed, he did not know that he should alter a single detail if he had now to prepare similar designs at his leisure. The new holder had been thoroughly criticized by eminent gas engineers, including Mr. George Livesey, who expressed a very favourable opinion concerning it. It would prove of immense advantage during the coming winter. The difficulty of supplying a town like Plymouth—where there was at times a very sudden demand upon the Company and a large consumption during the day—was very great. Formerly, they had only storage accommodation for 2,200,000 cubic feet; and sometimes they had been called upon to supply 3,250,000 cubic feet. On one day they had had the holders full, and on the next they had not known how to supply the town with gas. For many years gas had been supplied in Plymouth at a cheaper rate than in any other town in the world. This showed what could be done by a continuity of good management. But the question was asked, "What would happen when the Company had to extend their old works?" In some quarters an increase of price seemed to be anticipated. The Directors were, however, desirous of keeping the price low; and having made up their minds to see what could be done by the use of modern appliances, they were able last year to pay their full maximum dividends, and to sell gas at the same price as before. Indeed, compared with previous years, the price was lower, because Parliament had imposed upon them an extra candle in illuminating power, which meant an addition of 2d. per 1000 cubic feet to the cost of manufacture. Thus the 1s. 9d. per 1000 cubic feet charged now was only equal to 1s. 7d. at the former quality of the gas supplied. They were enabled to do this by savings in labour. They had 352 retorts in the new house; and they were making more gas than with the 720 retorts which they previously had in the four old houses in which hand-stoking was in use. They had only to open the retorts half the number of times, and to keep them open only half as long as when they were hand charged; so that there was less waste, less smoke, and, if there was any nuisance, less nuisance than before. They were now making about 8000 cubic feet of gas per mouthpiece daily. The new plant was working most satisfactorily; and although the old plant was not all that it should be, they would in time remodel this also. The consumption of gas in the town was increasing very rapidly; and during the past month they had sent out 5½ per cent. more than in the corresponding month of last year. People were now using incandescent gas-lamps more freely; and these were perhaps destined to be the light of the future. At all events, he thought that the gas producers had nothing to fear from the electric light. So long as they could produce gas to sell at 1s. 9d. per 1000 cubic feet, and pay good dividends into the bargain, he did not think electricians would stand much chance with them. At Plymouth, they were making gas on the old lines from coal and cannel; and his engineering friends would have to do something very great with their carburetting systems before they could prove to him that the old methods could be beaten. They were, however, watching all the new systems; and if they adopted any, it would certainly be the best. They had not much of a margin to play with there; and this perhaps put them on their mettle to do as much as was at all possible with the material at their disposal.

Mr. T. Pitts, jun., proposed the health of the Contractors.

Mr. H. A. Willey, in reply, said he welcomed the confidence reposed in him by the Directors as affording him an opportunity of making a name and of showing he could—humbly, but worthily—follow in the footsteps of his late father, and maintain the industry which he had built up in the West of England. The work that day inaugurated was of an exceptional kind, and had been done in a very limited space of time. By no ordinary methods, or no ordinary routine, could the work have been carried out in the time; and throughout the year he had worked almost day and night to fulfil his responsibility, and carry out his engagement. All through, he had been most ably assisted by Mr. West, by Mr. Thomas, the Secretary of the Company, and the other officials.

Mr. Jinkin also acknowledged the toast.

Mr. C. Rowe proposed "Prosperity to the Town and Trade of Plymouth, especially of the Plymouth Gas Company."

Mr. Thomas responded. After referring to the increasing prosperity of Plymouth, he said that the Gas Company might take a little credit to themselves for contributing in some degree to that success. If they took simply the import of coal by the Company, it would be evident that there had been a large increase to the labour and trade of the town. In 1857, the quantity of coal imported by the Company was 8220 tons. In 1865, it amounted to 16,150 tons; in 1870, to 21,680 tons; in 1879, to 31,000 tons; in 1889, to nearly 50,000 tons; and in 1894 to nearly 63,000 tons. In that period of 37 years, there had been a very large increase in business, which must have resulted in a greater distribution of wages among the working population and the small traders. That the Company had participated in the prosperity, there could be no doubt; and while they had been contributing to the welfare of others, they had been extending their own business, and had derived great benefit from the increase in the consumption of gas. In 1857, they produced 84½ million cubic feet of gas; in 1865, it had increased to 165½ millions; in 1870, to 231 millions; in 1879, to 327 millions; in 1889, to 542 millions; in 1894, to 677¼ millions; and in all probability, when they made up their accounts on the 31st of March next, they would find that the consumption was very little short of 700 million cubic feet. These figures evidenced a vast increase in the consuming power of the town, and a great addition to its ordinary business transactions. The consumers numbered 3000 in the year 1857; and they were now 11,000. As the demand had grown, the plant had had to be enlarged to keep pace with it. There had been a very considerable increase in the storage capacity. The first holder erected at the works had a capacity of only 40,000 cubic feet. At that time the present Plymouth and Stonehouse Gas Company was a competing Company. There were two Companies supplying gas in the town; and the present Company had not the whole district in their hands. In a few years, the other Company retired from the field, and the Plymouth Company bought from them four small holders with wooden tanks, which would contain in the aggregate something like 10,000 cubic feet. In 1854 and 1862, the Directors instructed Mr. Vickary, the predecessor of Mr. Willey, to erect two more holders upon the works. In 1876, a still larger advance was made; and a holder with a capacity of 200,000 cubic feet—one of the largest at that time west of Bristol—was put up. Seven years later, another holder, with a capacity of 220,000 cubic feet, was added by Mr. Willey; and at the end of a further period of eight years, an additional lift was put to both of these vessels. It was hoped that these would suffice for a considerable period. But they soon found it necessary to have more storage room; and, on the advice of Mr. West, they had constructed the holder with a capacity of 2 million cubic feet which had been inaugurated that day, and which just doubled the storage capacity of the works. They hoped now without fear to meet the public wants, and to carry on the works without that disturbance and nervous anxiety which had been experienced recently. The Company might claim to have done their duty to the public. They came into existence to supply gas at the lowest possible price; and though at that time gas was being sold at as high a rate as 15s. per 1000 cubic feet (the consumption being by burner), the Plymouth Company consented to a maximum of 6s. being put in their Act. They soon came to see that the cheaper the commodity the larger would be the sale; and by the year 1857 the price was reduced to 4s. Year by year, with the increasing prosperity of the Company, the Directors had given the public a share in it. Sometimes the reduction had been 6d., sometimes 3d., and sometimes 2d.; and on many occasions they had been content to go down a penny at a time. There had been no attempt to increase the price, except in the years of the coal famine, when coal was not to be had, and when they had to put up the price 6d. per 1000 cubic feet. In 1887, they reached the present figure of 1s. 9d.; and although there had been fluctuations in the coal market which rather strained them, they had fallen back upon the reserve fund to make up the dividends, and continued to supply the public at the same price. They had been pioneers in the great work of producing light at a cheap rate, and they had produced energy in the form of motive power as well as cooking and heating power at a low charge; so that every section of the community in Plymouth was placed in easy circumstances as regards light and fuel. While they had done this, they had not forgotten the shareholders, who had received the maximum dividends to which they were fairly entitled.

The remaining toasts were "The Press," proposed by Mr. May; "The Visitors," proposed by Mr. Wills, and responded to by Messrs. Bailey, Rowe, and Beynon; and "The Chairman and Vice-Chairman," proposed by Mr. West, and acknowledged by Mr. Snow and Mr. Wills.

IMPROVEMENTS AT THE MIDDLESBROUGH GAS-WORKS.

In the Journal for the 26th ult., we gave illustrations of the new holder, on the wire-rope system of guiding, which Messrs. Ashmore, Benson, Pease, and Co., Limited, have erected at the Middlesbrough Gas-Works. Apart from this valuable addition to one section of the plant, alterations and reconstructions of an extensive and important character have of late years been necessary at the works, in order to meet the constant increase in the demand made upon them. Some particulars in regard to these may be of interest by way of supplementing the details as to the holder which have already been published.

Going back to the year 1882, we find that the manufacturing power of the works was about 200 million cubic feet; whereas in the year 1894-5 it was just double—viz., 400 millions. It was at the beginning of the first-named year that the late Borough Surveyor (Mr. E. D. Latham), the predecessor of Mr. David Terrace, the present Gas Engineer and Manager, began the work of reconstruction; his labours being directed mainly to the augmentation of the carbonizing and purifying plant. During the past five years, Mr. Terrace has continued this work with increased activity so as to be in a position to cope with demands. At the old works—the manufacturing station—nearly all the apparatus has been improved or duplicated. The introduction of the inclined retort system a few years ago has resulted (although no more ground space is occupied by the retort-houses than during the last eight or nine years) in the supply being sufficient, through the increased power of production resulting from the process. Every retort was at work last winter; and the additional storage will enable the plant to meet all the requirements of the town until further extensions can be made in the carbonizing department. A large new condenser was erected about four years ago; and the exhauster-house has also been improved by the provision of the most recently invented machinery. New scrubbers are being erected; and three years ago the purifying power was doubled—thus making provision for some years to come. The measuring capacity was also doubled by the addition of a new station meter capable of passing 50,000 cubic feet per hour. It will thus be seen that nearly the whole of the extensions and alterations—being practically the reconstruction of the works—have been carried out during the past six years, and have been designed and superintended by Mr. Terrace. The addition of so much new plant has necessitated the severance of the old; and the reconnection of the modern apparatus has entailed very great care and forethought in its successful execution, considering that the manufacture of gas had to go on while the alterations were in progress. New ground has been recently acquired for additions—notably for extending the new retort-house—to meet the immediate demands of next season.

With regard to storage, in the past six years two old gasholders have been removed, and the new one already described has been erected. The effect has been that, whereas a few years ago there was only storage for a million cubic feet of gas, there is now room for 3¼ millions, or equal to 1½ days' supply in midwinter. The additional storage has been attained by doubling the capacity of one holder on the Marsh site—from 500,000 to 1,000,000 cubic feet—to make up for the loss entailed by the removal of the two old ones; and the erection of the rope-guided holder. The holder on the Marsh site had fortunately been designed with a view to an increase of its capacity.

Mr. Terrace has given considerable attention to the regulation of pressure; and 24-inch governors have been interposed between the new holder and the supply-mains. About three years ago, a large main was laid from the Marsh site to the centre of the town. The connections from this centre lead to all the other streets. Great improvements have been effected in regard to the equalization of pressure of late years; the pressure over the whole area of supply having been practically doubled since 1890 and 1891.

All these improvements have necessarily entailed the expenditure of a large amount of money; but, as the capital outlay has only kept pace with the gas manufactured, the extensions have, in a sense, been met by the increased income. Thus in 1882-3 the capital account stood at £116,000 for a sale of 180 million cubic feet, or equal to 13s. per 1000 cubic feet sold; in 1888-9, it was £145,800 for a sale of 262 millions, equal to 11s. 2d. per 1000 feet sold; whereas the last financial year shows it to be £192,000, with a sale of 385 millions, or equal to 10s. per 1000 feet sold. Large amounts are annually written off to meet the statutory requirements for redemption of capital. It may be mentioned that twelve years ago, for every 1000 cubic feet of gas sold, the cost of interest and redemption was about 6d.; six years ago, it was about 4¾d.; and last year it was covered by a payment of a little over 4d.—thus showing that the gas undertaking of the Corporation, financially considered, is in a healthy condition.

INSTALLATION OF WEST'S STOKING MACHINERY AT THE WEST BROMWICH GAS-WORKS.

Last Tuesday, the Gas Committee of the West Bromwich Corporation, accompanied by the Secretary (Mr. T. Hudson) and other officials, made an inspection of the installation of stoking machinery which has just been completed there; and they displayed much interest in the new method of drawing and charging gas-retorts. The retort-house is 230 feet long and 70 feet wide, and contains 240 retorts. Of these, 128 are 22 in. by 16 in., ⌂-shape, and are now heated by regenerative furnaces; and ultimately the whole of the retorts will be heated on this principle. The machinery has been supplied and fixed by West's Gas Improvement Company, Limited, to the specification of the Gas Manager of the Corporation (Mr. T. Glover). It consists of two sets of engines, with coal breakers, elevators, conveyor, and hoppers; and two drawing and two charging machines. In addition, provision has been made for receiving the coal from the elevated railway in large hopper shoots, which feed it direct to the breakers. By this arrangement, the cost of conveying the coal from the railway trucks to the retorts is reduced to a minimum. The condition of the contents of the retorts before being drawn (the retorts had been previously charged by the machine) was closely scrutinized; and the level appearance of the charge gave every satisfaction, as did also the quality of the coke when drawn. The company afterwards adjourned to the Committee-room, on the invitation of the Chairman (Alderman Farley, J.P.), and partook of refreshments. Mr. John West, jun. (representing the Contractors), in proposing Alderman Farley's health, mentioned the fact that under his chairmanship, which had covered a period of nearly fifteen years, the works had prospered, and were in a position to compete successfully with neighbouring gas establishments. He hoped the introduction of the machinery which had been inaugurated that day would enable them to compete still more successfully. Alderman Farley responded; and shortly afterwards the company dispersed, expressing pleasure at all they had seen.

Additional Pumping Plant for the South Staffordshire Water-Works Company.—In addition to the new works recently noticed in the JOURNAL, the South Staffordshire Water-Works Company have just placed orders for two more pumping-engines, each of a capacity of 1½ million gallons per 24 hours. One of the engines is for their Shenstone station, near Lichfield; and the other for the Bourne Vale, Aldridge, station.

Portsmouth Water-Works Company.—The half-yearly meeting of this Company was held on the 28th ult. The profit and loss account showed that the available balance was £18,373, from which the Directors recommended the payment of the full statutory dividends, and that a sum of £858 be carried to the arrears of dividend fund, which, with the sum already standing to the credit of that fund, would enable a similar distribution to be made in respect of such arrears of dividend as on previous occasions, in accordance with a scheme already approved by the shareholders. This, after the usual deductions for void houses, &c., would leave a balance of about £3290 to be carried forward. During the half year, 2925 yards of new street service-pipes were laid, and 227 additional premises were connected with the mains—making the total number supplied 36,013. The average daily supply of water during the half year for all purposes was 6,828,000 gallons. In moving the adoption of the report, the Chairman (Mr. W. Grant, J.P.) said that, comparing the water-rental of the past year with that of four years ago, it showed no less an increase than £4014—an annual average advance of £1000. Thus they were able to recommend not only the distribution of the full statutory dividends to which they had become so much accustomed, but they were able to carry £858 to the arrears of dividend fund, and in spite of this to carry forward £3290. The Company were about to apply to Parliament for some further powers. The provisions of the proposed Act were of a very simple and harmless character; and he did not anticipate any opposition to them. Some thirteen years ago, the Directors most wisely made it their policy to buy up springs and lands in the vicinity of their works; and this was to be continued. The Town Council were apparently disposed to renew their negotiations for the purchase of the undertaking. He would venture to deprecate any discussion on the subject at the moment, because it might do untold harm. The position which they took up on the last negotiations was that any proposal which might be submitted must be based on such terms as were usual in the compulsory purchase of water undertakings, and to that position they meant to adhere. The report was then adopted.

BIRMINGHAM CORPORATION GAS SUPPLY.

Additions to Plant—The Prepayment Meter System—The Decline in the Value of Coke and Sulphate.

At the Meeting of the Birmingham City Council last Tuesday—the MAYOR (Mr. James Smith) presiding—the Gas Committee submitted a report dealing with several matters affecting their department.

Having regard to the success which has attended the use of coke-conveying and screening machinery at the Saltley and Windsor Street works, both in respect to economy and convenience, the Committee stated that they had authorized an expenditure of £2476 in the provision of similar plant at Swan Village, with such modifications in the design as further experience had shown to be required to keep down the cost of maintenance. The Birmingham Canal Company having complained that the quantity of water taken from the canal for manufacturing purposes at the Windsor Street works was excessive, and a large additional supply being required there in connection with the introduction of charging and drawing machinery, the Committee, after making a trial boring for a well at these works, and after communication with the Water-Works Committee, had authorized an expenditure of £962 10s. in sinking a well, and in the provision of the necessary engine, pumps, and plant. The sinking of the well had been completed, and a sufficient supply of water obtained. A further expenditure of £590 had been authorized at the Windsor Street works in the extension of the coal-conveying plant and hoppers used in connection with the charging and drawing machinery. The following tenders, the Committee reported, had been accepted in connection with the extensions, alterations, and repair of plant at the works: Piggott and Co., conveyor, elevator, and oscillating screen at Swan Village, £1577; Grice and Son, gas-engine for coke-conveying machinery at Swan Village, £178; Aird and Sons, sinking well at Windsor Street, £362 10s.; Hands and Son, pumping plant, £282; Ewen and Mitton, revolving coke-screen, Windsor Street, £170; Ewen and Mitton, extension of coal-hoppers, Windsor Street, £176 10s.; Chain Belt Engineering Company, extension of coal-hoppers, Windsor Street, £184 10s.; Grice and Son, repair of air-compressors, Saltley, £120. The Committee had agreed with Messrs. Lewis Demuth and Co., Limited, that the price to be paid for tar in the current year under their contract should be the same as in the past year. Contracts for the supply of the coal required in the present year had also been made on favourable terms. In negotiating these contracts, it was found that the great advance made in 1893 in the rates for carrying coal to Windsor Street, over the North Staffordshire Railway, had, in the present state of the market, excluded the purchase of any coal from that district. The Committee reported that, having regard to the reduction in the price of coal, and to a probability of their losing one of their markets for coke in the coming year, they had reduced the price of coke and breeze by 2s. per ton as from Oct. 1. Referring to prepayment meters, the Committee said that, finding their efforts to introduce them through the agency of house owners and agents were unsuccessful, they had authorized the payment of a small commission to the meter inspectors who brought in orders for these meters in the summer months from their respective districts. About 1000 applications had thus been received; and the number of meters now fixed was 932. Owing to the pressure on the fittings department in the winter months, it was not now possible to fix the meters as fast as the orders were received; and the supply of them had for this reason been somewhat checked since October. Orders for them were, however, being continually received, and were now accumulating; and the Committee had no doubt that, when the pressure of the winter months on the fittings department had ceased, a very large additional number of meters would be required. Many applications had been received from quarterly consumers now on the books to be allowed to exchange to the prepayment system. The Committee had informed all such consumers that the consideration of these applications must be postponed until the applications for a new supply had been satisfied. The recent demands on the fittings department having outgrown the power of the staff to attend to them punctually, they had given instructions that no orders should be received for fittings work, beyond those of emergency, so long as it was not possible to give all work prompt attention. They found, however, that consumers were reluctant to accept refusals of their orders, preferring in very many cases to wait until the department was able to execute them. The Committee have withdrawn their notice of appeal to Quarter Sessions against the re-assessment of their mains in Handsworth and Wednesbury, not feeling justified in incurring the expense of a contest in respect of the comparatively small amount in dispute.

Alderman POLLACK, in moving the adoption of the report of the Committee, incidentally referred to the laying down of new coke conveying and screening machinery at Swan Village, and to the sinking of a well at the Windsor Street works. As to the introduction of prepayment meters, he regretted that the system had not been taken advantage of to the extent anticipated. The efforts of the Committee to introduce these meters through the agency of house owners and agents had been unsuccessful; and so they offered a small commission to the meter inspectors on orders brought in during the summer months. About 1000 applications had been received; and the number of meters now fixed was 932. In other large towns, such as Liverpool and parts of London, the system had made rapid strides. In Birmingham, there were comparatively fewer small consumers than in other places—one reason being that the accounts were presented quarterly, which necessitated the giving of a guarantee or deposit by the consumer. This would not be required under the prepayment system, which, he believed, would facilitate the introduction of gas into a large number of small houses. The difficulty of the department was to fix the meters, especially in winter, as rapidly as was required; and at the present time the fittings department was overwhelmed with work. They would, however, be able to employ additional hands during the summer; and so he hoped more mechanics would be encouraged to embrace this branch of trade. The Committee were indebted to the Postmaster (Mr. Wight) for the facilities he had afforded them for the collection of accounts at the post offices in the suburban districts. The small gas consumers in these districts had not been slow to avail themselves of

the advantages offered them to pay their accounts at the post-offices. The year's accounts, so far, presented some favourable and some adverse points; but four of the busiest months remained to be included. The increase in the consumption of gas had been a little more than 2 per cent.—a remarkable increase considering that, in the corresponding six summer months of last year, there was an increase of 6 per cent. The Committee could not expect, on the whole, a larger average increase than 2 per cent.; but, even at this rate, it would soon be necessary for the Committee to consider the question of a further extension of their works, especially with the contingency of a repetition of a hard and long frost, perhaps at the busiest time of the year, similar to the one last year. It was not improbable that such auxiliary plant would take the shape of carburetted water gas plant, the expense of which was comparatively small, and which would assist them in utilizing some of their coke. That was the first favourable feature; and the next was that their coal contracts would leave a not inconsiderable margin as to price and quality. They had more coal now which would yield a larger quantity of gas per ton. The unfavourable side was in respect to some of their residuals. The consequence of a reduction in the price of coal had been a reduction in the charge for coke. Last year this residual yielded a net revenue of £70,000. The reduction they had made was 2s. per ton, or nearly 15 per cent.; and this meant a considerable reduction on the £70,000. But the loss on this residual would be somewhat mitigated by the saving which would be effected by having coke conveying and screening machinery in use at nearly all of their works, and also by the rapid way in which they had disposed of their coke, for at the end of November they had less than 1000 tons of coke in stock at their four works. The second and more important adverse circumstance was the fall in the price of sulphate of ammonia. The price was very low in 1892, and then it rose; but it was considerably lower now. In 1892 the ammoniacal liquor yielded £27,000; and in 1893, £44,500—an increase of more than £17,000. The price remained steady during 1894, when they earned £45,000; but the fall in the price of sulphate from £12 9s. in 1894 to £8 19s.—the present market price—meant a reduction of nearly 40 per cent., and a loss to the department of about £20,000 on the year's trading. Notwithstanding, however, the adversities against which they had to struggle, he trusted the Committee would not only be able to make both ends meet, but would also be able to keep their promise to the Finance Department, and hand over a contribution of £25,000 to the account of the improvement rate.

Mr. Hennesy asked several questions regarding the report, various points of which he criticized. In regard to the prepayment meter system, he said he thought the artizan classes would find it very costly, for the penny payment method would mean to them a double rent, because it would amount to about 3s. per 1000 cubic feet. This, he considered, would be unjust.

Mr. Jarvis protested against the Committee extending the work of the fittings department. In his opinion, it should be done by private tradesmen.

Mr. Lane, referring to the proposed new machinery, said the works were already crammed full—in fact, there was so much machinery that more men were required to attend to it than would be necessary to do the work itself. The price that was being paid for gas was higher than it should be by several pence per 1000 cubic feet; and the quality of the gas was certainly not so good as it ought to be. He thought that there must be financial leakage somewhere, seeing that the amount annually allotted to the relief of the rates represented only 1 per cent. on the capital expenditure. He moved, as an amendment—"That this Council desires its Gas Committee to introduce in its next report a retrospective statement comparing the present position of the department with the anticipations proclaimed when the gas-works were acquired by the Corporation. It further desires its Committee to ascertain and report as to the results obtained by other private and public gas undertakings in this country, the questions of quality, price, and profitable administration to be considered as of special interest to this Council."

Mr. S. Lloyd seconded the amendment.

Mr. Jacobs asserted that the Committee would not dare to compare their undertaking with that of other places. Private undertakings were making their 10 per cent., and spending money lavishly on salaries and buildings so that it might be consumed; but in Birmingham they made a profit of 1 per cent. on a capital of 2½ millions.

Mr. Moore Bayley proposed an amendment to the effect that the Committee be instructed to confine the work of the fittings department as much as possible to emergency orders only, and not extend the trading of the department in further competition with ratepaying traders.

Mr. E. Fletcher seconded the amendment.

Mr. Jephcott pointed out that it was not the Gas Committee who pushed the trade in fittings; it was the consumers who wished the Corporation to do the work.

Mr. Beale declared that, if Mr. Bayley's amendment were carried, the effect would be that the department would not be able to find work in summer for the fitters required for emergency work in winter.

Mr. Marsh, though opposed to Corporation trading in the usual sense of the term, thought the Gas Committee were justified in carrying on the fittings department as now. On more occasions than one, he had had work carried out by persons who held themselves to be good gas-fitters and thoroughly practical men, but he had had to have the work done over again by the Gas Department.

Mr. Stevens emphasized what had been said as to the popularity of the fittings department with consumers and employees; and said that as the latter were paid the highest wages in the trade, private firms could not complain that the department was underbidding them.

Alderman Pollack, in replying on the discussion, said it was true that some consumers by the prepayment meters were charged 3s. 4d. per 1000 cubic feet instead of the usual price of 2s. 7d.; but this charge included the hire of fittings. Where the Gas Department did not find the fittings, the charge through these meters was the same as that to other customers. As to the fittings department, the emergency work now simply cost the Committee nothing; being paid for out of the profit made on the fittings work. It must be remembered that the fittings business was one of the things paid for when the Corporation took to the gas undertaking. It was the principle of the department never to tout or compete for orders against other traders. The reason why there were so few competent gas-fitters was that it was only a season trade; and the department therefore was anxious to keep as many of their men as possible employed all through the summer. As to Mr. Lane's amendment, all the information Mr. Lane asked for would be found in the Gas Committee's report presented in May last. He would find that in 1875, when they bought the undertaking, they paid £2,000,931; and that in May last the capital amounted to only £191,000 more than that, though the works had been more than doubled, and new machinery had been introduced everywhere—a large portion of the profits having gone in extending the works. It should be remembered that what they contributed in relief of the rates was in addition to the interest on capital—an item that was included in the dividend of a private undertaking. Besides this, they had accumulated a sinking fund of half a million.

The amendments were both rejected; and the motion was then put and carried.

OPPOSITION TO THE HUDDERSFIELD CORPORATION BILLS.

The Omnibus Bill Abandoned—The Gas Committee's Proposals.

Last Wednesday, the Statutory Meeting of the ratepayers of Huddersfield was held for considering the two Bills which the Corporation proposed to promote in Parliament, and notices of which appeared in our "Parliamentary Intelligence" last week.

The Town Clerk having announced that the first Bill had reference to the construction of the new water-works and to the extension of the time for the completion of the Blakeley reservoir, Alderman Crosland, the Chairman of the Corporation Water Committee, explained that the Bill would not involve any expenditure beyond the Corporation's present powers, and was intended really to effect a saving. The Corporation had undertaken to supply water to the villages of Shepley, Shelley, and Lepton; but the Water Committee had been unable to give the people on the higher levels an adequate supply, because they could not raise the water sufficiently with the existing pressure. A new main would enable them to obtain a very good income for their expenditure, besides carrying out their obligations under the Act. If the Corporation did not now go to Parliament for an extension of the time for the completion of the Blakeley reservoir, they would at once lose their power, and would have to commence over again. The Mayor (Alderman J. L. Walker) moved a formal resolution, giving the Corporation power to promote the Bill. This having been seconded, Mr. B. Brown moved the direct negative, and said that already the Corporation had decided to eliminate one objectionable feature of the Bill—the borrowing powers. Several leading opponents of the Corporation, however, agreed as to the advisability of promoting the Bill; and the amendment was withdrawn. The motion was then carried.

The meeting then proceeded to consider the proposals contained in the Omnibus Bill. Among its objects are several referring to the Gas Department, as described last week—the principal being powers to borrow £100,000 for gas-works purposes, and to acquire the Longwood Gas Company's works. It was explained by the Town Clerk that the £100,000 was the estimated amount needed for the development of the gas-works within the next ten years. Mr. B. Shaw, a member of the Gas Committee, said he had ascertained that the alterations now going on at the works were to be "hung up," and defrayed out of profits. He alleged that on one occasion after the business at a Gas Committee meeting had been declared to be closed, and some of the members had gone away to attend another meeting, a proposition was made to go in for this little loan of £100,000. He maintained that the proposition was passed illegally, and under false pretences. The loan, he alleged, was not called for on the ground of prospective requirements. At the present time, the consumption of gas was about stationary; and he believed that, as the competition of the electric light became keener, there would be but a slight increase in the consumption of gas. He advised the ratepayers to vote "dead" against the proposed borrowing of £100,000. Mr. Crosland, the Vice-Chairman of the Gas Committee, averred that Mr. Shaw was very much mistaken; and his remarks were calculated to mislead the public. The proposal to borrow £100,000 had been known for twelve months, and had not, therefore, been sprung upon them suddenly. For his own part, he was quite willing to withdraw the borrowing powers. Mr. Shaw declared that what he had stated was absolutely true. Mr. E. Mellor opposed the clause conferring power on the Corporation to purchase the Longwood Gas Company's works, as it would involve an expenditure of between £70,000 and £80,000. It having been decided to eliminate certain clauses referring to other matters, the Mayor put to the meeting a resolution in favour of the Bill as amended, and declared it carried. This ruling was immediately challenged; and a formal demand for a poll was lodged on behalf of the Property Owners' Association.

A meeting of the Council was held later in the day, at which it was decided to promote the Water-Works Bill; but, with reference to the Improvement Bill, the Town Clerk stated that a poll of the ratepayers would cost the borough nearly £2000, as a special register would have to be prepared. The proceedings were adjourned to Friday, when, on the motion of the Mayor, it was resolved not to proceed with the Bill in the coming session, owing to the demands of the Property Owners' Association for the elimination of a large number of its clauses.

THE LOANS FOR THE STOURBRIDGE GAS-WORKS.

At a Special Meeting of the Stourbridge District Council held on the 11th ult., the Gas Committee brought up a report on the subject of the loans contracted for the purchase of the gas-works, amounting to about £116,000. The money was borrowed at 4 per cent., repayable by way of annuities in a period of forty years. The loan was taken up two years ago; and at the end of ten years from its being contracted, the Stourbridge Council have the option of repaying it. The Committee

stated that there had been communications with the Insurance Company from whom the money was borrowed; and it had been intimated that it would be recommended to the Trustees to reduce the interest to 3½ per cent., in consideration of the Council agreeing to waive the right of repayment otherwise than by annuities for the term originally fixed. The Committee were of opinion that there were only two courses open—to accept the offer of the Company to take 3½ instead of 4 per cent. interest for the remaining thirty-eight years, or to let the matter remain as it is for eight years, and then try to get the money at 3 per cent. By accepting the offer, an immediate saving of £423 a year would be effected, and a total saving of £15,722 in thirty-eight years. By waiting eight years, and then borrowing the money at 3¼ per cent. for thirty years, there would be £17,040 saved; while if the money could be had in eight years at 3 per cent., the saving would be £19,565. But in that case the Council would have to wait about twenty-one years before obtaining a greater pecuniary advantage. The Chairman of the Gas Committee (Mr. H. Collis) moved the acceptance of the proposal to reduce the interest to 3½ per cent. He said there was a difference of opinion in the Committee as to whether it was best to accept the offer to reduce the interest on the loans to 3½ per cent., or to wait the eight years till they had the option of repayment, and then try to borrow the money on more favourable terms. They would save £423 a year at once by accepting the offer of a reduction of interest to 3½ per cent.; but if they waited the eight years, and then proposed to issue stock of their own, it would cost them about £250 a year, if not more, in expenses, and there would be underwriters' charges and other matters. Mr. Collis went into details on the point, and said the benefit would be small and spread over a future period; while if they agreed to the reduced interest of 3½ per cent.; there would be the immediate gain of £423 a year. Mr. Purkis seconded the motion. Some members of the Council expressed the opinion that it would be better to wait the eight years—a policy which was supported by the Chairman (Mr. W. Jones). Mr. Collis replied to the objections raised to the acceptance of the offer of an immediate reduction of the rate of interest; and the matter was adjourned till the next meeting, to allow time for its further consideration. The subject came up again at the meeting of the Council on the 25th ult. Mr. Collis once more expressed the opinion that the best thing for the town would be for the Council to accept the offer of the Insurance Company; and he moved a resolution to that effect. Objections were, however, again urged to this course being taken; and, in the result, the motion was lost by 15 votes to 8.

ELECTRIC LIGHTING NOTES.

By direction of the Local Government Board, Mr. G. W. Willcocks has held an inquiry at Wakefield with reference to an application by the City Council for permission to borrow £25,000 for defraying the cost of the proposed electric lighting works. The estimated outlay for the undertaking was stated to be: Plant, £15,853; buildings, and making good streets, &c., £7260; engineers' and other incidental expenses, £1887—making up a total of £25,000. There was no money included for the purchase of land, as the site had already been acquired by the Corporation for the purposes of sewerage and other works. Particulars were furnished by the Town Clerk (Mr. C. J. Hudson) as to the financial position of the city; and the scheme was described by the Engineer (Mr. R. Hammond). The works, he informed the Inspector, are to be constructed at Calder Vale, which is about 1¼ miles from the centre of the city. At the start, 2200 yards of distributing-mains will be laid. The high-tension electricity will be brought from the works in 5-inch culverts; and three sets of cables will be in use, either two of which will be capable of carrying the total output of the works—the third set of cables thereby corresponding to a spare plant at the works. There will be three sets of plant, each capable of producing electricity for 3300 8-candle power incandescent lamps. There will also be a small plant, capable of dealing with a day load, or equal to 800 lights.

A Sub-Committee of the Stockton Corporation Gas Committee have been appointed to investigate and report as to the electric light. With the object of keeping speculative companies out of the borough, the Corporation obtained a Provisional Order a few years since giving them electric lighting powers. These Orders have again and again expired, and been renewed. On the last occasion, the Board of Trade, however, intimated that steps must be taken to install the light; and as the Order expires next year, the need for the Corporation to be up and doing is apparent. Commenting upon the matter, the *Northern Echo* says: In Mr. Ford, the Corporation of Stockton have one of the admittedly ablest gas-works managers in the country; and he has kept himself abreast with the various new illuminants that have been again and again projected. We believe that Mr. Ford has never had any doubt that electricity was the coming illuminant; but its application has been so largely experimental as to render him chary in advising the Corporation to adopt it. Its cost is still great; and if we are not mistaken, Mr. Ford is of opinion that at any time some discoverer may hit upon the invention that will infinitely cheapen it. The wisdom, therefore, of not hastening with large expenditure on costly electric plant is obvious; and for advising and, up to now, so successfully influencing the Corporation, the members of that body and the ratepayers generally are further debtors to Mr. Ford. At the same time, it is palpable that longer delay would be injudicious, for several of the large works in Stockton have had the electric light in operation for some years, and others are adopting it.

Speaking at last week's meeting of the Cheltenham Town Council upon the progress made with the electric light undertaking, Alderman Norman informed his colleagues that in four weeks the applications had risen from 4540 8 candle power lamps to 5120. There was every certainty, he was glad to say, that the undertaking would turn out a greater success than the Committee had anticipated.

The Local Government Board have consented to grant power to the Monmouth Corporation to borrow £20,000 for the purpose of carrying out a combined scheme of drainage and electric light.

It was announced at the meeting of the Lighting and Electrical Committee of the Cardiff Corporation last Tuesday, that the Local Government Board had sanctioned the borrowing of £12,500 for electric light extensions—the principal to be repaid in a period of 25 years. A statement was also made that the revenue for the quarter ending Dec. 31 was estimated at £1800; that the revenue for the September quarter was £671; and that the Committee already had applications for 943 lamps which they had been obliged to refuse to take on.

METROPOLIS WATER SUPPLY.

The London County Council and the East London Water Company.

At the Meeting of the London County Council last Tuesday, the Parliamentary Committee recommended—"That the East London Water-Works (Height of Supply) Bill, in the form in which it has been circulated, be approved; that the seal of the Council be affixed to a petition for leave to bring in the Bill; and that the Bill and petition be deposited, pursuant to the Standing Orders of Parliament, with such necessary alterations (if any) in the Bill as the Parliamentary Committee may consider desirable." Mr. Harrison proposed that the words "and within the County of London" should be added to clause 2 of the Bill. Mr. Fleming Williams seconded the proposal; and Mr. Harris, the Chairman of the Committee, accepted the addition. Mr. Harrison next proposed that the penalty to be imposed upon the Company for not complying with the provisions of the Act should be £100 a day, instead of per month, during the period that such default should continue. Mr. Fleming Williams seconded the proposal. Mr. Beachcroft urged the Council not to accept the amendment, as the Bill would never pass through Parliament in such a form. The Council should treat all the Water Companies alike, and not impose a greater penalty on the East London Company than on the others. Mr. Harris said the penalty put in the Bill was the one placed upon the other Metropolitan Water Companies. The penalty Mr. Harrison wished to enforce in cases of default was such as none of the other Companies were subjected to; and he believed the Bill would have no chance of passing through Parliament in such an amended form. Mr. Costelloe said the present penalty was inadequate. Mr. Westacott pointed out that the Committee, in framing the Bill, wished to put the East London Company on the same footing as the other Water Companies; but that Mr. Harrison's amendment would place them in a totally different position. Lord Tweedmouth urged that Mr. Harrison should withdraw the amendment. The Council wished to see the Bill carried through Parliament. This would, he said, be impossible with the amended clause, which was unfair to the Company. The amendment was lost by a large majority.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly Report and Accounts.

In the report of the Directors of the above-named Company to be submitted to the proprietors to-morrow, it is pointed out that the accounts accompanying it, for the six months ending Sept. 30, do not contain any charge for lowering the mains, necessitated by the severe frost of last winter. So far as can be ascertained, the cost will be about £15,000, of which they consider a moiety may fairly be placed to capital; and as the accounts for the entire year have had to bear a charge of £20,559 (being the total exceptional expenditure), they consider that the proportion of revenue chargeable with respect to the mains should be borne by the next year's accounts. Owing to the extreme heat and dryness of the past summer, the consumption of water was greater than usual. The Company's works nevertheless proved fully equal to the increased demand; and the quality of the supply was maintained at a high standard of excellence. Attention is called to the fact that all the Metropolitan Water Companies were subjected to a severe contest in the last session of Parliament. Of the eight Bills promoted by the London County Council for the transfer to that body of the Companies' undertakings, two were referred to a Select Committee, whose deliberations were broken off by the dissolution of Parliament. The London County Council have decided not to proceed further with these Bills. Reference is made to the fact that the Directors, in conjunction with those of the New River and West Middlesex Companies, have given notice of an application to Parliament for powers to raise money, and to construct storage reservoirs in the Thames Valley on the lines of the scheme prepared by Messrs. Hunter and Fraser, and approved by the Royal Commission. Allusion is made to the death, on the 6th of October, of Mr. Alexander Fraser, the Engineer of the Company, who had been in their service for 35 years; and the Directors remark that the loss of so well-known and valuable an officer will be widely felt. Arrangements have been made for carrying on the practical duties of the Engineering Department with the existing staff, under the supervision of Mr. Walter Hunter, M.Inst.C.E. In this connection, the following resolution will be proposed: "That, in consideration of the time and attention which Mr. Hunter will, during the vacancy in the office of Engineer, devote to the supervision of the engineering department of the Company, the proprietors hereby authorize the Directors to pay to Mr. Hunter special remuneration at the rate of £500 per annum, pending the filling up of the office of Engineer." Owing to the exceptional expenditure already mentioned, the Directors recommend a dividend for the last financial half year at the rate of 6 per cent. per annum on the ordinary share capital of the Company, and on the "C" and "D" shares. The accounts accompanying the report show that the water-rents accrued due in the half year ending Sept. 30 amounted to the sum of £101,878, as compared with £99,941 in the corresponding six months of 1894; the total receipts being £102,367, against £100,853. The expenditure for maintenance came to £34,262, the special outlay on account of the frost was £12,343; and management cost £7819. The amount carried to the dividend and interest account is £41,944; and a sum of £6000 is carried forward to provide for losses. In the corresponding six months, maintenance cost £32,124, and management, £7900. A sum of £54,328 was carried to the dividend and interest account, and £6500 was carried forward.

THE PROPOSED ACQUISITION OF THE SHOREHAM WATER WORKS BY THE BRIGHTON CORPORATION.

The Terms of Transfer.

As briefly mentioned in the JOURNAL last week, the shareholders of the Shoreham and District Water-Works Company have sanctioned the sale of the undertaking to the Brighton Corporation. This was done at a special meeting held on the 25th ult., when the following statement, setting forth the terms of purchase, was submitted to the proprietors: "(1) The sale to be completed on the 31st day of March, 1896, if the Corporation can obtain the necessary powers at or before that date; if not, the sale to be completed on the 30th day of September, 1896. There are to be the usual conditions as to apportionment and calculation of the rates, rents, profits, incomings, and outgoings up to the date of completion. (2) The consideration to be paid by the Corporation to be as follows: (*a*) Corporation stock to produce an income of £1304 per annum (this being the total amount of yearly interest payable on the Company's called-up share capital) and the following several sums in addition—viz. (*b*) the sum of £4875, being the par value of the debenture capital; (*c*) the sum of £1000, being the amount of the reserve fund; (*d*) the sum of £500 to be divided among the Directors in settlement of their fees; (*e*) the sum of £5300, being for and in respect of unpaid back dividends. (3) The stock in hand and coals, &c., to be taken at a valuation. (4) Provisions for the taking over by the Corporation of the Company's statutory liabilities and obligations as from the date of completion. (5) The usual provisions for the continuing of the Secretary, officers, and servants of the Company. (6) The Company to be at liberty to attend proceedings on the Bill to be promoted (subject to the Company's approval), by and at the expense of the Corporation. (7) The Corporation to bear and pay all the legal and parliamentary costs and expenses of the Company from the commencement of negotiations for sale up to completion, or, if never carried through, up to determination of proceedings or negotiations. (8) Unless the sale be approved by Parliament in the session of 1896, the agreement to sell to be determined. (9) An agreement to be prepared to provide (*inter alia*) for the foregoing matters and to be scheduled to, or carried into effect by, the Bill. (10) If any alteration be made in the agreement by Parliament, or in the Bill, so that the objects of the agreement be altered in any particular which the Company may deem material, the Corporation shall, if requested so to do by the Company, withdraw the Bill, paying nevertheless all costs as aforesaid incurred by the Company." The Chairman (Dr. T. Fuller) explained that the Directors were approached about the end of September by the Brighton Corporation, who wished to know whether they were willing to part with their undertaking, and to ascertain what terms they would be likely to accept. The Directors unanimously came to the conclusion that they could not accept anything that would put the shareholders in a worse position than they now were in regard to their investment, but rather that there should be an improvement upon it. They also recognized that dividends earned by a trading company could not, of course, be on so secure a foundation as those secured upon a corporation of a large town. They therefore made this principle the basis of their terms. There were other considerations which had weight with them, as to the debentures and back dividends. At the present rate, the process of paying off back dividends would take some time, and the Directors thought if they could get a lump sum wherewith to pay them off, it would be to the advantage of the shareholders. Another fact which had also weighed with the Directors was that the tendency of legislation was to make it much easier in the future for local authorities to take up such undertakings as theirs upon terms perhaps less advantageous than now; and it went without saying that if the works had been bought up by compulsion through some mistake or failure in the supply, the local authority could have obtained better terms than under the agreement. This being the case, the Directors felt it would not be right on their part to refuse the offer made by the Corporation. He concluded by proposing a resolution authorizing the Directors to carry out the sale on the terms set forth. Dr. Rutter seconded the motion. Mr. Barton asked whether the Corporation stock to be received by the shareholders was permanent or terminable. The Chairman, referring to a letter written by the Town Clerk of Brighton (Mr. F. J. Tillstone) stated that the stock to be issued was £37,257 2s. 11d. of 3½ per cent. stock, terminable in 1946. The object the Directors had in view, he continued, in making this arrangement was that the shareholders should have no trouble in investing their money, and any of them wishing to sell could do so at the market price of the stock. Some further explanations having been given, the motion was carried unanimously.

THE FINANCES OF THE MARGATE CORPORATION WATER DEPARTMENT.

The Margate Corporation Water-Works, regarded from a financial point of view, have not been a success, principally owing to difficulties with the supply. A report on the subject, which had been prepared by the Borough Engineer, was submitted to the Council last Tuesday. Its reception was moved by Alderman E. S. Wootton, who complained that past Water Committees had not taken the Council fully into their confidence. He had thought the works would, in time, be self-supporting; but that was not the case yet, and was not likely to be for some years. They would have to obtain a better supply; and it was useless to go to Tivoli for it. Last season the Tivoli water supply caused great anxiety both as to quality and quantity. Although one year, in which they had five quarters' rental, they had a profit of £500, and in another year or two the profit amounted to £200, some years they had lost £2000. Up to the present time, the works had represented a loss of £7829; and this year the loss had been £700. He expressed the opinion that the drainage department had not paid sufficient towards the rates according to the water consumed; but still, the question of increased supply had to be faced. Next year, a large amount would have to be paid out of the district rate to meet the costs of the department. Several members took part in the discussion, among them being Mr. Macfarlane, who complained of the outrageous price the Council had to pay the Company on taking over their works, and regarded this as one reason why the Council had not been able to make them pay. During the last ten years, Margate had, he said, subsidized the department to the extent of £5700. The Mayor (Alderman J. Coleman) remarked that the Committee did not wish to spend money needlessly; and he spoke of the Dane works as a great auxiliary to the water supply. He pointed out that the old Company paid a dividend on a capital of £22,000 only; and, if they had not disposed of the works when they did, having "milked the cow dry," they would have had to make heavy calls, whereas the Council had to pay interest and repay the principal by annual instalments. The report was received. A report from Mr. James Mansergh was also adopted, in which was a recommendation that £300 should be spent in making investigations, so as to obtain such facts as would avoid a repetition of the disappointment that had been experienced at the Dane works.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

This week, at the Glasgow Town Council meeting there was a discussion over a proposal by the Watching and Lighting Committee to give permission to the Incandescent Gas-Light Company to make use of a report by Mr. Hamilton, the Inspector of Lighting in the city, upon his experiences in the use of incandescent gas-lamps. Bailie Burt moved that permission should not be granted. As the Electric Lighting Committee understood it, the report put the matter in a very unfavourable position so far as the electric light was concerned. It certainly did in regard to the cost and illuminating power. Mr. Primrose rose to a point of order. There was no comparison instituted in the report between the two systems of lighting. The report was submitted to the Council; and the Company might have got it through the press, but they had the courtesy to apply for it. Bailie Burt (continuing) said he objected to the publication of the report on the ground that it was based on laboratory tests and not on practical work. Mr. W. F. Anderson seconded the amendment, not on the merits of the two lights, but because he objected to the Corporation giving a certificate in the matter. Mr. Primrose said the tests were all made under the practical conditions of street lighting; they were not inside tests. So careful were they in putting the report forward, that they delayed it for several months, till Mr. Hamilton could speak on the matter; and they took a report which he was prepared to stand upon. The recommendation of the Committee was adopted by 28 to 19 votes. It is not often that the Town Council of Glasgow are found discussing such small matters; but in this case there was underlying it the jealousy of incandescent gas lighting which is shown by those who support the claims of electricity. I do not see why there should have been any difficulty about giving this report, seeing that reports about electric lighting are sown broadcast over the land, and are not always too reliable. I have not seen Mr. Hamilton's report; but knowing his system of fitting up the incandescent lamps, I am certain that his conclusions will be sound. I was looking at his lamps the other night; and though not qualified to describe them technically, I may say that they differ from all that I have seen in any other town. Mr. Hamilton has, quite apparently, put a great deal of thought into the fitting up of the lamps. As we all know, for street lighting purposes there is usually a cup-like glass fitting below the burner, to throw off the effect of sudden gusts of wind. Mr. Hamilton has retained this arrangement, but has improved upon it by the placing of another cup higher up, the result of which, I surmise, is to get rid of the effect of down currents. Whether this be so or not, I observed that the mantles were all in wonderful preservation, and were glowing from bottom to top; the light being, of course, ever so much more than if the top portion had been dark. The street in which I particularly observed them ran at right angles to one lighted by electricity; and a comparison could thus be easily made. The conclusion I came to was that, while in the electrically-lighted street there was a greater glare around the lamp, there were portions of the thoroughfare, between the lamps, in which it would have been easy to have stumbled over an obstruction, such as a brick; but that in the gas-lighted street, the light of the one lamp ran into that of the other, and there was no part so dark but that a small obstruction would have been seen a considerable distance off.

This, however, does not dispose of the question of the relative values of the two lights generally; it only applies to Glasgow. There the lanterns of the electric arc lamps are not of the best construction; and the light they give forth is not equal to what may be found in some towns, although, at the same time, I have seen worse. This subject was before the Town Council at the same meeting; and it was reported that the Sub-Committee on Electric Lighting had considered the remit regarding the question of the electric lighting of the city, and particularly the kind of lamp to be used for such lighting; and had resolved to recommend that a small deputation, to be named by the Corporation, should visit Blackpool, and report on the electric lighting of that town. It was left to the Watching and Lighting Committee to appoint the deputation.

According to custom after the municipal election, the members of the Gas and Electric Lighting Committee of the Aberdeen Town Council paid their annual visit to the gas-works and electrical station on Wednesday. With their Convener (Mr. Johnston) at their head, they were conveyed to the large new gasholder at Gallowhill, the workmanship of which they all admired. Adjoining the gasholder, is a plot of about 5½ acres of land, part of which it is proposed to feu out as model gardens. The party were then taken to the gas-works, over which they were conducted by the Manager (Mr. Alex. Smith). They were also shown the electric lighting plant by the local Engineer (Mr. Blackman). Mr. Boddie, one of the new members of the Town Council, proposed the health of Mr. Johnston. He said he had never before had any idea of the size of the gas-works; it was worth all their election expenses to see them. They were exceedingly obliged to Mr. Smith

for the courteous way he had shown them over the works. Mr. Johnston, in acknowledging the compliment, said that very few of the ratepayers had any conception of the size of the gas undertaking. The Gas Committee might very properly be termed the Finance Committee. This year he expected that the overturn in connection with the gas undertaking alone would be about £80,000—a sum which was nearly equal to all the other taxes of the city put together. The Gas Committee had more onerous duties to perform than many would be disposed to think. He did not believe they could have a more efficient Manager than Mr. Smith, who really had the interest of the undertaking at heart, and who, in season and out of season, could always be depended upon for being at his post. He had been Convener of the Gas Committee for two years; and, although he did not think that any of the new members would create friction in the Committee, he might say that during the time of his convenership there had been only one division over the Committee's minutes—a state of affairs to which he did not think any other Committee could lay claim. At one time matters did not run very smoothly in the Gas Committee; but he was glad to say that those days were over.

A very untoward affair happened in the Broughty Ferry Corporation Gas-Works on Thursday night. Shortly before eight o'clock, the gas-lights all over the town suddenly went out. The explanation given is the not unknown one of a workman having failed to turn on one gas-holder before the other gave out. Neglect like this, I should say, is one which calls for exemplary treatment—there can be no excuse for it. Happily the stoppage of the gas was but of momentary duration; and the shops were very speedily all relit.

For the seven months which have elapsed of the current financial year, the revenue from gas in Dundee has amounted to £26,585—an increase upon the corresponding period of last year of £925. The revenue from electricity has been £1325—an increase of £330.

There is a proposal on foot to light the village of Pitlochry by means of electricity; the power to drive the dynamos being obtained by utilizing the Falls of Tummel. Professor George Forbes has some relationship to the place; and it is his connection with the Niagara Falls electric adventure which has set the affair on foot. The works of the local Gas Company, it is reported, are too small. But if this electric lighting scheme goes on, they might then be large enough; and the hope is expressed—by some anonym, of course—that the Gas Company may see their way to take up the electric light, and work both systems. If such an experiment should be made, it is not likely to be in a village containing 1200 inhabitants.

The Edinburgh Town Council have resolved to disjoin the offices of Inspector of Cleaning and Lighting; and to create the Electric Lighting Committee a Lighting Committee, with Mr. Mackenzie as Convener thereof.

The system of regenerative retort-settings invented by Mr. G. R. Hislop, of Paisley, continues to receive highly encouraging support from gas managers in this and other lands, as it well deserves to, on account of its simplicity and cheapness. The following installations have been fitted up within the past two months: One oven of 5 retorts, at Halifax, Nova Scotia; one oven of 8 retorts, at Waltham Cross (third order); eight ovens of 8 retorts each at Milan; two ovens of 6 retorts each, at Forfar; and two ovens of 7 retorts each, at Cirencester.

At a meeting this week of the Town Council of Pollokshaws, which is one of the suburban burghs that declines to be incorporated with Glasgow, although the community is served with gas, water, tramways, &c., by the Corporation of Glasgow, it was resolved to write to the Corporation in regard to the bad quality of the gas supplied. I presume there is little at the bottom of this move, except a desire to assert that semi-independence which the local community affect while they are in reality part of the city of Glasgow.

Mr. Forbes Waddell, the Manager of the Forfar Corporation Gas-Works, who was injured recently in an explosion in the works, is progressing favourably towards recovery. The Corporation have granted him a fortnight's leave of absence. This points to an early return to his duties; and when that takes place, there is be an inquiry into the incident. Mr. Waddell, it seems, was threatened, a fortnight before the explosion, by a dyker who entered the works in search of him, armed with a hammer. The man was turned out by one of the stokers; and he then made his way to the door of Mr. Waddell's house, where he began to make a noise. The same stoker tackled him again, and had him put away; but not before the violent one had uttered a threat to the effect that if he had been the Manager, he would have knocked his skull in. The man was tried at the Police Court on Monday on a charge of committing a breach of the peace, and using threatening language towards Mr. Waddell. It transpired that he had been in the gas-works three or four months ago; and was then turned away by Mr. Waddell and one of the Commissioners. Whether this was the reason for his present appearance or not, was not made evident; but the solicitor who defended the accused stated that if there had not been certain "wheels within wheels," there would have been no prosecution. Forfar must be a curious place if it is necessary that there should be wire-pulling to procure a criminal prosecution. The heads of the community require to have light let in upon them. In this case, the man was convicted; but the ridiculously small fine of 7s. 6d., with the alternative of five days in gaol, was all the penalty which was imposed for what, but for the fact that Mr. Waddell was not present, might have been a murderous attack upon him.

The Melrose Gas Company have reduced the price of gas from 5s. 7½d. to 5s. 2½d. per 1000 cubic feet.

The Hamilton Police Commissioners on Thursday contracted with Messrs. J. M'Kelvie and Co. to supply 100 tons of cannel, at 30s. 5d. per ton. This step is necessary at the present time on account of the large output of gas and the limited storage capacity available. This drawback will be remedied when the new gasholder is brought into use; but meanwhile the purchase of such high-priced coal will affect the working results, which is one of the penalties the Corporation will pay for the opposition that prevented the new gasholder being gone on with sooner.

Sheriff Mackay, on Monday, held an inquiry at Cupar into an application to the Secretary for Scotland by the Police Commissioners of Cupar for authority to borrow £7000 for the purpose of extending the water supply of the burgh. The sum expended on the water-works was about £25,000; but, by the operation of a sinking fund, the debt on the undertaking is now £19,500. The valuation of the burgh is £22,780. There is sufficient reservoir accommodation; but the mains are too small. It is proposed to expend £6828 upon new mains. The Sheriff said he would report to the Secretary for Scotland in favour of the application.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec. 7.*

Sulphate of Ammonia.—The tendency of the market is still rather weak; and, in view of possibly lower prices, consumers are purchasing very sparingly. Consequently, the field is almost entirely in the hands of the speculators; and it may be taken for granted that they will wait as long as they can, expecting to gain some advantage by so doing. It is difficult to say whence immediate relief is likely to be forthcoming, so much apathy being displayed from most of the usual consuming quarters; but with prices lower than they have ever been, the appearance of a revival would speedily bring in hesitating buyers. The quotations are more or less nominal—£8 12s. 6d. Hull; £8 12s. 6d. Leith; and £8 15s. f.o.b. Liverpool.

Nitrate of Soda is perhaps a little easier; cargoes, December sailing, having been sold at 7s. 6d. to 7s. 7½d. per cwt., which is also spot value. Several works having had to suspend, and the lower prices now current, will probably have the effect of diminishing the output for some time at least.

LONDON, *Dec. 6.*

Tar Products.—There has been an exciting market in benzols, which are still advancing. Common tar oils are weak, and evidently in over-production; and the price of creosote oil is extremely low and unprofitable. Anthracene continues firm, with a good deal of inquiry. Carbolic acid is steady; and important forward business is announced, at prices quoted below. No new business of any magnitude is reported in pitch, although a strong effort exists on the part of dealers to depress this article. There is a fair inquiry for solvent and other naphtha; but there is no important advance compared with benzol. Prices paid during the week have been: Tar, 18s. 6d. to 24s., according to position. Pitch, nominal, 33s. 6d. west coast; 36s. east coast. Benzols, 90's, 2s. 4½d.; 50's, 2s. 1½d. Solvent naphtha, 1s. 3d. Toluol, 2s. Crude, 30 per cent., naphtha, 9d. Creosote, 1d. Naphthalene, pressed, 50s.; drained, 30s. Cresylic acid, 1s. 0½d.; crude, 9d. Carbolic acid, 60's, 1s. 8d.; 75's, 2s. Anthracene, "A," 1s.; "B," 10½d. These prices are usually subject to 2½ per cent. for cash.

Sulphate of Ammonia does not revive. Selling has been freely done at prices ranging between £8 11s. 3d. and £8 15s., less 3½ per cent. at all ports. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—During the last two or three months, considerable anxiety has prevailed as to the possibility of the wages question being re-opened by some movement on the part of the Miners' Federation for demanding a return of the 10 per cent. reduction to which the men temporarily submitted last year—if they did not even ask for a further advance of 5 per cent., which they would be in a position to do at the close of the year, under the Conciliation Board agreement. It would seem, however, as if the leaders of the Miners' Federation had abandoned any idea, at present at least, of taking any steps which would bring about a renewal of the conflict with the coal-owners; and it is very significant that the official programme of the business to be brought before the Annual Conference of the Federation at Birmingham next month, contains no proposal whatever in regard to wages. This will naturally be a great relief, not only to coalowners, but to coal consumers generally; and it is to be hoped that the men will have sufficient discretion to allow things to remain as they are until there is some real improvement in trade to justify any move towards a higher rate of wages. In accordance with what I stated last week with reference to the increased charges for siding-rents, and the action taken by the railway companies against many of the coal traders in this district, the Manchester and Northern Counties Coal Traders' Association have issued a circular, intimating that a formal complaint will, in the course of a few days, be lodged before the Board of Trade with regard to the increased siding-rents; and it is expected that the matter will probably go forward to the Railway Commissioners for decision. In the meantime, the coal traders' associations throughout the country are uniting to raise a special fund to defend members of the federated associations against any County Court actions entered by the railway companies, with a view of recovering the increased rates. Considering the season of the year, the weight of business coming forward in the coal trade continues very unsatisfactory; and the demand is, in many cases, not more than sufficient to keep pits on three to four days per week—full time being exceptional. House coals meet with only a moderate sale; and with ample supplies offering, prices show no upward move with the commencement of the month, low-priced coal which is coming in from other districts tending to weaken the tone of the market. The lower qualities of round coal are in but limited request for iron-making, steam, and general manufacturing purposes, with supplies pushed for sale at exceedingly low figures. At the pit mouth, best Wigan Arley does not average more than 10s. to 10s. 6d. per ton; Pemberton four-feet and seconds Arley, 9s. to 9s. 6d.; common house coal, 7s. to 7s. 6d.; ordinary steam and forge coal, 5s. 6d. to 6s.; and better qualities 6s. 6d. With regard to engine classes of fuel, no change is noticeable. Although there are plentiful supplies offering, the better qualities are, in most cases, being disposed of pretty readily; and prices for these are well maintained at about 4s. 6d. to 5s. per ton. Common slack, however, is in but limited demand; and some very low sales are reported—3s. to 3s. 6d. per ton being the full figure obtainable. In the shipping trade, the position shows no break in the spell of depression that has prevailed for the last few months; and sales continue to be made at

very low prices. Common steam coal is readily obtainable at 7s. per ton, with 7s. 6d. to 7s. 9d. quoted for the better sorts, delivered at the ports on the Mersey.

Northern Coal Trade.—The Northumbrian coal trade has on the whole maintained its position; but many of the collieries are still only working half time, so that the limited production does in some degree help to maintain prices also. Best Northumbrian steam coal is still quoted at about 8s. per ton f.o.b.; second-class steam, at 7s. 6d.; and steam smalls, at 3s. 6d. to 3s. 9d. There seems at present no probability of much improvement in the demand for steam coal, so much of the production being sent to the Baltic and northern ports, which are now closed or closing. In manufacturing coals there is less doing; but most of the contracts that are being renewed are practically at the same prices as those that expire with the present year. In gas coals, there have been very few new contracts; but the deliveries are at the maximum, and the production is fully taxed at several of the pits to keep up with the demand. For odd cargoes, the price of best Durham gas coals varies from 6s. 6d. to 7s. 3d. per ton f.o.b. Household coals have also been in good demand; and for shipment, the present price for best kinds varies from 10s. to 11s. 6d. per ton f.o.b. In the coke trade, the demand for blast-furnace purposes has been increased, more furnaces being now in operation in this district. But the price is on the whole easier, as the iron trade, on which the local coke trade depends, is generally quieter in the winter. For shipment, best Durham coke is quoted at 14s. 6d. to 15s. per ton f.o.b. There are negotiations in progress for the sale of large quantities of gas coke; but the buyers want reductions in price that are not very likely to be entirely conceded, as after this month the output will be reduced. It may be needful to add that large locomotive coal contracts are also in course of settlement; and it seems to be expected they will ultimately average something like 7s. 3d. per ton. This is, however, a free on rail price; and is of course much more favourable than where there is a large cost of carriage to be deducted.

Scotch Coal Trade.—The labour dispute in the engineering trade still continues; and the coal trade is beginning to feel the effect of the stoppage, or slackness of industries, more than it has done yet. There is a fair quantity of coal passing; but it is nearly all under contract, very little new business being done. Prices are therefore, if anything, a little easier. The prices quoted are: Main, 5s. 9d. to 6s. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. The shipments during the week amounted to 165,568 tons—an increase over the previous week of 13,557 tons, and as compared with the corresponding week of last year of 557 tons. For the year to date, the total shipments have amounted to 6,906,819 tons—an increase over the corresponding period of last year of 2,105,754 tons, but a decrease on the corresponding period of 1893 of 476,297 tons.

Forthcoming Sale of Gas Stocks and Shares.—Investors desirous of obtaining shares in well-established gas undertakings will be afforded an opportunity of doing so next Monday, when, as announced in another part of the JOURNAL, Mr. Alfred Richards will conduct, at the Mart, a sale of shares and stock in the Tottenham, Reigate, Romford, and Wolverhampton Gas Companies. On the same occasion, 150 £10 shares (£8 paid) in the Gas-Meter Company, Limited, will be submitted for public competition. The shares of this Company are seldom on the market; and, in view of the fact that the last dividend upon them, with bonus, was at the rate of 17½ per cent. per annum, we should think they will not long remain so.

Sales of Shares.—Last Wednesday, 25 £10 shares in the *Norwich Water Company* were sold by auction, and realized an average of £18 17s. each; and 19 shares in the *British Gaslight Company* averaged £54 7s. 6d. each. On the same occasion, two fully-paid £10 shares in the *Ashford Gas Company* secured £20 each; and two £5 shares (on which £3 had been paid) fetched £6 per share.——The whole of the £18,000 of 3½ per cent. debenture stock for which tenders were recently invited by the *Bromley Gas Company* has been placed at prices ranging from £105 (the minimum specified) to £107 10s. per cent.; the average being £105 2s. 8d.——Shares in the *Long Eaton Gas Company* (£5 paid) realized £11 15s. at a public sale at Nottingham last week. ——Last Thursday, a few £20 shares in the *Hastings and St. Leonards Gas Company* were sold by auction. They were 7 per cent. shares; but, under the sliding-scale, 9½ per cent. is being paid upon them. Half of them fetched £46 5s. per share; and the remainder £48 5s. each.——At the Mart last Wednesday, Messrs. Edwin Fox and Bousfield sold 150 £10 shares in the *Hayward's Heath District Gas Company*. The shares rank for a standard dividend of 7 per cent., but under the sliding-scale are entitled at the present price of gas to pay over 8 per cent. in June next. Twenty-five shares were sold at £16 15s. per share; 95 at £16 10s.; and 30 at £16 5s.

Prepayment Meters at Rotherham.—It was reported at last Wednesday's meeting of the Rotherham Town Council that the number of prepayment meters in use was 646. Answering an inquiry by Mr. Robinson, Mr. Gummer, the Chairman of the Gas Committee, gave some further information on the subject. He said the cost of the meter and fixing a pendant, bracket, and stove was about £3 3s.—it was any way under £3 10s. If the average consumption of these meters amounted to 8000 cubic feet, in a very short time the expense incurred in the cost and fixing would be repaid. The price charged for the gas consumed in the automatic meters was 3s. 4d. per 1000 cubic feet, as against 2s. 9d.—the highest price charged to ordinary consumers. The additional 7d. would make up for the outlay on capital, which would be recouped in a very short time. The Committee hoped that by Christmas they would have 1000 of the meters fixed. At the present time, there were over 400 applications on the books; and they were coming in at the rate of 50 or 60 per day. Alderman Gummer took the opportunity of drawing attention to a novel point in connection with this new class of business—viz., the increase of expenditure on the highways arising from the laying of the services for automatic meters. The work, he said, was making "sad havoc" with the roads; and he thought some arrangement should be arrived at with regard to the expense. During the last few weeks, the cost to the Highway Department had been £5 per week to repair the roads.

Pontypridd Water Company.—The Directors of this Company have received the authority of the shareholders to raise £50,000 additional capital, in £10 shares, as required.

The Gas-Works Purchase Question at Cheltenham.—At the meeting of the Cheltenham Town Council yesterday week, the Town Clerk read a letter he had received from the Solicitors to the Gas Company, stating that the Directors declined a conference, and refused to sell their works, and also intimating that the Company would strenuously oppose the proposal to purchase.

The Gas Question at Settle.—In accordance with resolutions passed by a ratepayers' meeting on the previous night, the Settle District Council last Tuesday confirmed a provisional arrangement to purchase the Settle Gas-Works for £5000, subject to the obtaining of powers for the supply of gas in the townships of Settle and Giggleswick. They resolved to apply to the Local Government Board for the necessary powers.

The Newport (Salop) District Council and the Gas-Works.—Negotiations have recently been in progress between the Newport (Salop) District Council and the Gas Company with reference to the transfer of the gas-works from the latter to the former. What was considered as a reasonable amount was tendered by the Council; but it did not come up to the Company's idea of the value of their property. They have since offered the works to the Council for £10,000; but, at last week's meeting of that body, this was declined.

Smoking Concert at the Midland Iron-Works.—The fourth annual smoking concert held in connection with the Midland Iron-Works, Donnington, took place (by permission of Mr. C. C. Walker, J.P.) in the dining-room attached to the works, on the 30th ult. Like its predecessors, the concert was far above the average of similar entertainments held in the neighbourhood. The best talent, both local and otherwise, was engaged; and the result was that the proceedings were of a kind to be appreciated by the large concourse of people who assembled to hear the attractive programme provided. The President of the concert was Mr. A. Featherstone; Mr. H. Howell and Mr. T. Palin being Vice-Presidents. Mr. W. W. Martin was the Hon. Secretary and organizer of the event; and it was largely owing to his untiring exertions that the concert was so successful. At the conclusion of the concert, thanks were accorded to Mr. and Mrs. Walker for the interest they manifested in the concert, to the Committee, and to Mr. Featherstone; and the singing of the National Anthem brought to a close a most enjoyable entertainment.

Fatality to a Gas Superintendent at Bolton.—At the Bolton Town Hall last Thursday, an inquiry was held by the Borough Coroner touching the death of Mr. Miles Dudgeon, the Superintendent at the Lum Street works of the Corporation. From the evidence, it appeared that the deceased was directing the unloading of some coal-waggons, when he was struck by an iron hook worked by a capstan. He was taken to the infirmary, where it was found that there had been a compound fracture of the kneecap, which necessitated an operation. After this had been performed, the patient gradually sank and died; the great shock he had sustained appearing to seriously affect his rallying power. Jarvis Jenkinson, who worked the capstan, said the accident was due to the overlapping of the rope, which was wet at the time. Mr. W. Smith, the Gas Engineer, stated that eighteen months ago the Gas Committee determined to introduce a hydraulic capstan, which would be much safer than the existing arrangement. This was now approaching completion; and it should have been finished long ago but for the dilatoriness of the Contractors. The jury returned a verdict of "Accidental death."

Proposed Extension of the Hythe Water-Works.—At an adjourned meeting of the Hythe Town Council last Tuesday, to consider the proposed extension of the local water-works, the Mayor (Mr. R. Price) said they must, in his opinion, have another reservoir. He had visited the Black Rock spring, and found it to be yielding at the rate of 25,920 gallons in 24 hours; but on the other side of the road, where there was an overflow-pipe, it was running at the rate of 51,840 gallons—thus showing that only about half the water ran into their reservoir. The spring gave Seabrook practically a constant supply of water, and also charged the mains at Hythe. Their reservoir only contained 30,000 gallons; and they were therefore losing large quantities of water which ran into the stream. They had plenty of water, but no means at present of collecting and storing it. The Town Clerk said the cistern field (where the Corporation works are situated) was bought by the Council to prevent it from being broken up and interfering with the water underneath. Alderman Scott thereupon recommended the Council to construct another reservoir there; and he moved that one capable of holding 400,000 gallons should be constructed. This proposal met with general approval; and it was decided to engage Mr. C. Hawksley, M.Inst.C.E., to make a report on the matter.

Water Consumers and the Possible Advent of Frost.—The East London Water Company have issued the following notice to their consumers: "In view of the inconvenience and expense caused by the frost of last February, the Company think it right to direct attention, before another winter sets in, to the following points: The whole of the communication pipe, as far as the point of junction with the Company's main in the roadway, belongs to the consumer, not to the Company. It is the duty of the consumer to see that this pipe is so laid and protected as to be secure against the effects of frost, and also at any unavoidably exposed point it should be thickly covered with some efficient non-conducting material. All pipes within private premises should be similarly protected at exposed points, especially in the case of stand-pipes and taps fixed in back yards. . . . Where there are cisterns or water-closets likely to be affected by frost, it will be useful to keep gas or oil lamps continually burning during severe weather. The reprehensible practice of wilfully wasting water by allowing taps to run is not only illegal (subjecting persons so offending to a fine), but can only lead to the necessity of restricting the supply throughout the Company's district. Equal immunity from frost can be secured by fixing a draw-tap as near as possible to the stopcock on its service or house side. The stopcock can then be shut each night, and the tap being opened, the pipes throughout the house can be emptied.'

Additional Land for the Liverpool Corporation Water Department.—The Liverpool City Council have confirmed a recommendation of the Water Committee that a freehold estate at Rivington, comprising four farms, and containing in the aggregate 193 acres of land, should be purchased for £6750.

The Burton-on-Trent Corporation and the Water Supply.—The Burton-on-Trent Corporation last Wednesday instructed the Estates and General Purposes Committee to consider the question of opening negotiations with the South Staffordshire Water Company, with the object of acquiring the right of supply in the borough.

The Fylde Water-Works Purchase Question.—The Blackpool Town Council decided last Tuesday to concur with the suggestions of the Joint Authorities Committees in regard to the Fylde Water Company. The Blackpool, Fleetwood, St. Anne's, Lytham, and Kirkham Authorities have jointly offered £650,000 for the purchase of the water-works; and it is now sought to bring the negotiations to a head.

The Oil-Gas Enrichment Experiments at Bradford.—The *Bradford Observer* in a paragraph upon this subject says: "The Gas and Electricity Committee has done nothing during the month in regard to the oil enrichment question. Upon that matter the deadlock which had existed for some months prior to the elections was only strengthened by the results of these contests. The Committee was stiffened in its opposition to the oil-gas process; the Council obtained a more decisive majority in favour of a trial of the process."

The Sandwich Town Council and the Gas Undertaking.—The shareholders of the Sandwich Gas Company have passed a resolution approving of the offer of the Sandwich Town Council to purchase their works and undertaking; and consequent on this decision, the Town Clerk has been directed to discontinue all proceedings in connection with the Bill for the compulsory acquisition of the property, and to proceed only with the application for power to purchase by agreement, with authority to borrow money for the purpose.

Coventry Corporation Gas Supply.—The Gas Committee of the Coventry Corporation had a good increase in the quantity of gas made during the six months ending Sept. 30 last, compared with the corresponding period of 1894. The total was 140,158,000 cubic feet, as against 125,436,000 feet, which was an addition of 14,722,000 cubic feet, or 11·73 per cent. The number of consumers on Sept. 30 was 6000, which was only an advance of 38 in the twelve months. The cooking and heating stoves on hire showed an increase of 145; making the total 1560.

The Reduction of the Public Lighting at Liverpool.—The Lighting Committee of the Liverpool Corporation last Friday had under consideration the question of the turning down of the lights in the street-lamps; and it was resolved that, in the case of street-lamps of every description, the reduction should not commence before midnight, and that the lighting of the lamps on the lower rates—the smaller burners—should, for a week about the period of the full moon, be discontinued. This decision was the outcome of a recommendation by Mr. C. R. Bellamy, the Superintendent of Street Lighting.

New Water-Works for the Faversham Rural District.—The Local Government Board have sanctioned the application of the Faversham Rural District Council for permission to erect new water-works, with a pumping-station and reservoir, at Boughton-under-Blean; and it has been decided to proceed with the work as soon as possible, in order to provide employment for men in the district during the winter. The scheme has been under consideration for a long time. It has been delayed in consequence of the Local Government Board at first insisting on the erection of duplicate engines and electrical connections between the pumping-station and the reservoir; but this condition has now been withdrawn.

Revaluations of Gas and Water Works.—The Newhaven District Council have decided to appoint Mr. Marshall to re-value the properties of the Newhaven Gas Company and the Seaford and Newhaven Water Company; the remuneration being fixed at 1½ per cent. on the assessment finally approved of. The Epsom District Council have passed a resolution asking the Guardians to appoint a valuer for the re-assessment of the properties of the gas and water authorities in the parishes of Ashstead, Banstead, Great Bookham, Carshalton, Cheam, Cuddington, Cobham, Chessington, Epsom, Ewell, Fetcham, Leatherhead, and Sutton; and it has been resolved to request Mr. Ede to state his terms for making the proposed new valuation.

Drogheda Corporation and the Water-Works.—At the meeting of the Drogheda Corporation last Wednesday, the Mayor (Mr. B. Nulty) said it was desirable there should be a meeting of the Committee in connection with the Improvement Bill, to consider an offer of the Drogheda Water Company to sell their interest at £25,000. If the Committee, with the approval of the Corporation, did not make an offer, friction might be created, and the Company attempt to oppose their Bill. He was of opinion the Committee should meet and decide on a sum to offer. Mr. Elcock believed the Committee should offer the outside value rather than have friction, as a good many people in the town had interest in the works, and they wished to deal fairly with them. Alderman Downey said if the Bill were opposed plenty of evidence could be produced to show that the water supply was inadequate. The suggestion of the Mayor was agreed to.

Gas Explosion in Dublin.—Last Thursday morning, about ten o'clock, a gas explosion occurred in Upper Stephen Street, Dublin, by which two men and a youth, named respectively John H. Armstrong, William Colley, and Charles Colley (father and son) were injured. The men were engaged in laying down pipes for the supply of water to a closet. The spot where the junction with the service-pipe was to be made was in an area contiguous to a coal-vault through which the pipe passed. This vault had been closed for some years, and its existence was unknown. When the men were proceeding to make the joint, they approached the spot with a lighted spirit-lamp; and the result was an explosion, which seriously injured themselves and the youth. All were conveyed to Mercer's Hospital, where the two men were treated and sent home. The youth, however, was detained, but by midnight he had recovered from his shock, and was going on satisfactorily. The house had not been occupied for about four years.

The New Water-Works for Bilston.—The works for supplying Bilston with a direct water supply are now being carried out under the direction of Mr. Baldwin Latham, M.Inst.C.E., of Westminster, with Mr. C. L. Wilson, M.Inst.C.E., as Resident Engineer. The scheme is to convey a constant supply of water from the pumping-station at The Bratch, Wombourn, to a reservoir at Goldthorn Hill, Wolverhampton, and thence into the Bilston township; the distance between the two places to be connected being nearly five miles. The work is to be completed by April.

The Stoppage of the Wentwood Water Scheme of the Newport Corporation.—The Corporation of Newport have, in Committee, ratified the payment to Mr. J. Young, the Contractor to the Wentwood water-works scheme, of £31,730, in addition to £16,400 already paid on the certificate of the Engineer. With £17,000 spent on land, this brings the total cost up to £65,130; but as there are still a few claims to be dealt with, the full outlay will doubtless reach £70,000. The payment to the Contractor includes £9000 as the "consideration for the termination of the contract"—in other words, this sum is in lieu of the profit the contract was expected to yield. The Contractor also gets £1000 for interest on his expenditure. The plant, valued at £6385, becomes the property of the Corporation for £1000.

Devonport Water Supply.—The Belliver reservoir which the Devonport Water Company have made for the improvement of their supply, and of which there was a brief description in the JOURNAL for Oct. 22 (p. 841), has now been completed. It was formally opened on Friday last, when the Directors and Mr. H. Francis, the Engineer to the Company, paid a visit to the works. The completion of the reservoir will relieve the Company of much of the anxiety and difficulty experienced in previous winters. It has a capacity of 2 million gallons; while between it and the older reservoir at Crownhill a main has been laid, and the open leat (which was liable to be choked by snow and ice) has been filled in. The additional storage will enable the Company to tide over any temporary stoppage of the leat, which still conveys the water over the moorland from the intake to the Belliver reservoir.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1187.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Invest. £	s.	d.
£			p. c.	GAS COMPANIES.						
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	23—24	..	4	7	6
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	..	4	5	8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4	11	9
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¾—7¼	..	4	9	8
40,000	5	,,	6½	Do. New	4	5—5½	..	4	14	7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	257—262	+4	4	11	7
180,000	,,	,,	9	Do. New	100	205—210	..	4	5	8
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4	14	10
933,500	Stck.	29 Aug.	5	Bristol	100	124—128	..	3	18	1
320,000	20	27 Sept.	11¼	British	20	54½—55½	..	4	1	1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4	17	10
51,510	10	,,	8½	Do. 7 p. c.	10	19—20	+½	4	5	0
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	7¾—8¼	−¼	4	17	1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5	15	5
150,000	20	11 July	8¼	Cagliari, Limited	20	30—32	..	5	3	3
550,000	Stck.	16 Oct.	13½	Commercial, Old Stock	100	322—327	+2	4	2	7
165,000	,,	,,	10½	Do. New do.	100	247—252	..	4	3	4
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3	1	3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	277—282	−1	4	12	2
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	..	4	11	10
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	127—132	+2	3	19	6
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4	3	0
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4	14	3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100*	293—298	+1	4	5	6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3	11	5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	285—290	+1½	3	9	0
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3	11	5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3	13	2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3	10	9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3	9	8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—170	..	3	10	7
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	137—142	..	2	16	4
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	147—152	..	2	19	2
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2	17	11
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	235—240	+2	5	0	0
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	6—6½	..	4	12	4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4	6	2
541,920	20	14 Nov.	5	Monte Video, Limited	20	16½—17½	..	5	14	3
150,000	5	28 Nov.	8	Oriental, Limited	5	7¾—8¼†	+¼	4	16	11
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6	7	3
166,870	10	14 Feb.	2	Para, Limited	10	1½—2½	..	8	0	0
				People's Gas of Chicago—						
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105—110	..	5	9	1
500,000	100	4 June	6	2nd Do.	100	102—107	..	5	12	1
150,000	10	16 Oct.	7	San Paulo, Limited	10	11½—12½	+½	5	12	0
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	370—375	..	4	2	8
1,350,000	,,	,,	12	Do. B do.	100	308—315	+1	3	16	8
308,685	,,	,,	13	Do. C do.	100	325—330	..	3	18	9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk	100	175—178	..	2	16	2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4	17	10
				WATER COMPANIES.						
716,021	Stck.	26 June	10	Chelsea, Ordinary	100	297—302	..	3	6	2
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	215—220	..	3	3	7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2	15	6
700,000	50	26 June	6½†	Grand Junction	50	110—115	..	2	16	6
708,000	Stck.	29 Aug.	12	Kent	100	310—315	+3	3	16	2
1,043,800	100	26 June	7½†	Lambeth, 10 p. c. max.	100	247—252	..	2	17	8
406,200	100	,,	7½†	Do. 7½ p. c. max.	100	210—215	..	3	7	6
430,000	Stck	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2	14	2
500,000	100	14 Aug.	12¾	New River, New Shares	100	380—390	..	3	8	7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2	14	2
902,400	Stck	12 June	4	S'thwk & V'xhall, 10 p.c. max	100	145—150	+7	2	13	4
126,500	100	,,	4	Do. D 7½ p.c. do.	100	140—145	..	2	15	2
1,155,066	Stck.	12 June	10	West Middlesex	100	293—298	..	3	7	1

* Ex div.

† Next dividend will be at this rate.

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THE "JOURNAL" OFFICES.

The rebuilding of the "Journal" Offices having been completed, the Editorial and Publishing Departments have been transferred from Temple Chambers and No. 1, Gough Square, to No. 11, BOLT COURT, FLEET STREET, E.C. Correspondents and friends calling will kindly note that this will in future be the ONLY ADDRESS for "Journal" business.

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EDITORIAL NOTES.

The Preparation for Good Work.

THE Duke of Devonshire and Mr. Chamberlain were last week in Birmingham together, the auspicious occasion being the opening of new buildings for the Municipal Technical School—an enterprise which is doubtless, at least in part, supported out of the profits of the Corporation gas undertaking; thus realizing to a certain extent aspirations which form the subject of another paragraph of these editorial notes. We do not notice the opening of the Birmingham school building on this slender account, however, but because, in officiating on this occasion, His Grace of Devonshire delivered himself of some reflections upon the subject of education of that sterling quality which the British public has learnt to expect from this most solid of statesmen, whatever the subject upon which he speaks. We often hear about the strain and stress of the competition to which British industry is subjected; and probably there is no industrial centre in the kingdom more powerfully stimulated by this pressure than Birmingham, or less favoured now by natural advantages for withstanding it. The trade of Birmingham was once helped by cheap local supplies of coal and iron; but at present most of the raw materials worked up in the town and its vicinity are of "foreign" origin. Consequently, it is simply the men of Birmingham that give the city whatever superiority it may possess as a source of commodities capable of commanding a paying price in the markets of the world; and the Corporation, by their schools, are doing all that can be done to increase the efficiency of the splendid local breed of working people.

When one talks of schools, and especially of the operation of the Elementary Education Act, one is very apt, if a person of technical training, to question whether, as generally administered, this universal schooling really effects its proper purpose. There is more than a suspicion in the public mind that the character of the schooling received by the mass of the rising generation is not suited for them, inasmuch as it tends to turn the most promising boys and girls from following handicrafts, and predisposes them to join the ranks of the non-producers. The Duke of Devonshire is clearly one of those who entertain this view. "Too "long, in my opinion," he said in Birmingham, "it has "been the tendency of our educational system, from its "too literary character, to make the student who has dis-"tinguished himself imagine that he has become too good "merely to labour with his hands, and that it is necessary for "him to aspire to some class of work other than that of the "work of his own hands. That is a position which I emphati-"cally desire to repudiate." It is to be hoped the Duke will be able to use his official position to destroy this tradition of pedagogy, which requires the rates to be spent in turning the son of the good bricklayer into an indifferent mercantile clerk, and the daughter of the expert workwoman into a type-writer. What is wanted is to put the child of the unskilled labourer in the way of becoming a skilled workman, and to enable the tradesman's son to excel his father. Our engineers are inventing, adapting, and applying the discoveries made by our men of science, and redeeming the conquests of our pioneers. They need foremen and good hands to work the improved apparatus which they are giving civilized nations. As the Duke of Devonshire, and following him Mr. Chamberlain, said in Birmingham, the unskilled—the merely mechanical—workman will be rendered obsolete before very long. The future is with the skilled hand; but this will have to be accompanied and guided by the instructed and educated mind. We do not want the type of skilled workman who is just at present unhappily too familiar a figure—the man who can do his work well when he likes, but has a brain so little cultured that he is as clay in the hands of the glib agitator who has had the wit to pick up a few German socialistic notions, and possesses the "gift of the gab" for expounding them. The country wants workmen who are wise enough to make friends with machinery, and are expert and careful enough to make a machine yield its utmost—not fools like those who would drive every industry out of the country rather than give up the "union stroke."

Incidentally, the Duke of Devonshire described the operation of the much-vaunted German system of technical training, and showed how it eventuates in a caste system as rigid as that of India. The advanced schoolboy may

pass from one educational establishment to another; but the workman must always remain a workman. There is no graduated instruction for him. He takes his orders, like a soldier on parade, and executes them. The English employer notoriously has a preference for the foreman or head of department who has risen from the ranks of labour. This weakness for "the practical man" is greatly resented by our own highly-schooled youth, who are often heard to complain that, after all their expensive training, they are not wanted for the posts they would like to fill. The remedy seems to lie in the direction discussed by the Duke of Devonshire. The country and the employer want the practical man; but why should he not also be an educated and instructed man?

In the ranks of the gas industry, we hear of a host of aspirants to managerial or sub-managerial positions, which are not easy to obtain, and are not over-well paid at that. We are not going to enter into this part of the question, but only allude to it in passing by way of introducing the observation that many a young man, who would fain be a gas manager, had far better shun the drawing office and the books, and get a berth as main-layer, or as attendant on a stoking-machine. He can keep up his drawing and his other studies at the same time; and, under the system of the eight-hour shift, he will have plenty of leisure to improve himself. He must, of course, learn to possess his soul in patience until his opportunity arrives, as arrive it almost certainly will. We say "almost certainly" advisedly; for nothing is certain for any one of us but death. There is, however, as small a chance of disappointment in a life begun this way as in any other. The French proverb says: "*Tout vient à lui qui sait attendre*"—not, as in the current (and erroneous) English rendering, "Every-thing comes to him who waits," but to him who *knows how* to wait. A great and notable difference. We commend these words to all whom they may concern, with the advice that the counsel should be taken in connection with the drift of the Duke of Devonshire's and Mr. Chamberlain's speeches of last Friday.

The Deadlock in the Engineering Trade.

The conference of employers and operatives concerned in the labour trouble of Glasgow and Belfast duly came off last week, as arranged, with Lord James in the chair, and resulted provisionally in the formulation of a definite offer by the employers of terms upon which engineering work in their yards might be resumed. These terms, which referred solely to the scale of wages, and made no mention of the socialistic invention of the "minimum wage" imported into the case by the men's Society, were submitted to the Belfast operatives first, and were by them rejected by an almost unanimous vote. The Greenock and Glasgow hands have followed suit; so that for the present there seems to be no prospect of the termination of the dispute by any more expeditious and less wasteful method than that of punishing one or both sides to the point of exhaustion and despair. It is a curious feature of the situation that a decision which is generally regarded as threatening to shake to its very foundations the shipbuilding industry of the regions affected, is ostensibly due to the obstinacy of a few hundreds—at any rate less than 3000 workmen belonging to a particular Trade Union. It is now recognized that, as the special correspondent of *The Times* put it yesterday, "the moment has come when the title, under "which the movements and rumours of movements on the "Clyde and the Lagan, and the consequent developments "at Barrow and on the East Coast have been recorded, "must be changed." The affair stands disclosed as a strike pure and simple, of the regular common-place type. "That the disputes on the Clyde and the Lagan were "substantially identical, there has never been real doubt; "but there has been some semblance of justification for "those persons who have persisted in describing the action "of the masters on the Clyde by the term 'lock-out in "'sympathy.' They cannot say anything of that kind "now." Hence the responsibility for prolonging the deadlock rests upon the Society men, who are evidently completely under the influence of their leaders. The net result so far is a keen disappointment to all those who saw in the willingness of the two parties to meet in conference a promise of readiness to accept any offer that might be the issue of this meeting. The truth of the matter appears to be that the conference after all was premature. The men were not so ready as their partisans in the Press assured the public, to accept any reasonable settlement which did not touch in any way their sacred right of combination. What will be said for them now that they have proved recalcitrant in face of an offer which had no reference to that sacred principle which the employers' federation was supposed to aim at destroying? It is to be noticed that the newspapers which have been foremost in denouncing the employers and backing up the men merely recorded the result of the ballots without comment. In the city itself, as may well be understood, the decision is viewed with much alarm and sorrow, as indicating the indefinite prolongation of the dispute. It would not be surprising if the next step on the part of the employers were the engagement of non-union labour.

Meanwhile, the promised independent investigation of the financial position of the Amalgamated Society of Engineers has been completed; and the assertions of those critics who have declared the organization not solvent are confirmed by it. As a writer in the *Globe* remarks, "few people have been in a position to actually realize the "extent to which its funds have been squandered, and the "truly terrible position of such of its members as may "look to it as a means of support in their old age." The actuarial calculation is based on the information contained in the last annual report of the Society, which brings matters up to the close of 1894. There is shown to be a deficiency of very nearly a million and a half of money in respect of the superannuation liability of the Society alone. To make this good would require an immediate payment from every one of the 64,188 subscribing members of £22 5s. 10d., which is, of course, an utter impossibility. Apart from this liability, the expenditure of the Society upon "trade contingencies" and "donation benefit" so jeopardizes its solvency that, to cover everything, it would be necessary to raise the annual subscriptions from £3 18s. to £8 2s. 5d. per member. And this is the state of the Trade Union that has been vaunted as the richest, best managed, and most powerful organization of the kind in existence. So far, the Executive of the Union have not taken any steps to deal with, or even to show that they are conscious of, the disastrous condition to which the Society has been brought—partly perhaps by mismanagement, but chiefly, it would appear, from engaging to do more for its members than is possible for the amount of their subscriptions.

The Judgment in the Croydon Assessment Appeal.

The report we published last week of the judgment of the Recorder of Croydon in the matter of the appeal of the Croydon Gas Company against the increase of the assessment of their property in the borough from £11,717 to £18,343 should be carefully noted by all Gas Companies and Local Authorities. In the first place, the event was a conspicuous triumph for the appellants, who not only gained a substantial reduction from the new assessment, which, as the Recorder pointed out, they could not have obtained in any other way; but also, in consequence of their action being thus justified, the Company get their costs—a very exceptional result, and one that will go a long way towards checking future raids upon gas undertakings by the speculative professionals who make a speciality of this class of business. The fact that the Recorder of Croydon (Mr. R. G. Glenn, LL.B.) is an authority on the law of rating lends additional weight to his carefully considered judgment, which had the peculiarity of being supported by figures. It thus takes rank as a judicial monograph on the matter at issue; and it will doubtless serve for the future, as was intended, to facilitate the settlement of similar disputes without going to appeal. The "profession" already alluded to will very probably feel hugely disgusted at this spoiling of sport by the Croydon Recorder; but the larger interests affected will be grateful for this contribution to the elucidation of vexed questions that usually give enormous trouble, and run into vast expense, before they are settled. Mr. Glenn proceeded to ascertain the rateable value of the Croydon Gas Company's hereditament as follows: He found that the gross receipts, less bad debts, amounted to £78,707. The various disbursements, detailed in the judgment, made up a grand total of £38,603, which deducted from the receipts left a balance of £40,104. The amount of the occupier's share is next worked out, taking into this account five-twelfths of the cost of coal and the working expenses. Then the usual 17½ per cent. tenant's allowance is given; and the statutory

deductions are fairly treated according to established practice. So it came out that the net rateable value of the property is to be taken at £15,305, as stated. The valuation put forward by the Assessment Committee was based upon the insidious plan of reducing the tenant's allowances for capital, stock of coal, and every other necessary for carrying on a gas undertaking. This is a plausible and dangerous way of attacking a Gas Company upon their assessment, because it is so easy for Surveyors to swear, and for Counsel to argue, that any fancy figure that happens to suit them ought to be substituted for the customary proportion. If there is to be any finality about the valuation of gas-works, however, and any firm ground allotted for the hypothetical tenant to stand upon, there must be some constants from which his imaginary calculations can be legitimately started; and it is the peculiar value of this Croydon judgment that this principle has been re-affirmed in it.

School Boards and Gas Profits.

Some observations of the kind with which ratepayers everywhere are painfully familiar, were heard in London when the announcement was made that the precept of the London School Board for the ensuing half year would entail an increase of the rate by three-farthings in the pound, bringing up the total rate for the year to 11½d. The presentation of this estimate by the Chairman of the Finance Committee of the Board was the occasion of a lively debate, in which some members blamed the whole system administered by the Board for being practically worthless as well as costly; and one prominent Educationist—Mr. Macnamara—scouted the notion of there being any prospect for the Metropolitan ratepayer of relief from the burden of the schools, except he can find it in appropriated charity funds, the taxation of ground-rents, and "municipalized" gas-works, tramways, and so forth. Referring to this suggestion, *The Times* remarked that the history of the School Board building operations does not encourage the hope of "gigantic profits from the large "undertakings Mr. Macnamara has marked down as "spoil." Mr. Macnamara did not like the suggestion of the leader-writer in *The Times* that he was anxious to "mark down as spoil" the gas, water, and tram undertakings of London; and he wrote a letter to say that he was anxious "to treat all existing interests in the most "honourable manner." Of course, elementary honesty is not to be cast aside by an enthusiast for Board School teaching. At the same time, Mr. Macnamara confesses he is equally anxious "to see a future when the municipal "purse may be replenished from the profits accruing from "these particular undertakings;" and he makes out that "the profits from London gas concerns came out last year, "roughly, at the level of a 10d. rate." He asks why the gas and water profits should not, "say in twenty-five "years' time, be running our elementary schools in "London? If to cherish some sort of a more or less "despairful ideal in this direction is to be guilty of a desire "to 'mark down' certain things as 'spoil,'" Mr. Macnamara owns that he must, after all, be marked down a "spoiler." We have no sort of objection to anybody cherishing a "despairful ideal" of seeing gas profits applied to any purpose, after the legitimate appropriations of such moneys have been duly met and discharged. It is possible that in another quarter of a century the London gas and water profits may be equivalent to the charges of the London School Board; but the latter has no especial pretension to be liquidated by the former. Mr. Macnamara wants the gas and water profits for his own particular purposes. He may be paralleled by a professed sanitarian, who would spend the same money upon drains and sewage disposal; by an æsthetical individual, who would beautify London out of the same funds; by a would-be abolisher of poverty, who would apply all the money to solve the problem of "unemployment." And in the end there would be no gas or water profits left to quarrel over, and nothing more would be done for London, and the rates would be higher than ever. This is generally the way of reformers.

The Sandwich Corporation and the Gas Undertaking.—In the Journal last week, it was stated that the Sandwich Town Council had decided to purchase by agreement the undertaking of the Sandwich Gas Company. The terms will be settled by arbitration; Mr. E. Herbert Stevenson, M.Inst.C.E. (of Messrs. Stevenson and Burstal), acting for the Corporation, and Mr. H. E. Jones, M.Inst.C.E., for the Company.

WATER AND SANITARY AFFAIRS.

At their meeting to-day, the London County Council are expected to discuss the policy of the Moderate party on the question of the Metropolitan Water Supply; having in view the terms in which that policy is set forth in the report of the Parliamentary Committee, of which some account appeared in our columns last week. The report is of considerable length; but the recommendations at the close are sufficiently concise. First among these, we find the proposal that Her Majesty's Government be invited to constitute by Act of Parliament a public authority for the water area as defined in the report. It will be observed that the body to be created is at the outset a "water "Authority," and not a Water "Trust," though it might become such later on. But whatever shape it may assume, it is to be a distinct body from the County Council; and in this respect the recommendation directly traverses the lines of the Progressive party. The recommendation also departs from the spirit of the resolution by which the Committee were called upon to report the lines on which they would suggest that the Government should be asked to legislate. The divergence to which we refer consists in the non-observance of the condition set forth in the resolution, that the Council desired to be "the water authority for London." This desire was given as a reason why the Parliamentary Committee were to prepare a plan in place of that embodied in the Council's suspended Water Bills, which the Moderate party were said to have "wrecked." It may thus be held that the Committee have failed to observe the instructions under which they were called upon to prepare their report. Supposing the recommendation of the Committee to be adopted, it would place the Council in the peculiar position of calling upon the Government to set them aside in the disposal of the water question. Satisfactory as this would be in relation to the interests of the public, it is expecting too much to suppose that the County Council would exercise such self-abnegation. The Committee are bold, even too bold, to ask the Council to go to such a length.

In settling the constitution of the water authority, the Parliamentary Committee have regard to the extent of the jurisdiction. They mention that the County of London forms "only one-seventh of the area, the water require-"ments of which, according to the report of the Royal "Commission of 1893, have to be considered." They also suggest that the districts outside the Administrative County, now containing a population of a million and a quarter, may in forty years' time possess a population exceeding that of London. For this and other reasons, they consider it "essential for the complete settlement of the "question that a body should be created which shall "represent the interests and command the confidence of "the water consumers throughout the water area." This, in effect, takes the matter out of the hands of the Council. For the constitution of the water authority, the Committee are able to fall back, rather oddly, on a scheme sketched out by the Select Committee over which Sir William Harcourt presided in 1880. But while stating this for the information of the Council, they do not think it desirable at the present moment to indicate any specific lines on which the Government should be asked to proceed with regard to the composition of the proposed authority. Of course, it is expected that the County Council will be represented, as well as the Corporation, and with these the authorities of the outer area. The Local Government Board is also to have a place. The next question to be considered is, What is the water authority to do? First of all, it is to have vested in itself all the powers now lodged in other hands for the regulation of the Water Companies—including that for instituting inquiries into the quantity and quality of the water. These powers are to be exercised "pending purchase." The water authority is to have "full power to purchase the undertakings of all or any of "the Companies by agreement," failing which, parliamentary powers are to be sought, in order to provide for settling the business in some other way. There is also to be power "for dealing with the whole question, including "that of future supply."

Concerning purchase, we see particular objection to the proposal that the authority shall have power to acquire the undertakings of "all or any" of the Companies. In

fairness, it should be "all or none." We agree with the Committee where they say, in respect to purchase, that "no serious attempt has yet been made by the Council to "negotiate with the Companies." The attempts hitherto have been mere feints. The Committee urge that "friendly "negotiations" should at once be opened with the Companies for the transfer of their undertakings. This is to be done in order to avoid "a long and expensive contest "before Committees of Parliament" over the Bill of the Grand Junction, New River, and West Middlesex Companies. But our opinion of the County Council is such that we do not think it likely they will take the trouble to settle terms of purchase for property which they are not themselves to possess, but which is to be handed over in due time to the new authority. A curious proposal which finds expression in the report is, that it may be the duty of the Council to secure remote sources of supply in case they should be wanted, though this "need not involve any "obligation on the Council or the new authority to under-"take the expense of bringing the supply to London." To test the views of the Council on this point, it is asked that the Water Committee should be requested to report their final conclusions concerning new sources of supply "without delay." The Welsh scheme is not to act as a bogey, but is to be accepted or dismissed forthwith.

Reaching this point, and looking back over the whole report, we feel constrained to say that, while it is permeated by much that is sound and good, it is yet—and mainly for that reason—a most hopeless document to put before the London County Council; and its appearance there is absolutely incongruous. Its minimum demand is for more efficient control over the Companies. To this, the latter might consent; but it would never satisfy the Progressives. For a proper settlement of the water question, the great *desideratum* is a reasonable reform of the County Council. When this comes to pass, it will be found that little more is wanted. With regard to the report of the Parliamentary Committee, Mr. T. M'Kinnon Wood has given notice of an amendment, that Her Majesty's Government be asked whether they will promote or assist legislation dealing with the Metropolitan Water Supply on certain lines, including among other arrangements a severance between London and the outlying parts—the supply to London being placed under the entire control of the County Council in conjunction with the Corporation.

At the half-yearly meeting of the Southwark and Vauxhall Company on Tuesday last, the Chairman, Alderman Sir Henry E. Knight, referred in very decided terms to the expenditure forced upon the Company by the hostile policy of the London County Council. The shareholders had suffered from this cause to the extent of £10,000 in the past five years; and the outlay incurred during the present half year had been as much as £3000. The Chairman computed that, including the expenses devolving on the whole of the eight Companies, and those incurred by the Council, a total of about a quarter of a million sterling had gone utterly to the bad. For all this outlay there was nothing to show. This appeal to the facts of the case ought to have its proper weight with the press and with the public; but we fear that very little heed will be given to it, though Sir Henry Knight describes the attack by the Council as "a public scandal," and one which "ought "not to be permitted to go on." Some future historian—a kind of municipal Macaulay—may be expected to do justice to the situation. But for this we must wait. The immediate remedy rests with Parliament. Proceeding to the consideration of another point, we observe that the expenses arising out of the phenomenal frost in the early part of the year bear heavily on the Southwark Company; the outlay amounting to the weighty sum of £27,000. It was only by carrying £10,000 of this charge to the next half year that it became possible to pay a dividend of 6 per cent.; but the Chairman feared that on the next occasion the dividend would fall to 4 per cent. We share with Mr. Jeffreys in the hope that the increase in the Company's income, and the reduction of expenses will prevent the dividend from being so materially reduced. Even the Chairman expected a return to the higher rate. Some interesting facts were given with regard to the important works recently undertaken by the Company. The extensions authorized by the Act of 1894 will meet the demand up to the year 1900 or 1902. Parliament will now be asked to authorize a complete scheme, which will suffice until 1940. But more about this is to be learned at the Wharncliffe meeting to be held in due course. No doubt, the County Council will oppose the scheme, though it is designed to meet the requirements set forth in the report of the recent Royal Commission.

Mr. Frederick Tendron, presiding at the half-yearly meeting of the Grand Junction Company last Wednesday, drew a very marked distinction between the action of the County Council and the conduct of the official staff belonging to that body. In his argument, the Chairman was evidently influenced by a belief that the Council had undergone a partial "regeneration." But the fact remains that, including the aldermen, there is yet a majority on the Progressive side at Spring Gardens. The good influence of the Moderates is doubtless felt, backed as it is by the vote of the electorate. Hence, in part, arose the late decision not to proceed with the suspended Transfer Bills. But, at the next meeting, the Progressives defeated the recommendation of the Parliamentary Committee for placing the subject of the water supply in the hands of the Government, with the view of establishing "a" public authority to have charge of the supply in the Metropolis and the surrounding districts. A very similar proposal, but more thoroughly worked out in detail, comes before the Council to-day, though of its success we have the least possible hope. If the Council had a Moderate majority throughout, there would be some chance for such a recommendation; but the "altered nature" does not yet exist to that extent, though the balance, comprehending aldermen as well as councillors, has become a fine one. Mr. Tendron clearly has hope of the Council; and he throws the responsibilty of their hostile action towards the Companies on the officers, of whom he says he has "to complain most bitterly." Certainly there has been mischief somewhere; and "ambition" among the officials of the Council may in some degree account for it, though we rather lay the blame upon the Progressive members themselves. Concerning the Staines storage scheme, Mr. Tendron gave some striking figures, such as are at wide variance with Mr. Binnie's estimates, and which promise well for the success of the Bill which has been founded on that project. Mr. Tendron even hopes that the members of the County Council may have their eyes opened to see the extent to which they have been misled. This is complimentary to the Council, and is a very good way of broaching the question.

The Engineership of the West Ham Gas Company.—We understand that the duties of the engineership of the above-named Company have, since the death of Mr. John Thorman, been performed by Mr. John Clark, the Consulting Engineer to the Company, with the help of Mr. J. C. Wright, the Assistant-Engineer; the Directors having requested Mr. Clark to take the entire responsibility for the present.

Resignation of Mr. Ernest A. Loam.—The managership of the Stalybridge Gas-Works is about to become vacant by the resignation of Mr. E. A. Loam, who has held the position of Engineer and Manager for the past eight years. Mr. Loam has, we understand, been compelled to take this step solely owing to the worry and anxiety caused by the persistent and unnecessary interference of members of his Committee, which has lately become unbearable. Since Mr. Loam has been at Stalybridge, he has carried out considerable extensions of the works, including the erection of a 130-feet telescopic holder and tank, &c.

Management Changes.—Mr. William Ruxton, of the Arbroath Gas-Works, has been appointed Manager of the gas-works at Berwick-on-Tweed. There were upwards of seventy applicants for the situation. Mr. Ruxton's appointment will give general satisfaction; he being well known among the members of the North British Association of Gas Managers, whose annual meetings he regularly attended. His career is sketched by our Scotch Correspondent to-day.——Mr. Wynn, of Bollington, has been appointed Manager of the Milnthorpe Gas-Works, in succession to Mr. F. Hill, who has taken the management of the works of the Usk Gas Company, Limited.

Proposed Memorial of Mr. Denny Lane.—Those of our readers who perused the notice of the career of the late Mr. Denny Lane which appeared in the JOURNAL for the 3rd inst. will not be surprised to learn that a desire has been expressed in Cork, where he was regarded as a public benefactor, to perpetuate his memory by some permanent recognition of his services to science, art, and literature. The Mayor has accordingly convened a meeting of the citizens to consider the matter. The form which the memorial will take has not yet been decided; and it will, of course, depend upon the support accorded to the movement. As Mr. Denny Lane had a wide circle of friends and admirers among the readers of the JOURNAL, many will no doubt be disposed to assist in bringing the proposal to a definite issue. Those who are desirous of doing so will perhaps communicate with Mr. Thos. P. Travers, Gas-Works, Cork.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1258.)

THE condition of quietude which we noted in our last article as having come over the stock markets in general was continued all through the week just closed. Indeed, it was a good deal quieter; and it grew worse as the days went on. At first, prices were pretty steady; and some markets did fairly well—railways, for instance, being favoured by very good traffic returns. But gradually a decided state of flatness prevailed; buyers standing aloof, and giving no support. Consequently, prices for the most part went down; but not to so great an extent as might have been expected. Nor was the abatement universal; for here and there, owing to special causes, an advance was effected, and the Funds notably improved. The Money Market remains in just the same condition. The Gas Market did not share the general quietude, but was really pretty active, although not to the degree attained in the preceding week. The strength and buoyancy of the soundest and most choice undertakings were remarkable; and some quotations have made large advances in value, while several others have improved in more modest proportions. In Gaslights, the "A" stock was active, especially at the opening, and continued fairly busy through the week. Prices were steady; but they could not beat the best of the week before, until just at the close, when half a point better was scored. The secured issues were almost untouched—a solitary bargain in the "K" 6 per cent. preference being all the record. But it sent the quotation up nicely; and "C," "D," and "E" also rose. Dealings in South Metropolitans were numerous in the first half of the week; and prices were good generally, while the "A" stock marked a rise of 5. Commercials were lively again—both stocks scoring record prices; and the quotation of the new had a good rise. Among the Suburban and Provincial undertakings, the feature was the phenomenal progress of Brentford old, which rose every day, while the new also gained slightly. This, too, was done without a bargain being marked in either. Alliance old and Bromley new, however, had a slight recoil. The Continental Companies were unchanged, and exhibited no particular feature. In the remoter world, Chicago second mortgage was rather better, and Pará rather worse. There was a good deal more business marked in Water stocks; and the tendency was decidedly favourable. Chelsea and Southwark benefited by their improved dividends; and, among those whose dividends have fallen off, Grand Junction recovered a little from the resulting depression.

The daily operations were: The Gas Market was remarkably active on the opening day; the Metropolitan undertakings being well to the front. Prices were firm generally, and Brentford old rose 3; but Alliance old fell ½. Southwark Water gained 2. Transactions on Tuesday were less extensive; but prices remained firm. Brentford old went up 2; but Pará receded ½. Southwark Water rose 3. Business on Wednesday was about the same in quantity; but many more advances were made in quotations. South Metropolitan "A" improved 5; Commercial new, 2½; and Gaslight "C," "D," and "E," and Brentford old, 2 each; but Bromley new fell ½. On Thursday, there was renewed activity in Gaslight "A;" but the rest were quiet. Brentford old rose 1. In Water, Southwark advanced 2; and Grand Junction, 1½. Friday was a very quiet day; but both Brentfords rose 2; and Gaslight "K," 1½. Very little business was done on Saturday; but everything was firm. Brentfords and Commercials were "beyond price."

ELECTRIC LIGHTING MEMORANDA.

Report of Board of Trade Committee on Low-Pressure Supply—The Question of the 200-Volt Lamp—The Consumers' Interest in the New System.

As will be seen by the report on the subject in another column, the Committee of experts appointed by the Board of Trade to consider the desirability of altering the limit of low pressure, as defined by the regulations issued by the Department under the Electric Lighting Act, have lost no time in submitting their conclusions on the question to the President (Mr. Ritchie). The Committee (consisting of Lord Kelvin, Mr. W. H. Preece, and Major Cardew) had to deal first with the question of the sense in which the term "electric pressure" should be understood in connection with the alternating as well as with the continuous current; and they recommend the omission of the old definition which based it upon the production of heating effect in a thin, stretched wire or carbon filament. They further advise that where the conditions of supply are such that the pressure may at any time exceed 500 volts if continuous, or 250 volts if alternating, but cannot in any case exceed 3000 volts, the supply shall be deemed a high-pressure supply. This is as much as to say that anything up to 500 volts pressure in a continuous system, or its equivalent in an alternating system, should be regarded as a low-pressure supply; which is practically conceding the point raised in the interest of electric lighting undertakings at the recent conference. Certain subsidiary questions in regard to the matter are left in the hands of the Board of Trade, with a hint that further concessions to the demands of undertakers had better be granted tentatively. If the report is accepted by the Board, and the new regulations are drafted accordingly, the way will be cleared for the general introduction of the 200-volt lamp, which is what the supply companies are aiming at. A spoke is put in their wheel, however, by the requirement that the consent of the consumer shall be obtained before any alteration is made in the pressure of supply—consent of the consumer meaning, of course, that of fire insurance offices also.

The question of the 200-volt lamp was freely discussed by the *Electrical Review* in a recent issue; and it is deserving of a little examination, inasmuch as it certainly is one of the most prominent of the electricity supply problems of the day. On the face of it, the desirability of doubling the pressure in the supply mains seems hardly disputable, since it means a good deal more than merely enabling two lamps to be supplied where only one could be served before; thus repeating, with only a change of name, the hackneyed economist's claim to public gratitude. In many cases such a change would mean the salvation of a supply undertaking from impending bankruptcy; for it is notoriously hard to do a profitable trade with a 100-volt continuous supply save in a very few exceptionally good districts. On the other hand, our contemporary pertinently inquires: Why stop at the 200-volt lamp? Why not aspire to a 300-volt lamp with all that it entails? This sounds very enterprising, and full of promise of good times to come. But it is urged that, however desirable such a change may be, it will be wisdom to fall back upon the Cæsarean maxim and "hasten slowly." This caution is given for two reasons: First, because much of the wiring in existence is in a dangerous condition; secondly, because there will be for some time a difficulty in filling large orders for 200-volt lamps. Our contemporary ventures upon the assertion that "a good deal of inferior wiring would go clean out of existence if 200 volts were sent through it," with consequences that, for the good of electric lighting, it would be as well to avoid. There is, of course, a great deal of truth in this assertion; but it is difficult to believe that matters in this regard are really so bad as is asserted. At the same time, if there is any doubt respecting the carrying capacity of a system of house wiring, the new Board of Trade regulations will give the proprietor the benefit of it.

With regard to the much-talked-of 200-volt lamp, there is little reason to fear that, with a fair allowance of grace, the makers of lamps will be able to meet all possible demands upon them for these delicate articles. Up to the present time, such requirements for 200-volt lamps as have been tendered have been satisfied with an article in which the usual single filament is simply duplicated in series. You double the length of the filament in this way, and there you are! Unfortunately, as the *Electrical Review* reluctantly admits, this device can only be accepted as a temporary makeshift. If there are two filaments in the lamp in place of one, it means a double risk of collapse; and, besides, such lamps are more expensive to make. To obtain all the required resistance in a single filament, however, means a longer one than could be conveniently packed away in a bulb of the standard size, to which consumers have become accustomed, and to which their fittings are adapted. Thus it appears that the problem of the 200-volt lamp becomes more formidable the more attentively it is regarded. The thing that is clearest about it is that the new type of lamp must be either more delicate or clumsier than the old, and necessarily dearer. If this view of the matter should turn out to be permanently true, the consumer will have a good deal to say before he accepts a supply at 200 volts as an equivalent for the service he originally contracted for.

The proposed new regulations promise that before a 200-volt supply is imposed upon a consumer, his consent is to be sought and obtained. This in the first place means, as already remarked, making sure about the fire risks in this connection. So far as the consumer himself is concerned, however, his interest in the question lies in the cost of the lamps and renewals. What representation is to be made to him upon these points, and what is to be his remedy if he should be misled in this regard, and should, after experience of the new system, desire a return to the old? It seems to us that this is something for the partisans of the new system to settle before going any further with it. It is all very well for station managers to instigate a radical alteration in the conditions of the lighting service, on the plea that it will enable the same plant to serve double the number of lamps. But if a consumer discovers that it also entails his paying a higher price for lamps, and using up two for one, why should he be bound to go on taking a supply which lays him under this disadvantage? For, be it borne in mind, the consumer has nothing whatever to gain by being supplied with current at one voltage rather than at another. All he wants or cares for is the light he receives, and the price he pays for it; and to victimize him for the sake of the supply company is a proposal that it needs all the unequalled assurance of the electrician to make. We cannot fancy such a demand being preferred for the sake of the gas industry. Of course, the dearer lamp may be compensated for by a cheaper unit of supply. But there is no promise of this consideration for the present; so that, for the time being, the latest improvement of electric lighting technics would seem to imply not a cheaper, but a dearer lighting service.

THE VIRTUE OF TECHNICAL SOCIETIES.

It appears from his letter, published in last week's Journal, that Mr. D. Irving, of Bristol, has been somewhat exercised in mind respecting the terms in which we have referred editorially to the suggested amalgamation of the South-West of England District Association of Gas Managers with the Southern District Association. He thinks we have permitted ourselves to indulge in some "strong criticisms of the South-West Association and those responsible for its management;" leaving it to be inferred from this observation that he could effectually dispose of these criticisms, if he would. As it is, however, our comments stand for what they may be worth; and we now desire to take the earliest opportunity for assuring Mr. Irving, and whoever may share his jealousy for the fair fame of the South-West Association and its recent management, that we have never been inspired, on this or any previous occasion, by any other feeling towards the members of the Association in question than that of extreme goodwill. The efforts of gas managers—scattered as the character of their employment requires them to be over the face of the land—to counteract some of the worst influences of this isolation, are deserving of the heartiest support and the warmest encouragement. We are not aware of having failed to render to the South-West Association, as a body, or to the individual members of it, all the help and recognition that a journal devoted to the same cause as that with which the organization is identified can be expected to afford. At the same time, there is nothing sacred about the nature or conduct of any particular District Gas Managers' Association, that we or anybody else should lie under an obligation to discuss it with bated breath. It can hardly be denied that the South-West Association has entered upon a period of decadence, and has been brought so low that—like St. Patrick's snakes—its leading spirits see no better fate before them than that of "committing suicide to save themselves from slaughter" in their official capacity. In what we have had to say respecting this condition of affairs in the South-West, we have chiefly sought to point a moral for the good of other technical societies of the kind to whom a similar fate may open unless they are warned in time. We endeavoured to place the facts of the situation of the South-West Association clearly before those whom such things concern; and if our diagnosis of the disease of the organization was faulty, it should be easy to correct it. Meanwhile, one might be disposed to condole with Mr. Irving and the others of his company, who, finding the times "out of joint," are fain to try and right them, but for the patent consideration that they are the best men available for discharging the painful duty they have undertaken.

We desire, however, to pass from the subject of the vicissitudes of the South-West of England Gas Managers' Association to the larger one of the proper work and the advantages of technical societies of the kind, and others. It is a commonplace to urge that the idea of the association, for the purpose of mutual assistance and instruction, of men of the same calling and tastes is a good one. Yet signs are not wanting that, so far at least as gas managers are concerned, the idea is losing something of its attractiveness. The fact of there being in England two national organizations for gas engineers where one would not merely suffice, but would be infinitely preferable, has doubtless something to do with the origination of that apathy to the claims of the smaller societies of which the case of the South-Western is the most striking, but not the only, example. Without adventuring further in this dangerous direction, it cannot be gainsaid that there are many gas managers who have ceased to interest themselves as they should do, and in numerous instances as they once did, in the proceedings of the District Association to which they still formally belong. This is not as it should be; yet it is not easy to suggest a remedy. It can be easily understood that when a small technical society, professing geographical limitations, is first started in a certain unoccupied and, so to speak, virgin district, if it succeeds at all its success is at first, and for some years afterwards, highly gratifying to its founders. The early Presidents and members of the Committee suggest themselves; and the rank and file of the profession dutifully attend the meetings and constitute the necessary "chorus." As time passes, a change comes over the proceedings. The prominent men of the locality get used up for office; and it seldom happens that the undistinguished chorus furnishes many examples of genius condemned to "blush unseen" whom the society has the good fortune to save from wasting sweetness upon the "desert air." More general is it for the transactions to serve as means of advertising the familiar figures of a handful of worthy persons who somehow become inevitable. Very remarkable it is how the "public form" which has shown itself in larger fields is confirmed by the experiences of these small societies. The prominent men are, as a rule, the best men; and there are not many of them. There is no reason in the nature of things why the small, undistinguished men—the hard-working, worthy souls who never write to the technical journals, never speak at a big meeting, have no speciality to urge them into what might be called public life, yet who do their duty manfully in the places appointed for them—should not do something to help to increase the interest of the unpretentious gatherings of their professional friends and neighbours; but they never do.

So the District Association Executive get, naturally enough, into the bad habit of looking to a few well-known members for help in the shape of papers and addresses; and the bulk of the membership does nothing at all besides assisting to pass votes of thanks, and so forth. It is even worse where the personality of the society is swelled by the inclusion of the much-discussed order of associates—"trading" or otherwise. It is not necessary to revive the more familiar of the strictures that have been passed upon this order of society members. We have always been willing to concede the force of the theoretic claim for those who are connected with the gas industry in capacities other than those of works' management and engineering to a share in the benefits of association; but it must be admitted that, with rare, though noteworthy, exceptions, the men of this order do little in return for the privilege, except such things as were better left undone. This may be a hard saying; but it is a true one, and needs to be said. There are in the kingdom technical societies for followers of the gas industry which include "associates," and there are others from which all but gas managers and engineers strictly so termed are rigorously excluded. Which are the most successful, enjoyable, and fruitful of good teaching and criticism?

The ordinary, silent member of a technical society may be, and often is, a great stickler for its credit and reputation for usefulness. At times, he gets upon the Committee, and may then go about saying the most truculent things respecting the "irresponsible critics" who venture to find fault with some points of the policy of the administration. Even if it may be found expedient to alter the policy upon the lines of the criticism, no public admission of the fact is permitted to go upon the record. Such things have been, and will be; but it should be understood that devotion of this kind cannot save a technical society from perishing of constitutional weakness. Whether the society is a small local one or aspires to national importance, it can only be saved by all the members doing their duty by it in their degree—the prominent ones not flagging after they have made out of it such advantage as the highest office can bring; the less distinguished not resting content with the state of insignificance to which but for others the whole organization would be brought through them.

Not long since, a contemporay, *Engineering*, published an article upon the work of Technical Societies, which was well worth reading. Contrasting the state of knowledge during the ages when "the exponents of the arts delighted to speak of their callings as 'mysteries'" with that of the present time, the article sought to establish the conclusion that the chief cause of the difference is the modern practice of spreading information, to which nothing contributes more than the technical society and the technical press. The observation is made that the new order—the change from ancient and mediæval obscurantism to modern openness—was not really due, as is often said, to the invention of printing. We fully agree with this view; because books were cheap enough for most practical purposes in ancient Rome, and farther back still the Greek philosophers managed to get their ideas into all the circulation it was possible for them to attain by the very simple method of talking about them. Printing, when it came, was merely the new agent for the conveyance of the renascent spirit of the free disclosure of knowledge; and neither the modern journal not the modern society could exist if the willingness to share information were not pre-existent. Humanity is slow to learn; but among the lessons which it has conquered is that knowledge increases by spending. Those who refrain from mingling with their compeers are apt to lie under the suspicion of being tainted with faults of temperament to which they may in reality be strangers; but the surest way to escape from such disadvantages is to come out of one's shell, and live at least a part of one's life in the open. The decay of Gas Managers' Associations would be regrettable on many accounts, and not the least that it would inevitably tend to a repetition in the annals of the industry of that phase of occultism through which it had to pass when one gas manager knew not his nearest neighbour save as a possible rival for the scanty rewards of an imperfectly understood and inefficiently practised manufacture upon which the light of free criticism had never been allowed to shine. As it is, the gas engineer who wilfully withdraws from association with his compeers may have his excuse; but it is certain that he loses more than he can possibly gain from his aloofness.

Important Issues of Additional Metropolitan Gas Stock.—Readers of our advertisement columns will doubtless have noticed the somewhat unusual announcement of the issue of additional stock by the two principal Metropolitan Gas Companies. The Gaslight and Coke Company invite tenders for £100,000 of their ordinary "A" consolidated stock, the minimum price for which has been fixed at £292 per cent. As this stock brings the investor, according to our share-list to-day, £4 5s. 6d. per cent. for his money, applications for it are not likely to flag. Noon on Thursday next is the latest time for sending in tenders. The South Metropolitan Gas Company are about to sell by tender £20,000 of 5 per cent. perpetual debenture stock, the minimum price for which is fixed at £172 10s. per cent. This stock is yielding the investor £2 16s. 2d. per cent. The 1st prox. is the limit of time for sending in tenders.

COMMUNICATED ARTICLE.

NOTES ON CURRENT TOPICS.

By "Veritas."

It is a very open question, with regard to the illuminating power of gas, what particular quality would most pay the consumer and the producer. In making this comment, the question of illuminating power is solely referred to, and not the possible increase or decrease in the proportion of those compounds which are at present regarded as impurities. Parliamentary legislation with respect to the latter is perhaps not altogether sensible from all points of view. The limitation of "sulphur compounds other than sulphuretted hydrogen," to a fixed limit such as an ordinary gas company can conform to, is useful and reasonable in the public interest, inasmuch as there is no dispute that the products of combustion from these particular compounds are more or less injurious to health, and are also open to the suspicion of having a prejudicial action on wall-papers, picture-frames, and the binding of books.

With reference to the limitation of the amount of ammonia permissible in the gas supplied to the public, this particular substance can hardly be regarded, in an ordinary sense, as an impurity. The only injurious effect on the consumer from an excess of ammonia in the gas supplied is the well-known corrosive action which it exercises on brass fittings. I am not aware that this form of so-called impurity in any way affects the products of combustion. At the same time, considering the commercial value of ammonia as a bye-product of the manufacture of gas, it is obviously to all gas companies' interests to remove as much as possible of this special substance on the works, and allow the minimum amount of it to go on to the district. Not only is this true, but the removal of ammonia from the gas in the process of manufacture is so simple, and the means for effecting it are so well known, that there is really no excuse, under ordinary circumstances, for any company to exceed the official limits.

As to sulphuretted hydrogen, the case is totally different. No trace of this form of impurity is, under prescribed conditions, allowable; and the delicacy of the test is so great that the most minute fraction of a grain, estimated by almost a vanishing decimal, is discoverable. There is no doubt that *free* sulphuretted hydrogen would be an objectionable compound in the atmosphere of rooms. It is probably normally present during an ordinary London fog, if the testimony of blackened silver plate is any evidence which a scientific chemist would certainly take as good and substantial proof. With regard to the presence of an infinitesimal quantity of sulphuretted hydrogen in the gas supply, the ordinary fittings are supposed to be sound; and if they are not in this condition, they are a source of distinct danger. If unsound, and presuming the gas supply to contain an amount of sulphuretted hydrogen far exceeding the parliamentary allowance, danger-point would be reached on the pure question of an escape of gas long before any injury would be incurred from the presence of sulphuretted hydrogen. Assuming that the usual gas-fittings are practically sound, which is normally the case, we have simply to deal with the possibility of a minute proportion of sulphuretted hydrogen affecting the products of combustion. From this point of view, an amount of sulphuretted hydrogen which might render a gas company liable to a penalty of £50 a day would not have an appreciably prejudicial effect on the consumer, as it would simply add a fraction of a grain of sulphur to that already allowed in the form of other compounds.

The question of the parliamentary regulation being so rigid with respect to the presence of the faintest trace of sulphuretted hydrogen in the gas supplied to the public, regarded from an ordinary common-sense point of view, must thus seem absolutely ridiculous. The only redeeming feature of this rigid and extreme regulation is that the removal of sulphuretted hydrogen can be easily and efficiently accomplished by well-known means, and without the exercise of extreme scientific skill.

In dealing with the parliamentary regulations of public gas supply, the question of illuminating power is a distinctly debatable one. In some districts, 20-candle gas is supplied; in others, gas of only 16-candle value; while in the case of some provincial gas companies, the Special Acts under which they are working only require a standard of 14 candles. The fact of some districts being satisfied with the lower-grade gas has been made a pretext, by authorities whose high position in the gas world should carry considerable weight, that the supply of gas of high candle power is unnecessary, and that a comparatively low illuminating value would be sufficient for all public requirements. The argument has, indeed, been carried so far that it has been seriously discussed whether it would not be advisable to reduce to a lower limit the 16-candle standard of gas supplied to London. The only claim for this being done would be that, if the natural gas ordinarily produced from the coal could be supplied to the consumer, the expense of enrichment would be avoided, and that the cost of the gas would be proportionately reduced.

This question of low-grade gas demands serious consideration, and involves much complication. An ordinary consumer who uses most of his gas for illuminating purposes would have to employ a larger proportion to produce a definite light, if the quality of the gas, *quoad* lighting power, were deteriorated. He would thus, while obtaining gas at a cheaper rate per 1000 cubic feet, naturally use more of the material to obtain the same quantity of light that he had been previously accustomed to. With regard, however, to the application of gas to the purposes of heating and motive power, for which it is coming into increased demand, it is questionable whether the value of the gas to the consumer from this point of view would be proportionately deteriorated by a small diminution in lighting value. So long as a particular company have to supply gas to the public of an illuminating power higher than that normally produced by the coal employed in its manufacture, some light-giving adjunct must necessarily be resorted to. Whether cannel coal is employed for this purpose, or whether the more modern practice of carburetting by other materials, is adopted, the result in all cases must be an increase in the cost of manufacture; the expenditure for enrichment depending on the material used and its efficiency.

Putting on one side, for the present, the possible advantage of substituting carburetted water gas for normal coal gas, the necessity for enriching the latter, under existing regulations, must be recognized. Of materials available for this purpose, there are, in the first place, various grades of petroleum spirit, the limit of which is possibly reached with a specific gravity not much exceeding 700. The use of benzol has been strongly advocated; but the disadvantage of this special material is the extreme fluctuations in its market value, and therefore of its consequent cost as an enriching material. We have in addition the fact already previously known to competent authorities, but recently prominently alluded to in the letter to the JOURNAL by Mr. E. Llewellyn Pryce (*ante*, p. 1090), that commercial benzol contains sulphur compounds, and that gas companies working under sulphur restrictions might find this a serious drawback in the employment of this special material. There is no doubt, according to all the published statistics, the value of benzol as an enricher is far superior to any other material in the market; but the question of its employment in preference to lighter grades of petroleum spirit which are more readily available, and of which the supply is far more plentiful, must be a question of price in proportion to efficiency. The use of petroleum spirit has at least this one merit, that there has been in no case any suspicion of its containing sulphur compounds in any form.

In the modern system of enrichment by carburetting, dependent upon the vaporization of volatile fluids into the clean gas there are many points for consideration which have not as yet been thoroughly investigated. Initially, the ordinary manager might consider the problem practically solved in forming a judgment with regard to two different classes of material, if he were informed of the three special details of cost, volatility, and power of enrichment. One detail, however, is missing, and that is what is commonly termed "carrying power." Certain grades of hydrocarbons will seem to blend perfectly with the gas, and afford an apparently satisfactory result on the works; but the question of absolute permanency when the gas has to travel a long distance, is still more or less an unsolved problem.

Accident to a Water Intake.—A few weeks ago, the submerged steel intake of the water-works of Toronto (Ont.) made its appearance on the surface of the bay at two points. The upper portion of one of the flanged joints of the floating pipe opened about 2 feet, necessitating breaking the balance of the joint before the pipe could be lowered. In the winter of 1892, a somewhat similar accident occurred at Toronto, the pipe breaking through the ice.

Issue of Additional Debenture Stock of the East London Water Company.—In response to the invitation recently contained in our advertisement columns, there was keen competition for the £125,000 of 3 per cent. debenture stock which the Directors of the East London Water Company a short time ago decided to issue; the minimum price being par. The highest accepted tender was at £6 10s. 6d. per cent. premium; the lowest, at £4 11s. per cent. The average being £4 16s. 6d. As a proof that the investing public have not lost confidence in the Company's stock, it may be mentioned that the amount was tendered for five times over.

A Useful Pamphlet for Gas Consumers.—We have received from the Secretary of the Sheppy Gas Company (Mr. A. W. Marks) a copy of the new edition of the useful little pamphlet issued by them under the title of "A Few Words about Gas Lighting in Dwelling-Houses." The remark has at times been made to us that some gas managers are not sufficiently on the alert to "push" their commodity. This cannot be said of Mr. Marks. In the space of a dozen small pages, he sets forth the advantages and cost of gas as compared with the dangers of oil, deals with the question of fittings and their hire or purchase, explains how to read a meter, and furnishes estimates for fitting up houses. Here, in a nutshell, is all that a possible consumer wishes to know. But the author also slips into his pamphlet a leaflet in which he offers a few useful remarks on the prepayment system and the economy of coke as fuel. Mr. Marks will be pleased to send a copy of his pamphlet to any manager on receipt of a penny stamp to cover postage. The Company's offices are at Sheerness-on-Sea.

TECHNICAL RECORD.

NITROGEN AND THE NITROGEN PRODUCTS DERIVED FROM COAL.

The following is an abstract-translation of the paper read by Dr. Knublauch at this year's meeting of the German Association of Gas and Water Engineers at Cologne. The full text of the paper is given in the *Journal für Gasbeleuchtung* for Nov. 30 and Dec. 7.

The behaviour of the carbon and hydrogen of coal on distillation is the chief point of interest in gas or coke manufacture. At the coke ovens, the aim is to obtain the greatest quantity of carbon as solid residue; in the gas-works, it is to hold as much carbon as possible in combination with hydrogen—and especially in those combinations which form the best illuminating hydrocarbons. The choice of coal and the conditions of production—more particularly the temperature of distillation—are the most important factors in producing the best illuminating gas. It has been shown that benzol and a small quantity of toluol are chiefly responsible for the illuminating power of gas; but exposure to a somewhat higher temperature will partially destroy them, with formation of graphitic carbon and so-called diluents. But besides the constituents of coal which on its distillation yield gases suitable for producing light and heat, there are certain other constituents, occurring in inconsiderable quantities, which claim attention. These are sulphur and nitrogen, of which the latter is the more important, since certain of its products have a very high market value. The nitrogenous products of distillation were regarded for some time as very troublesome, and even to-day in gas-works are often considered of secondary importance, though costly ammonia-recovery apparatus is attached to coke-ovens. The importance of the nitrogen products from coal will be sufficient justification for the publication of the following results of experiments and observations, made during a number of years at the Cologne Gas-Works, and subsequently in the author's laboratory.

The amount of nitrogen is very variable in different sorts of coal, and even in the same kind. There is from 1·3 to 1·6 per cent. in Westphalian coal. The proportion that is converted to valuable compounds is, however, very small; forming only from 0·2 to 0·25 of the weight of Westphalian coal. The enormous amount of coal distilled daily in gas-works and coke-ovens, makes the total quantity of these easily obtained compounds very large indeed. The daily demand of a million tons of coal over the whole globe, corresponds to a yield of ammonium sulphate of about 10,000 tons daily, taking the nitrogen recovered as ammonia at 0·2 per cent. of the coal. The coal used at Cologne puts yearly into the gas-retorts alone about 1000 tons of nitrogen, of which 200 tons is recovered as ammonia and cyanogen; and these, reckoned as sulphate, may be valued at £12,500. It may appear remarkable that ten years ago we knew nothing of the remainder of the nitrogen; and only quite recently the matter of its disposition has been solved, in the course of a determination of the proportion which is converted to cyanogen.

We have seen that no certain relation exists between the nitrogen content of coal and the yield of nitrogen products; but until recently it was deemed correct to calculate the one from the other. This ignorance had two causes. On the one hand, too little value was attached to chemistry in the gas industry (and this remains the case); and, also, until the nitrogen question was better understood, probably there was no gas-works at which the products could be so separated as to enable any molecule of the coal distilled to be traced in any form in the products obtained. When this had been effected very well in Cologne, after the chemical bearings of the subject had been properly worked out, the nitrogen question again came to the front. The defects in wet purification and in the liquor works having been disposed of by chemical guidance, experiments showed that the ammonia completely extracted from the gas in the gas liquor yielded only 9·6 to 10 parts of sulphate per 1000 parts of coal—corresponding to a percentage of nitrogen in the coal of nearly 0·2 only. Estimations of the nitrogen in the coal carried out at the same time, showed seven to eight times that quantity—corresponding to 70 to 80 parts of sulphate per 1000 parts of coal. Attempts to convert more nitrogen into ammonia were so far successful; but, on the other hand, disadvantages accrued, and the new processes were put on one side. The most memorable were the addition of lime to the coal before distillation, and the passage of steam over the incandescent coal and coke.

What becomes of the 86 to 88 per cent. of the nitrogen of the coal unaccounted for hitherto? A very small quantity occurs as cyanogen in the gas and as nitrogen bases in the tar; and there are only the coke and the gas where the residue may possibly be found. Actually, analyses showed a great quantity of nitrogen in the coke. The nitrogen content of the coke may even be higher than that of the coal, especially when the volatile nitrogen is small in relation to the total volatile matter of the coal. Nitrogen is not, like sulphur, detrimental to the use of the coke; and estimations of it were not therefore carried out for the valuation of the coke. Without entering closely into the question, we gain the impression that, with a higher temperature in the retorts, the nitrogen will not remain in the coke. After estimating in addition the nitrogen in the tar and the nitrogen as cyanogen in the gas, no other nitrogen compounds are in the products; and the surplus nitrogen must be free in the gas.

Exact results are scarcely obtainable in large-scale working, or only after long-continued trials; and therefore a laboratory apparatus was devised for distilling the coal. By this, it was found that the generally possible yield of ammonia could be determined for various coals, and variations made dependent only on the choice of the coal. The results of experiments proved: (1) That the nitrogen content of the coal and its distribution among the different products are not in any degree proportional. For example, the yield of ammonia may be much greater from a coal of low than from one of high nitrogen content. This statement is also true of the other nitrogen products. Thus, a sample of coal containing 1·176 per cent. of nitrogen yielded 0·1874 as ammonia; one containing 1·555 per cent., yielded 0·1850; and one containing 1·479 per cent., yielded 0·2086. (2) These variations are frequently very great with coal of different origin, and often small with the same kind, though even then they are sometimes very considerable.

Foster has investigated the question as far as English coals are concerned; and Schilling has made some experiments with various kinds. The yield of ammonia found is confirmed in the three series of observations. The yield for different kinds of coal in coke-ovens working on the large scale has been also determined; and a series of coal distillations has been made in which the ammonia has been completely extracted from the gas and liquor. Though more recently introduced at the coke-ovens, ammonia-recovery is often better carried out there than in many gas-works. A large number of distillations of many kinds of coal have been made by the author to ascertain the yield in the various products. The average yield of sulphate of ammonia for coal from fifteen different sources is shown in the following table:—

Experiments on the Distillation of Coal.

Source of Coal.	Number of Tests Made.		Average Yield of Sulphate per 1000 Parts of Coal.
Westphalia (*a*) gas coal	6	..	10·4 parts.
,, (*b*) cannel (so-called)	3	..	7·7 ,,
,, (*c*) coke-oven coal	9	..	11·0 ,,
Upper Silesia (*a*) gas coal	1	..	13·5 ,,
,, ,, (*b*) coke-oven coal	8	..	
Lower Silesia (*a*) cas coal	2	..	7·7 ,,
,, ,, (*b*) coke-oven coal	3	..	8·4 ,,
Saar	6	..	8·2 ,,
England, gas coal	3	..	16·4 ,,
Belgium	1	..	6·8 ,,
Moravia, coke-oven coal	3	..	10·6 ,,
Russia	1	..	11·8 ,,
North America	10	..	9·4 ,,
South America	1	..	13·3 ,,
Italy, lignite-like coal	2	..	28·9 ,,
Bohemia	2	..	7·4 ,,
Scotland, cannel	2	..	7·9 ,,
Spain	1	..	2·3 ,,
Australia	2	..	1·9 ,,

In choosing coal for gas making, it is desirable to ascertain the yield of tar, ammonia, and sulphuretted hydrogen, as well as that of coke and gas. The difference in yield of ammonia varies in importance according to the current prices of ammonia compounds. The difference between 8 and 12 parts per 1000 parts of coal, would mean, to a works like Cologne, the difference between 700 and 1050 tons of sulphate per year—that is to say, about £4000 value. It is also of considerable importance to know the yield of sulphuretted hydrogen from a coal, especially in cases where the purifiers have occasionally to be worked to their utmost capacity. This yield also is in no degree proportional to the amount of sulphur in the coal. It is easy to choose coal which shall not throw a great burden on the purifying plant.

Returning to the nitrogen, a close examination of the amounts converted to ammonia reveals here and there considerable discrepancies, even with coal of the same origin. Thus, two tests of Westphalian coal give 12·6 and 9·6 of sulphate respectively; two of Upper Silesian coal, give 16·7 and 11·5 respectively. The above table reveals also very large differences in yield of ammonia in coals of different sources; English coal having the very high yield of 16·4 parts of sulphate per 1000 parts of coal. The differences in the yield of coals from the same source, one suited for gas making and the other for the coke-ovens, are also striking; and as regards Westphalian coal, the differences are exemplified in the results of the working at the gas-works and at the coke-ovens. This may be explained, since with the coals which produce more (or richer) gas and more tar, the affinity of hydrogen for carbon is favoured at the expense of its tendency to combine with nitrogen.

Reverting to the distribution of the nitrogen among the different products, we will, for the sake of simplicity, compare three samples of coal. The results are given in the next table. The ammoniacal nitrogen here ranges from 11·9 to 15·9 per cent. of the total nitrogen. The Saar coal, with the lowest content of nitrogen, gives the highest proportion of nitrogen as ammonia. The differences in the nitrogen in the coke and gas are especially striking. With Westphalian coal, about one-third of the nitrogen remains in the coke, and one-half passes into the gas; with Saar coal, two-thirds is in the coke, and one-sixth passes into the gas.

	Percentage of Nitrogen on the Coal.			Percentage of Nitrogen on Total Nitrogen.		
	Westphalian Coal.		Saar Coal.	Westphalian Coal.		Saar Coal.
	(1)	(2)		(1)	(2)	
Coke	0·4660	0·5260	0·7510	30·0	35·6	63·9
Gas	0·8560	0·6964	0·1896	55·0	47·1	16·1
Ammonia . . .	0·1850	0·2086	0·1874	11·9	14·1	15·9
Cyanogen . . .	0·0268	0·0268	0·0480	1·8	1·8	4·1
Tar	0·0212	0·0212		1·3	1·4	
Coal . . .	1·5550	1·4790	1·1760	100·0	100·0	100·0

The import of this is seen in the effect on the percentage of nitrogen in the gas. On converting the weights of nitrogen yielded to the gas into volumes, and taking an average make of gas from the coal, it will be found that the gas from the coal contains a percentage of 2·4 and 2·0 with the Westphalian samples, and only 0·54 with the Saar coal of nitrogen derived from the coal itself. The behaviour of the nitrogen is much more favourable to the gas with Saar coal, as the volume of this constituent, which so diminishes the illuminating power of the gas derived from it, is only one-quarter to one-fifth of the volume derived from the Westphalian coals.

The ammonia formed in the distillation of the coal must be completely secured in a marketable form. It will suffice, in this connection, to point out here that it is often easy to abstract the whole of the ammonia even with apparently inadequate plant. Recent observations have convinced the author that in many cases where only two-thirds to three-quarters of the ammonia was abstracted, a change in the working based on experiments resulted in the whole being secured, and without extension of either condensing or washing plant. No gas-works should be content with much less than the yield of ammonia indicated in the table given above for particular kinds of coal—for instance, 10 or rather more parts of sulphate per 1000 parts of Westphalian coal. Supposing a works of the size of Cologne only put two-thirds of the ammonia produced in the retorts on the market, the deficit due to the loss of ammonia would amount to about £3000 net profit, while many indirect disadvantages would be incurred. About 0·2 to 0·6 part of sulphate per 1000 parts of coal can generally be obtained from the water in the tar, and this is not usually recovered at the gas-works.

(To be continued.)

Consolidation of Gas Plants in New Jersey.—We learn from the *Engineering Record* that Messrs. Emerson M'Millin and Co., of New York City, representing a Syndicate headed by them, have purchased the gas and electric lighting plants of Long Branch, Red Bank, and Asbury Park (N.J.); and franchises covering the entire ocean front from Seabright to Sea Girt, about 20 miles, except Ocean Grove. The Consolidated Gas Company of New Jersey has been formed to develop and operate the properties. It is said the works will be enlarged so as to produce about 250 million cubic feet of gas per annum.

Received.—"Gas Manufacture: The Chemistry of. A Practical Handbook on the Production, Purification, and Testing of Illuminating Gas, and the Assay of the Bye-Products of Gas Manufacture. For the Use of Students, Chemists, and Gas Engineers." By W. J. A. Butterfield, M.A., F.C.S., Head Chemist at the Beckton Gas-Works. With numerous illustrations. (London: Charles Griffin and Co., Limited, Exeter Street, Strand.)——We have received from Mr. R. S. Carlow, of Arbroath, the Secretary of the North British Association of Gas Managers, the report of the proceedings at the meeting of the Association held in Melrose in July last. Appended thereto is the statistical report of the gas supply in Scotland, dealing with the period from July 31, 1894, to Aug. 1, 1895, prepared by the Committee of the Association.

Personal.—The Directors of the Tonbridge Water Company have presented their Chairman, Mr. John Fagg, with his portrait, enclosed in a handsome gilt frame, in recognition of his twenty-one years' connection with the directorate. Mr. Fagg has been Chairman of the Board for the past ten years. The presentation was made by Mr. Hodgskin, who expressed, on behalf of his colleagues, the hope that Mr. Fagg might continue for many years at the head of the Company, and see it go on as prosperously as it was doing now. Mr. Fagg, in acknowledging the gift, said he trusted he might be spared for some time to give his attention to the Company's affairs, and to witness its continued prosperity. The Company's Engineer and Secretary (Mr. J. Lees) then gave a brief sketch of the progress of the undertaking during Mr. Fagg's chairmanship; and the Chairman acknowledged the Directors' indebtedness to Mr. Lees for a great deal of excellent practical advice. Prior to the presentation, the Directors visited the pumping-station, and expressed their great satisfaction with the changes Mr. Lees had brought about there.——Messrs. Stevenson and Burstal, MM.Inst.C.E., have been engaged by the Faversham District Council to carry out their new water-works at Boughton-under-Blean, which, as mentioned in the JOURNAL last week, have just been sanctioned by the Local Government Board.

SOCIETY OF ENGINEERS.

The Forty-second Annual General Meeting of this Society was held on Monday last week, at their rooms, No. 17, Victoria Street, S.W.—Mr. W. G. Peirce (the President) in the chair. The following gentlemen were duly elected by ballot as the Council and officers for 1896: As President, Mr. S. H. Cox; as Vice-Presidents, Messrs. C. C. Carpenter, G. Maxwell Lawford, and W. Worby Beaumont; as Ordinary Members of Council, Messrs. J. Bernays, G. Burt, J. C. Fell, C. Gandon, P. Griffith, C. Mason, H. O'Connor, and S. Sellon; as Honorary Secretary and Treasurer, Mr. Perry Fairfax Nursey; as Honorary Auditors, Messrs. Alfred Lass, F.C.A., and Samuel Wood, F.C.A. The proceedings terminated with a vote of thanks to the President, Council, and officers for 1895, which was acknowledged by the President.

The Annual Dinner of the Society took place at the Holborn Restaurant on Wednesday—Mr. W. G. Peirce presiding. After the usual loyal and patriotic toasts had been duly honoured, Mr. J. W. Wilson proposed "The Society of Engineers," and congratulated the Society on the useful functions it continues to discharge. The President, in responding, said the papers read at the ordinary meetings had been on most interesting subjects, had been carefully prepared, and had evoked good discussions. He dwelt upon the value of belonging to scientific societies, and said that much valuable experience could be gained by joining those where opportunities were freely given to the members—both old and young—to take part in the discussions on the papers submitted. The summer vacation visits to engineering works had been of great interest. They had been well attended, and had proved most beneficial to all who availed themselves of the invitation to join in them. Lastly, the President advised all the younger members of the profession to take advantage of the opportunities offered by the Society both at ordinary meetings and at the vacation visits; for though the modern technical educational establishments did a great deal, there was much to be learnt in actual workshop experience and by visits to works in progress. Mr. Perry F. Nursey and the Secretary (Mr. G. A. Pryce Cuxson) also replied; the latter stating that in the last ten years the membership of the Society had increased by 30 per cent. Other toasts followed. During the evening, a good selection of vocal music was given under the able direction of Mr. J. A. Brown.

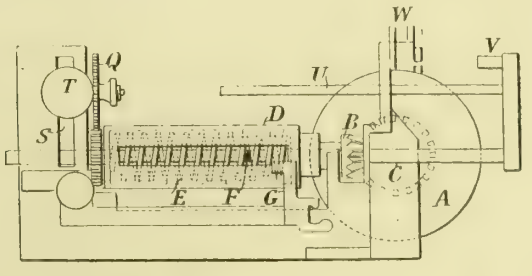
REGISTER OF PATENTS.

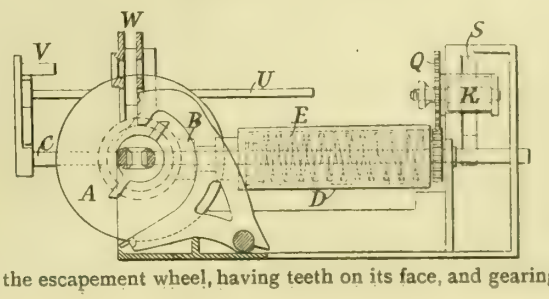
Convertible Lighting and Cooking Burner.—Maule, C., of Handsworth, Birmingham. No. 21,216; Nov. 5, 1894.

This arrangement consists of a small metal funnel, inverted over a gas-burner; the spout of the funnel being either cylindrical or sloping outwards to the top. The base of the funnel-cone is closed by a shutter (for admitting or excluding air) composed of two parts—the one moveable, and the other fixed. The fixed part crosses the middle of the base of the funnel, and has fixed in its centre a cylindrical socket—extending vertically inwards—of such height and diameter as to fit the burner, yet so as to move on and off easily. The moveable part is a slide revolving round this socket, and of such shape as when closed to entirely exclude air from the funnel, but when open to exactly coincide with the fixed part.

Coin-Freed Gas or Liquid Supply Apparatus.—Alexander, W., and Thompson, W. E., of Birkenhead. No. 22,217; Nov. 17, 1894.

In this arrangement of coin-freed meter, the patentees propose to employ preferably an escapement wheel rotated through a certain angle on the insertion of each coin, by means of any suitable coin-feeding device—such as that described in their former patent No. 20,475 of 1894. In this way, by means of gearing to be hereafter described, a cock, valve, switch, or the like is operated so as to release the supply mechanism; and also by the action of the meter after a certain quantity of gas has been supplied, or by the action of a time-keeping device after a certain time has elapsed, it operates to shut off the supply.





A is the escapement wheel, having teeth on its face, and gearing with

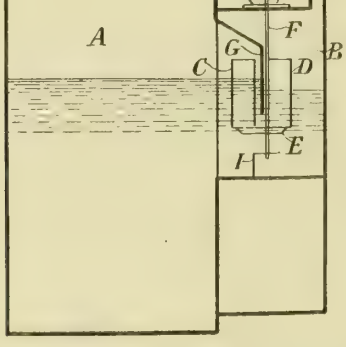
a bevel-wheel B, mounted loosely on the spindle C. D is a tube or cylinder, also mounted loosely on the spindle C, and carrying a toothed wheel, which gears with the ordinary index of the meter. E is a helix or spiral, fixed to the bevel-wheel B, and operated thereby on the insertion of a coin. F is a stop, mounted on the spindle C, so as to be free to rotate, but having no longitudinal movement thereon. It passes through a slot in the cylinder D. Thus, if the escapement wheel be rotated by the insertion of a coin, it will cause (by means of the bevel gearing) the helix or spiral E to rotate also; and the stop F, which engages in the coils of the helix, will be moved away from the catch G, which operates a valve or cock, so as to liberate the supply mechanism. The stop F is prevented from rotating during this movement by engaging a slot F^1 in the cylinder D, which latter (as before stated) is geared to the meter mechanism. When the projection F has travelled a distance proportional to the number of coins inserted, the cylinder is then rotated by the meter mechanism in a direction similar to that in which the helix was rotated, thereby causing the projection to travel along a spiral path back again to its original position, and shut off the supply. As the stop leaves the catch on the movement of the coin mechanism, a projection comes in contact with an arm of the catch, and forces the latter down so as to open the valve.

If a change of price takes place, adjustment of the mechanism is effected by changing a wheel in the gearing between the scape-wheel and the meter or time-keeping device and the stop mechanism. In the engraving, such a wheel Q is shown, carried in a moveable bearing R, which moves in a slot S, and is secured in any desired position by a set-screw T.

The effect of inserting a number of coins successively is to cause the stop F to be removed farther from its normal or shut-off position, and to require a correspondingly prolonged action of the meter or time-keeping device to move it back again; and so a greater or less quantity of gas will be delivered in proportion to the number of coins inserted. A pointer moving on a dial (not shown) may be attached to the arm U, which works in harmony with the stop F on the spindle C, and indicates the amount of gas still unconsumed. Moving with the arm U and spindle C is a bolt V, which, when a predetermined number of coins have been inserted, enters the coin-slot W, and prevents the insertion of any more coins until (under the action of the meter) the bolt is withdrawn.

Gas and Liquid Meters.—Alexander, W., and Thompson, W. E., of Birkenhead. No. 22,217A; Nov. 17, 1894.

This invention relates to wet gas-meters, and consists in an improved arrangement of float and parts appertaining thereto for actuating the valve which cuts off the supply when the water-line is lowered to a given extent.



A is the measuring chamber of the meter; and B, the chamber into which the gas enters. C D are two portions of a float—in this instance rigidly attached by a link-piece E. The link-piece can, however, be connected by hinges to the floats, and the floats be guided vertically in any required manner. F is the valve-spindle; and G, a diaphragm dipping below the surface of the water, and serving to separate the entering gas in the chamber B from that in the measuring chamber A. H is a valve on the spindle F; and I, a guide for the spindle below the level of the water. The spindle F is attached rigidly to a portion of the float, or else jointed to the connecting link, if the latter be hinged to the two portions of the float. In the latter case, the two portions of the float, or the length of the connecting link and the position of attachment to the valve-spindle in the connecting link, are so proportioned that, no matter how the gas pressure fluctuates and the water on one side of the diaphragm is lowered and that on the other side raised, the point of attachment of the spindle to the link shall remain at approximately one uniform height, with a given quantity of water in the meter, although the heights of the two portions of the float may vary widely according to the pressure of the gas. The centre of specific gravity of the entire float, however, remains approximately at rest. By this means, when a difference of pressure occurs, the water on one side of the diaphragm falls; and with it falls also the portion of the float on that side of the diaphragm. The water on the other side, however, rises; and with it the portion of the float on that side of the diaphragm. There is, however, one point in the link which, in such case, will remain stationary as regards vertical movement; and that is the point to which the valve-rod is attached. The float will thus act in exactly the same manner as an ordinary float would act with a general rising or falling of the water-level throughout the whole meter; but at the same time the valve-rod will remain steady, notwithstanding any oscillation of the water-level under fluctuating pressures.

Gas-Engines. Heys, W. E.; a communication from L. Letombe, of Paris. No. 24,133; Dec. 12, 1894.

This invention, relating to gas-engines of the "Otto" cycle type, is carried into effect by furnishing the cylinder end with two valves acting in opposite directions—one tending to open upon a reduction of pressure within the cylinder, while the other tends to close. This latter valve is also operated by a cam or other suitable device from the governor. A chamber of any suitable capacity is situated between the two valves. The first valve, which opens upon a reduction of pressure within the cylinder, has an enlarged stem open to the air, and is normally maintained upon its seat by a weak spring. The second valve, in opening, allows the air and gas to pass—the air passing around the valve, and between it and its seat; and the gas entering through holes formed in the seating.

Upon the commencement of the aspiration stroke, both valves are opened—the first by the reduction of pressure in the cylinder; the second, by the action of the cam. The piston then continues to move forward; and the explosive mixture enters the cylinder. The point at which the second valve cuts off the supply is regulated by the governor, so that the first valve remains open under the influence of the diminishing pressure in the cylinder.

In a double-acting engine, valves are placed at each end of the cylinder; and, in order to avoid the passage of gas from one side of the piston to the other, the piston is divided, or else provided with an annular cavity, which, if desired, may be in communication with the air through a hollow piston-rod.

Gas-Heated Irons, &c.—Eves, J. V., and O'Brien, W. D. and L. F., of Belfast. No. 189; Jan. 3, 1895.

This invention relates to apparatus heated by an internal flame of gas mixed with air—such as smoothing-irons, calendering-rollers, the cylinders or rolls of smoothing-machines, artificers' furnaces, for dental or other work, &c. It consists essentially in constructing a closed combustion chamber, connected with a gas and air supply on the one hand, and on the other with a positive exhaust set up by a fan or other like contrivance, whereby the gas and air are drawn into the combustion chamber, and the products of combustion are drawn into a flue, and thence carried outside the building.

Linings and Shelf-Carriers for Gas-Ovens.—Russell, W., Clare, A., and Fletcher, Russell, and Co., Limited, of Warrington. No. 601; Jan. 10, 1895.

The patentees propose to construct the shelf-carriers or linings of gas-stoves with lugs or projections upon one or both side edges; the lugs on one edge being capable of engaging behind a flange or with a groove formed in either the vertical door-frame or the back-frame of the oven. Upon the lining or shelf-carrier is cast a hook, with a corresponding catch or staple upon the inside of the oven-casing. Alternatively, the positions of the hook and of the staple or catch may be reversed; or, if the lining or shelf-carrier is provided with lugs or projections upon two edges, the second series of lugs engages with hooks or similar devices.

Hot-Plate Grids for Gas Cooking-Stoves.—Russell, W., Clare, A., and Fletcher, Russell, and Co., Limited, of Warrington. No. 602; Jan. 10, 1895.

The object of this invention is to provide means for holding the bars of hot-plate grids of gas cooking-apparatus firmly in place, and yet to enable them to be readily removed and replaced or substituted when required. At each end of the bars is formed any suitable kind of projection, lug, or the like, adapted to fit into corresponding recesses formed in the hot-plate, or to otherwise similarly engage therewith. At one end (preferably the back), there is formed, below each recess on the hot-plate, a flange or corresponding projecting part; and on the corresponding end of each bar is formed a projection or groove, capable of engaging the flange on the hot-plate. At the opposite end of each bar, there is a holding-down device, which may be variously constructed, but which consists preferably of a pin or projection passing perpendicularly downwards through a hole in the hot-plate, and secured by pins, cotters, nuts, or the like.

Internal Combustion Engines.—Wain, J., of Kennington, and Horsey, J. G., of Shortlands. No. 973; Jan. 15, 1895.

This invention connected with internal combustion engines, consists in closing the front end of the cylinder by a cover, gland, stuffing-box, or other means, and making the piston hollow; while ports and valves are arranged in the piston block and cylinder. The back-stroke of the piston draws a charge of gas and air, or vapour and air, into the front end of the cylinder, where it is retained by a valve. The forward stroke compresses this mixture into the hollow piston, where it is retained by a valve until about one-fourth of the return-stroke is completed, when the charge is admitted into the back-end of the cylinder by suitable ports and valves. The further motion of the piston compresses the charge, which is suitably exploded for forcing the piston forward in the usual manner.

Lighting and Extinguishing Gas-Burners Electrically.—Orling, A., and Wollert, O. E., of Stockholm. No. 1085; Jan. 16, 1895.

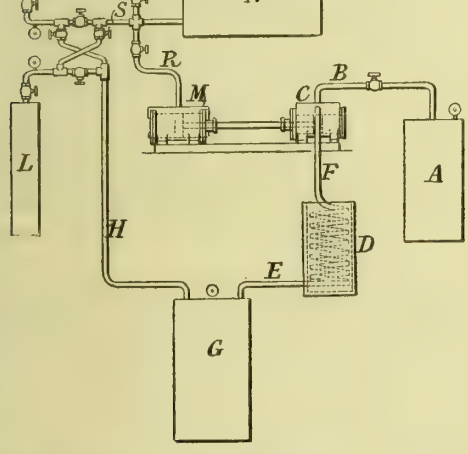
This apparatus for lighting and extinguishing gas-burners is of the class in which an electro-magnet is arranged with its armature in conjunction with a ratchet-wheel upon the plug of a gas-cock, and with a moveable bar of a spark producer, in such a manner that, when the armature is moved, the cock is opened and the spark produced to ignite the gas; and when the armature is again attracted, the gas is extinguished. To effect this, the patentees employ two electrical circuits, one of which serves for igniting the burner, and the other for extinguishing it. For this purpose there is arranged upon the plug of the cock, in addition to the ratchet-wheel operated by a pawl upon the magnet armature, a cam or "snail," which operates two contact-springs in the two electric circuits in such a manner that, when one spring is in contact with a contact-piece arranged in conjunction with it, the other spring is out of contact with its corresponding contact piece. With this arrangement, when the circuit is closed, the armature will keep on vibrating until the cam upon the plug is rotated sufficiently to break the circuit; and when the other circuit is closed, the same action

will again take place. The spark producer is arranged in conjunction with the armature magnet in the ordinary manner.

When applied to a series of burners (as, for instance, to the burners of the lamps of railway trains), there are arranged in conjunction with the spring-contacts two other contacts, two of which serve for the local burner, and two for conveying the current to the next burner of the series. By this arrangement, the whole series of lamps can be lighted in succession; each succeeding one being operated as the preceding one is lighted.

Enriching Water Gas with Acetylene.—Lake, H. H.; a communication from E. N. Dickerson, of New York. No. 11,848A; June 18, 1895.

This invention mainly relates to a process for increasing the illuminating power of water gas by the addition of acetylene in determined percentage. In the words of the patentee: "If acetylene as an enricher is added to water gas, the illumination at first is very high, but after a few hours decreases. It is, therefore, practically impossible to enrich water gas at the works by acetylene, and thereafter supply such enriched gas through the mains. This invention is, therefore, primarily designed to supply the enriching material to water gas practically at the point of consumption. . . . My process also enables the mixing, in practically predetermined quantities, of two gases—as, for instance, acetylene and air, or acetylene and water gas or coal gas; the whole being automatically controlled. I do not broadly claim to be the inventor of the addition of acetylene to water gas as an enricher; but the present invention is based upon a means of remedying a difficulty never known to exist, and the remedy of which never was discovered until this invention. The difficulty consists in the fact that, unlike other enrichers, acetylene will disappear (in part at least) as an enricher, if it remains in contact with water gas for a considerable time—as, for instance, during the period in which gas is stored in gas-works until its delivery to the consumer. It is also based upon the discovery of the law that, unlike other chemical combinations, the combination of the acetylene, or its conversion into some other hydrocarbon, does not occur immediately, but only after a period of contact between the water gas and the acetylene; and that, therefore, the acetylene can be added at the place of consumption without losing its illuminating power, while it cannot be so added in the ordinary way at the works."



By the process described in the specification, a single main can be used to supply heating and illuminating gas; the illumination being added to such portion of the gas as it is desired to use for illuminating purposes, and the remainder being burned for fuel. It is possible also by means of the invention to mingle the gases under high pressure, as well as under the normal or burning pressure last described, by employing the expanding power of one of the gases to accomplish the compression of the other gas.

For the proper burning of acetylene in ordinary burners, it is important (says the patentee) that the acetylene should be mingled with air, either in equal proportions or in proportions varying from 40 to 50 per cent. of air and 60 to 50 per cent. of acetylene, though, of course, other proportions may be utilized. In his present description, however, he refers to the mingling of equal quantities of air and acetylene. When acetylene gas is prepared from calcium carbide and water, it generates pressures, varying at normal temperatures from 600 to 3000 or 4000 lbs. to the square inch, dependent upon the internal temperature of the generator, which pressure can be utilized by this apparatus to effect the compression of the air to be mingled with it or supplied in a compressed condition. Another convenient source of acetylene gas is from cylinders containing the liquefied gas having (at ordinary temperatures) a pressure of from 600 to 700 lbs. per square inch. By utilizing the pressure of the escaping acetylene from either of these sources, the air is compressed to the desired pressure. This may be accomplished, if low pressures only are desired—say, 30 lbs. to the square inch above zero—by, in the first place, filling a chamber with air, and then allowing an equal volume of acetylene under pressure to enter, thereby compressing the air in the cylinder, and mingling it with the entering gas. The present apparatus is, however, especially designed for higher pressures—say, 150 lbs. to the square inch above the atmosphere—when the tanks containing the compressed gas become useful for transportation on vehicles or for similar purposes.

This part of the invention will be understood from a reference to the accompanying diagrammatic plan of the apparatus, wherein A represents a vessel containing acetylene under sufficient pressure to operate the plant, as, for instance, a vessel containing liquefied acetylene, or a vessel in which, water and calcium carbide being brought in contact, the necessary pressure is established. The pressure of the gas in A is carried by the pipe B to the motor C, operating an air-compressor M. The gas, having done its work in C, is expanded and very cold. Pressure can be restored to the gas, and the cold be utilized, by passing it through a heating-coil D, placed in brine to absorb the cold to be subsequently utilized, or it may be filled with flowing water, thereby adding pressure, if desired, to the escaping gas from the motor Whether such warming coil is required, depends upon the pressure desired in the transportation cylinders L L^1. Escaping from the coil D, the gas passes by the pipe E to the receiver G, of sufficient capacity to retain an excess of gas until it is required for the transportation cylinders. The air passing from the air-compressor by the pipe R, passes through a cock to the pipe S, communicating with the air-receiver N. In case the power of the expanding acetylene is not sufficient to compress the air to the requisite pressure, an additional supply of air may be carried to the receiver N from the air-compressor O by the pipe P.

To charge the shipping cylinders L L^1, it is only necessary in the first place to fill the chamber L with the requisite air pressure from the air-reservoir N. Having admitted, for instance, 75 lbs. of air to the cylinder L, as shown by the gauge, the first cock is closed, and the second one opened, when the acetylene compresses the air in the cylinder L by its own pressure from the chamber G, which must have a pressure in excess of 150 lbs., if that is the desired pressure in L. If 150 lbs. be allowed to enter into the cylinder L from the receiver G, substantially equal quantities of air and acetylene will be contained therein. The cylinder L can then be removed for transportation, by closing the cocks, and the cylinder L^1 can be similarly charged, while an empty cylinder replaces the cylinder L.

APPLICATIONS FOR LETTERS PATENT.

23,003.—Whitehead, J., "Repairing burst or fractured water-pipes." Dec. 2.

23,021.—Sykes, W. R., "Valves for water, steam, or other liquids or gases." Dec. 2.

23,022.—Toms, H. L., and Jackson, A. C., "Incandescent burners." Dec. 2.

23,024.—Griffin, J., and Pinchbeck, W. E. C., "Waste-preventer." Dec. 2.

23,028.—Johnson, S. A., "Burning hydrocarbon or other suitable oils in fire grates, stoves, ranges, or furnaces, for heating, cooking, or other purposes." Dec. 2.

23,046.—Tobler, A. C., "Gas-regulators." Dec. 2.

23,053.—Hantz, M. A. F. A., M. A. L. A., and E. E., "Mantle lamps." Dec. 2.

23,055.—Rickman, W. B., "Automatic apparatus for intermittent gas-lights." Dec. 2.

23,057.—Seeligmann, G., "Lighting material and apparatus." Dec. 2.

23,113.—Wise, W. L., "Gas-engines." A communication from the Buckeye Manufacturing Company. Dec. 3.

23,149.—Burgess, J. F., "Illuminant appliances for gas and other burners." Dec. 3.

23,150.—Burgess, J. F., "Gas-burners." Dec. 3.

23,170.—Thuman, F., "Gas-generators." Dec. 3.

23,179.—Thorp, T., and Marsh, T. G., "Gas and vapour burners." Dec. 4.

23,187.—Harding, R. & G., "Water supply by means of high-pressure cistern and retaining valve." Dec. 4.

23,224.—Bowing, J., "Manufacture of retorts and ovens." Dec. 4.

23,235.—Pitt, S., "Treating heavy hydrocarbons by means of heat, especially applicable for distillation and the manufacture of oil gas." A communication from La Société Internationale des Procédés Adolphe Seigle. Dec. 4.

23,288.—Dunscombe, M. E., "Pressure-regulator for gases or liquids." Dec. 5.

23,303.—Degroux, D., "Gas-lamps for lighting factories, work-rooms, and the like." Dec. 5.

23,323.—Stevens, G., "Indicating the frost or thaw in water-supply pipes, to prevent their bursting and explosion of kitchen boilers." Dec. 5.

23,346.—Bousfield, J. E., "Gas-burners." A communication from the Actiengesellschaft für Fabrication von Broncewaaron und Zinkguss." Dec. 5.

23,370.—Bentley, A., "Exhaust condenser and silencing chamber applicable to gas, oil, or other engines." Dec. 6.

23,388.—Hawkyard, J., and Braddock, J., "Prepayment gas-meters." Dec. 6.

23,417.—Sales, G. de R. de, "Gas and other like engines." Dec. 6.

23,418.—Sales, G. de R. de, "Igniter for gas and other like engines." Dec. 6.

23,514.—Dobbs, A. E., "Meters for water and other fluids." Dec. 7.

23,521.—Trouvé, G., "Producing, storing, and utilizing acetylene gas." Dec. 7.

Gas-Meter Rents at Batley.—There was a warm debate at the meeting of the Batley Corporation last Thursday on the question of abolishing gas-meter rents within the borough from March next. Mr. B. Turner initiated the discussion by introducing a special motion, which he justified on the ground of the large profits which had been made by the gas-works in past years towards the relief of the rates. Nearly £650 a year was realized out of gas-meter rents; and as the profits were made by the consumers, they were, he held, entitled to any advantage accruing in that way. The point of those who opposed the resolution was that out of 6000 meters 1300 were the private property of the consumer; and the question of compensation to the latter class would naturally have to be considered if there was to be any equity at all in the matter. In the end, the motion was withdrawn in favour of referring the question to the Gas Committee.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Extensions at the Plymouth Gas-Works.

SIR,—Will you kindly allow me to correct one or two inaccuracies in the report on the above subject in the last issue of the JOURNAL? You state: "When, some three years ago, the Directors began their present series of enlargements, everything of the most modern description was arranged for. . . . In the carrying out of this work, the Directors consulted Mr. John West, M.Inst.C.E., of Manchester. . . . Mr. West first turned his attention to the provision of the new retort-house," &c., &c.

Now, as a matter of fact, the contract was already let for the new retort-house, coal-store, and gasholder tank before Mr. West first called upon me; and I gave him the letter of introduction to the Chairman which led to the adoption at Plymouth of his stoking machinery and subsequent developments. The new retort-house, coal-store, and gasholder tank have been built as originally designed under my superintendence before Mr. West came near Plymouth; the only alteration due to him being accommodation for his coal breakers and elevators. The plans and specifications for the new engine-room, boiler-house, tar and liquor wells and tanks, boilers, and, in fact, the whole general design, were also prepared under my superintendence; and they have been erected according to those plans.

With respect to my management of the Company's works, I was appointed on March 25, 1890. On that date—

The reserve fund stood at	£14,736 15 7
The balance of the profit and loss account, at . .	26,278 13 10
Total	£41,015 9 5

I left on March 25, 1895, at which date—

The reserve fund stood at	£17,162 12 1
The profit and loss balance, at	23,908 15 8
Total	£41,071 7 9

So that the Plymouth Gas Company pulled through those five terrible years without lowering their reserves at all, and without increasing the price of their gas, which during all that period stood at 1s. 9d. per 1000 cubic feet all round—the lowest price in the world, although we were punished quite as heavily as other undertakings by the increased price of coals and labour. So that I think I can claim that the interests of the Company did not suffer in my hands.

H. TOWNSEND, Assoc.Mem.Inst.C.E.,
Late Engineer and Manager, Plymouth Gas-Works.

Wakefield, Dec. 12, 1895.

The Relative Prices of Crude Naphthas and Benzols.

SIR,—With regard to your quotations for 30 per cent. crude naphtha and benzols, I am very much astonished to see that, although 90's benzols have seemingly risen to about 2s. 4d., 30 per cent. crude naphtha is variously quoted at from 6d. to 9d. in different papers.

Taking crude naphtha at 6d. and 9d., and 90's benzols at 2s. 4d., this shows a difference of from 1s. 10d. to 1s. 7d. in these two quotations between crude naphtha and 90's benzols; whereas the margin during the last two years has, according to my information, scarcely been more than 8d. on an average.

The manufacturer of 90's benzol who continues to buy according to the recent and present quotations of the chemical journals—say from between 6d. and 9d.—does, therefore, now make a profit of say *about three times as much in making it into 90's benzols.*

This state of things is very unsatisfactory for those who, as I know in one certain case, have made contracts based on the quotations of your own valuable paper and two other chemical journals of standing. Naturally the expectation, in basing the contract in question, was that the margin between 30 per cent. crude naphtha and 90's benzol would remain at about the usual average level.

Can you or any of your readers explain how it is that this extraordinary state of things has come about; and would it not, in the interests of the trade, be better to entirely cease quoting 30 per cent. crude naphtha, if, as it would seem from information kindly vouchsafed to me from different sides, it is almost impossible to get reliable quotations for the 30 per cent. crude naphtha?

HENRY SIMON.

Manchester, Dec. 14, 1895.

P.S.—While you quote 9d. for crude naphtha, some other papers still quote 6d.—that is 50 per cent. less than the actual price. Such variations are exceedingly awkward.

The Prices of Ammoniacal Liquor and Sulphate of Ammonia.

SIR,—I very earnestly ask permission to make to you a personal appeal, based on the following particulars: My firm has for about a quarter of a century produced ammoniacal salts from the residual liquors of a considerable number of provincial gas-works. When it was first proposed to us that, instead of making speculative contracts for the purchase of residuals, of one or more years' duration, we should accept the invoices of each weekly or monthly delivery based on the quotations of the JOURNAL OF GAS LIGHTING, although recognizing the advantage of avoiding risky contracts, we nevertheless were unwilling to adopt the suggestion, on the ground that, however capable and honourable the Editor might be in his special sphere, it might reasonably be doubted whether his acquaintance with the movements of the chemical market could be sufficiently intimate to enable him to fix price levels with the accuracy necessary to form a basis for the invoices of the raw material of manufacture. But observing carefully for a very considerable time that (with very occasional exceptions) your weekly reports accurately recorded market fluctuations, and recognizing the high esteem in which all information given in the JOURNAL is held by the entire gas world, we at length not only adopted the suggestion when again made to us, but have since volunteered to make important contracts on the basis of your weekly quotations. Up to quite a recent date, the ratios between the prices of liquor and sulphate of ammonia have generally been in accord with the actual weekly movements of the market. But during the last three or four months, your figures have failed to represent the "spot" values of liquor, and I presume are intended to denote the prices at which extended contracts have been made, when buyer and seller agreed to recognize that future gains might compensate present losses. My meaning may be made clearer by definite references. Thus—

Date in JOURNAL.	Recorded Price of Sulphate per Ton.	Recorded Price of Liquor per Ton.
Average of the whole year 1892 .	£10 1 9¾	.. 6s. 3¾d.
Average of the whole year 1893 .	12 9 6	.. 8 6
Average of the whole year 1894 .	13 5 9	.. 10 0¼
In 1892—During June	9 12 6	.. 5s. to 6s.
Sept. 27 to Dec. 27 . .	9 18 6 to £10 5 0	.. 6 „ 7
In 1893—Jan. 31 to March 14 . .	10 5 0 to 11 5 0	.. 7 „ 8
Oct. 24 to Nov. 7 . . .	12 5 0	.. 7 „ 8
In 1894—Dec. 25	11 0 0	.. 6 „ 8
In 1895—Jan. 22	10 15 0 to £11 5 0	.. 7 „ 9
April 23	10 0 0	.. 7 „ 8
May 21 to June 4 . . .	9 15 0	.. 7 „ 8

Against these records, I beg to place that of last week, when you still value liquor at 7s. to 8s., although you report sulphate to have reached the lowest on record, and no less than £1 7s. 6d. below the April price of the present year.

It is well known to the initiated that, during the years that are passed, the position of the provincial distiller, basing his purchases on your valuations, has not been an enviable one. Taking into consideration the fact that the manufacture of sulphate is a nine months' industry, rating fairly the wages of superintendence, the cost of repairs, the depreciation of plant (which in a provincial works includes, in addition to the boiler, stills, tanks, pumps, &c., barges and railway tank-waggons), and the expenditure necessarily incurred in quite recent time to meet the requirements of the governmental and sanitary inspectors, it is easily demonstrated that there has never been more than a scant margin of profit.

But this truth would not have induced me to pen this letter. Nothing but the ruinous loss now being sustained through buying on your weekly reported values and selling at the highest obtainable levels, with the knowledge that it will be impossible to recoup later on, constrains me to undertake this most distasteful task, and to risk being thereby misunderstood. It is quite reasonable that all connected with the gas industry should hold in the very highest esteem any information given in a technical journal, conducted with such marked ability as is the JOURNAL. Hence, without any indication in your "notes" that the quoted values are for "time contracts," any representations that may be made by a chemical manufacturer may be expected to be ignored. I beg, therefore, to be permitted to suggest that your notes on market values may give the additional information that sulphate of ammonia is quoted free on board at ports and not free on rail at works, and also to state whether the weekly price of liquor is that of time contracts or of spot deliveries, and whether such price includes delivery at a chemical factory or on the gas-works, as the carriage from many small country gas-works cannot be ignored in making a valuation. Your quotations are more carefully studied by the thousand local gas managers than by the few who are located in populous or commercial centres; and it is with the former that the chemical manufacturer has more intimate relationships.

H. C. BROWN, Ph.D., F.I.C.

King's Lynn, Dec. 14, 1895.

[We much regret the condition of affairs complained of by Dr. Brown, and willingly accord him the help of publicity, which is the only check we can put upon our prices current reporters. Doubtless these gentlemen—whose good faith and competence we have never had reason to challenge—will take note of Dr. Brown's request for such additional information as to the meaning of the prices realized in certain instances as can fairly be published. We take this opportunity for repeating the warning to which we gave editorial expression in the JOURNAL for Feb. 14, 1893 (Vol. LXI., p. 262), in respect of the character and object of these reports. In so far as they have helped to break down the vicious long-contracts system, we are glad to know that our figures are found to be of definite practical use; but it must be distinctly understood that those who base their dealings upon them, do so at their own risk. That our information upon the state of the gas residuals trade from week to week is fairly accurate is, we are glad to note, conceded by Dr. Brown; and it seems proved by his omission to mention any better authority. Perhaps his difficulty would be overcome by the inclusion in his future contracts of a saving clause, permitting of some mutual rearrangement when the reported values of raw and finished products appear to get out of harmony with one another. We shall welcome further correspondence on this subject, and meanwhile acknowledge the temperate manner in which Dr. Brown has put his deplorable case.—ED. J.G.L.]

Old Gas and Water Literature.—A correspondent wants to learn of the present existence of any copies of the three following pamphlets, by William Matthews, the author of "A History of Gas Lighting": (1) "A Letter to the Lord Mayor on Gas Companies," Third edition published in 1828; (2) Facts, &c. Relating to the New River, 1835. (3) Gas Lighting Projects, 1836. Our correspondent says he has made diligent inquiry, and searched a large number of library catalogues—including that at the British Museum—without success. Perhaps some reader of the JOURNAL can help him.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Dec. 11.

(*Before Mr. Justice* VAUGHAN WILLIAMS.)

In re the South Kent Water Company.

This was a petition for winding up the above-named Company, presented by Messrs. James Oakes and Co.

Mr. JENKINS, who appeared for the petitioners, said the Company was incorporated by Act of Parliament in 1889; and it appeared to be an undertaking started and run by a Mr. Easton. In the year 1893, the petitioners supplied pipes, &c.; and in April, 1895, they obtained judgment for £826 9s. 5d., and levied two executions—one on the Company's premises in London (to which the return was *nulla bona*), and the other in Kent, where the Sheriff withdrew on the ground that the goods and chattels in his bailiwick were unsaleable. He believed they consisted principally of pipes underground, with perhaps a pump and a small steam-engine. The creditor had obtained about £50 by garnishee proceedings; and there was a balance of £750 still owing. The petitioners' debt was not disputed; but an affidavit had been filed by the Manager on behalf of the Company, stating that since July, 1895, the deponent had been very active. Up to that time, the only customer was the South-Eastern Railway Company, in respect of their station at Paddock Wood, for which they paid £4 a year. But since July there had been a new Manager, and he said there were now thirty cottagers who wanted water; and it was said that the Company was so much for the public benefit that it ought not to be wound up. He thought it would appear by the evidence that the only persons who were likely to benefit by it were the Manager and perhaps his clerks. According to the Act of Parliament, it was empowered to supply water in the parishes of Goudhurst, Hawkhurst, Tenterden, Cranbrook, and other places; but in the present year, an Act had been obtained by another Company, called the Cranbrook Water Company, which recited that the South Kent Company had not exercised the powers conferred upon them in 1889, so far as Goudhurst, Hawkhurst, and Cranbrook were concerned; and powers to supply those places were now vested in the Cranbrook Company.

Mr. CHUBB, who appeared for the Company, asked his Lordship not to make the order, on the ground that it could not benefit anybody, and would be to the public disadvantage. It was true that up to 1894 they had not been able to do much; but since then they had got the works in order, and were doing a substantial business, which it was hoped would much increase if they had a little further time, and could raise more capital with which to pay off their creditors. He should have thought it was in the petitioners' interest that such an opportunity should be afforded, as they could not get anything by stopping the Company, whereas, if the concern was allowed to go on, there might be a chance of them getting their money.

Justice WILLIAMS asked what the income was last year.

Mr. CHUBB replied that there was practically no income until 1894, because at first the water turned out to be "soda" water, which they could not supply; and when another well was sunk, the water from it was so impregnated with iron that settling-tanks had to be constructed. Thus the funds were exhausted before the Company had an opportunity of giving a supply. They could now do so; and they had already thirty customers, and applications from others. A contract was also pending with the Railway Company which would bring in £150 a year; and another with the Paddock Wood Cattle Company. In these circumstances, they hoped to be able to raise further capital. If the winding-up order were made, the liquidator could not sell the concern without getting an Act of Parliament.

Mr. JENKINS said the Company had no power to borrow; so that further capital could only be raised by shares.

Justice WILLIAMS pointed out that this was so much the better for the petitioners. If money were raised on debentures, they might take precedence of the petitioners; but every fresh share taken up would go to increase their security.

After some further discussion,

His LORDSHIP directed the petition to stand over till the first petition-day in next sittings; but he expressed the hope that, in the meantime, the parties would come to some arrangement.

Friday, Dec. 13.

(*Before Mr. Justice* CHITTY.)

The Incandescent Gas-Light Company, Limited, v. Leggatt and Co.

Mr. A. J. WALTER applied, on behalf of the plaintiffs, for an injunction against the defendants, who, he said, were sellers of incandescent gas mantles which the plaintiffs alleged to be an infringement of their patent; and a writ had accordingly been issued against them. After that the defendants put in their window a statement, which was utterly untrue, to the effect that the Welsbach patent had been cancelled by the Berlin Patent Court, and that the plaintiff Company were spreading lies to frighten the public; whereas it appeared, by an affidavit on behalf of the plaintiffs, that their principal patent had been declared valid by the Court. There were also some circulars pasted all over the defendants' window, containing similar untrue statements to those to which he had already referred. Thereupon the plaintiffs gave notice of motion for an injunction to restrain the issue of these circulars; and he understood that his friend Mr. Cutler was instructed to consent to an order in the terms of the notice of motion.

Mr. CUTLER said that was so.

Mr. WALTER suggested that the defendants should consent to a perpetual injunction, and make an end of it.

Mr. CUTLER said he could not do that.

Justice CHITTY said the injunction would be until the trial or further order; but if the defendants liked to consent before the Registrar to a perpetual injunction, it might be drawn up in that form.

A motion by the Meteor Incandescent Gas-Light Company against the Incandescent Gas-Light Company stood over for a week.

Damages for Injuries Sustained in a Gas Explosion at Idle.

At the Yorkshire Autumn Assizes at Leeds last Saturday week, Mr. Justice Wright had before him an action brought by Mr. Tom Hardaker and Julia his wife against the Idle District Council and Mr. A. Thornton, a Contractor, to recover damages for negligence. Mr. T. Atkinson, Q.C., for the plaintiffs, stated that they lived in a cottage which formed one of a block of buildings in Moorfield Place, Idle. The District Council, during last year, entered into a contract with Mr. Thornton for the purpose of constructing a sewer in the street. When carrying out the work, they found a gas-main, which had a diameter inside of about 3 inches, and which was put down thirty or forty years ago. It was the duty of the defendants to see that this main was properly propped and slung during the operations. The work was begun towards the end of December last year, and was carried on until March. It would be remembered that last winter was a very severe one; and operations were continued during the frost. Hardaker being a mason, was out of work at the time; and his wife earned money by her sewing-machine. When the soil was re-placed, it was frozen so hard that it had to be broken with picks; and it was impossible to pound it down properly. The main belonged to the Airedale Gas Company. It was usual to inform the Company when the mains were to be exposed; but no notice was given in this case. On Saturday, March 16, the tenant of the corner house noticed a strong smell of gas, and called in the inspector, who said he would remedy it. In another house, there was a strong smell; and in the plaintiffs' house, the children had made a complaint to Mrs. Hardaker. But she was suffering from influenza, and had almost lost the sense of smell. About five o'clock, a tremendous explosion occurred in the plaintiffs' house, which ruined it. The dividing-wall between plaintiffs' house and the next was shattered; and the outer wall was blown 18 inches out of plumb. Mrs. Hardaker was sitting near the fire when a great flash of flame almost blinded her; and she was grievously burnt. She was taken to a neighbour's house, and attended by a doctor. The furniture was completely destroyed; and the plaintiffs had to go to a new home. Several witnesses were examined on behalf of plaintiffs; and at the conclusion of their case, his Lordship said there was nothing to show that Mr. Thornton was not an independent Contractor. Mr. Atkinson then asked for judgment for the Idle District Council on the ground that there was not sufficient evidence that they interfered so as to make themselves responsible for the way in which the work was done. His Lordship gave judgment accordingly. Evidence was then called by Mr. Wright, on behalf of Thornton; his Lordship remarking that, if the work was improperly executed, he was responsible. Defendant was examined, and said that the orders of Mr. Nesfield, the Inspector for the District Council, had been obeyed fully in every respect. The jury gave a verdict for the plaintiffs, and added a rider that the District Council were to blame for allowing the work to proceed in such frosty weather. The jury were then dismissed; and the question as to the amount of damages was left to his Lordship, who reserved judgment. On Monday last week, his Lordship awarded plaintiffs £25 for the damage done to the furniture, and £20 for the injuries sustained by Mrs. Hardaker.

A Troublesome Gas Consumer.

Before the Croydon Borough Magistrates last Wednesday, the occupier of 2, Upper Grove, South Norwood, was summoned by the Crystal Palace District Gas Company for money due for gas. The defendant did not appear, nor did anyone attend on his behalf. The Company's inspector, in reply to the Mayor, said their officer had made several attempts to get into the house to read the meter-index; but he had been unable to do so. The door was never opened, although voices could be heard within. The Company had now cut off the gas—the occupier still retaining the meter. The Chief Clerk observed that if the Company's officials had been unable to take the readings of the meter, he did not see how the Company could make a demand for gas supplied. It transpired, however, that the charge had been made for gas up to June last. Police-constable Hornigold stated that, when he went to the house to serve the summons, a woman opened the window, and accepted service that way. She gave no reason for not opening the door. Witness went on to say that the knocker had been removed from the door, and both bell-handles were disconnected. The voices of children could be heard in the house; but no one would open the door. The Mayor made an order for payment within seven days, or distress.

The Main Drainage of London.—At the meeting of the London County Council last Tuesday, the report of the Main Drainage Committee, recommending extensive additions to the main drainage system of London north of the Thames, at a total estimated outlay of £745,000, to which reference was made in the JOURNAL last week, came up for consideration. Mr. M'Dougall moved as an amendment that the general enlargement of the system is not now necessary, but that local floodings need immediate attention. After considerable discussion, the amendment was carried by 55 votes to 18. A recommendation for the execution of certain relief works, at an estimated outlay of £50,000, was agreed to.

Wages at the Newcastle and Gateshead Gas-Works.—The question of the wages paid by the Newcastle and Gateshead Gas Company to certain of their employees for Sundays and holidays, which gave rise a few months back to a dispute which was submitted to Mr. T. Burt, M.P., has been settled by his award, which has lately been issued. The questions put to him were whether the retort-house men should have double pay for work done on Sundays and Good Fridays; and whether the principle of seniority should be recognized in engaging and discharging men. Mr. Burt's replies are as follows: (1) All retort-house men working on eight-hour shifts to be paid time-and-a-half on their existing wages for the first two shifts on Sundays; (2) wages for Good Friday to remain as at present; (3) the engagement and discharge of men to be dealt with by the men's representatives and the Manager as occasion may require. Mr. Burt suggests that the new arrangement should come into operation on the 1st prox.

MISCELLANEOUS NEWS.

CONTINENTAL UNION GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Tuesday, at the London Offices, No. 7, Drapers' Gardens, Throgmorton Street, E.C.—Mr. ARTHUR LUCAS in the chair.

The SECRETARY (Mr. F. W. Himing) read the notice convening the meeting, and also the Directors' report and the balance-sheet. The former was as follows:—

The Directors have to report that the number of consumers on the Company's books on June 30 last at Messina and Montargis—the two stations owned directly by the Continental Union Gas Company, Limited—shows an increase of 269.

There has been, however, a falling off in the quantity of gas consumed, owing chiefly to the earthquake shocks, which continued at Messina for a period of nearly two months at the beginning of last winter, causing large numbers of people to leave the town and disorganizing business generally. The profits at this station have consequently suffered a considerable reduction during the year ending June 30 last.

The total bad debts incurred and written off have amounted to less than £30.

The principal outlay on capital account during the year has been for the erection of a new exhauster and the continuation of the new 10-inch leading main at Messina, for the heightening of the scrubbers at Montargis, and for new mains, services, and public lamps generally at both of these stations.

The Union des Gaz has obtained a concession until 1924 for lighting the Commune of Vaucresson adjoining Rueil, near Paris.

The average length of the concessions of all the towns lit by both Companies is now 28 years.

The Italian State tax on gas referred to at the last meeting of the proprietors has since been voted by the Parliament of that country, and is payable by the consumer.

Turning to the thirteen stations belonging to l'Union des Gaz in which this Company has so large an interest, it will be seen by their report that their net outlay on capital account during the year amounted to £36 988; being for purchase of land at Genoa, Milan, Nimes, and Roanne, new benches at Rueil and Milan, new cooling-main at Roanne, boundary wall at Alessandria, a new station meter and a "Standard" washer at Strasbourg, and new mains, lamps, and services at the stations generally.

The following statistical information relating to the working of the Union des Gaz stations is, as usual, given here:—

There has been a net increase of 679 in the number of public lamps lit by gas; whilst the number of private consumers on the books of that Company on June 30 last shows the satisfactory increase of 5256—making a grand total of 76,606 consumers supplied by that Company at their thirteen stations.

The quantity of gas sold for all purposes shows an increase of 5 per cent. The average cost of coal shows a slight decrease, which is to some extent counterbalanced by the net value of the coke sold having fallen to the extent of 6d. per ton. The net value of tar also shows a decrease of 1s. 2d. per ton; whereas the value of ammoniacal liquor shows an increase of 2d. per ton of coal distilled.

Bad debts incurred and written off profits amounted to £662; being a trifle less than in the preceding year, though the gross rental is considerably larger.

Reverting to the accounts of the Continental Union Gas Company, Limited, it will be seen from the balance-sheet that the Directors have, during the year under review, invested £7555 of the surplus funds in the purchase of 285 shares in the German Continental Gas Company, having their head office at Dessau.

The Directors also have to report that they have authorized the expenditure of some £3000 in setting up a small installation of the electric light at Messina, in order to keep the whole of the lighting of that town entirely in their own hands.

After making the usual charges, the net profits of the Continental Union Gas Company, Limited, for the year ending June 30 last, amount to £116,027 19s. 4d. The available sum to the credit of general revenue is £154,118 7s. 7d., out of which the Directors recommend a dividend at the rate of 13 per cent per annum. The holders of 7 per cent. preference stock participate *pro ratâ* in all ordinary dividends exceeding 10 per cent.; and will therefore receive 10 per cent. for the year. It is proposed that, after deducting the interim dividend paid in July last, of 5 per cent on the ordinary and 3½ per cent. on the preferential stock, the balance of 8 per cent. on the former, and 6½ per cent. on the latter, all free of income-tax, should be paid on Jan. 4 next. The amount carried forward to the new account will be £37,918 7s. 7d.

The Director who retires by rotation is H. W. Blake, Esq.; and the Auditors (A. T. Eastman, Esq., and I. A. Crookenden, Esq.) also retire. All these gentlemen, being eligible, offer themselves for re-election.

The CHAIRMAN said he was sure the proprietors would share the regret of the Directors that the Chairman (Sir Julian Goldsmid) was prevented, by the state of his health, from attending the meeting. No doubt, they were aware that since May last Sir Julian had been suffering from a grievous illness—an illness which had, no doubt, in a measure, been brought on by his constant and unremitting attendance on his various duties. He (Mr. Lucas) would like to take this opportunity of saying to the proprietors that Sir Julian, since he became Chairman of the Company, had not been merely an ornamental Chairman, but had devoted an immense deal of time to the affairs of the Company. He had visited all the stations, attended continuously the weekly meetings of the Board, and had brought to bear on the work his unrivalled experience in the management of Continental gas companies. The proprietors would, he was sure, be glad to hear that, about two months ago, Sir Julian's illness took a turn for the better. His health was certainly stronger; and they had great hopes that, before long, he would be able to attend to their affairs as well as he had hitherto. Turning to the report and balance-sheet, he said they were, on the whole, satisfactory. The Company had earned the same dividend as in the two previous years, and at the same time they were carrying forward practically the same amount. This fair dividend, he was sorry to say, was not due to the two stations owned by the Continental Union Gas Company; because, on the working of those two stations, there had been a decrease in the profit, amounting to £1084. But the shareholders must not be disheartened by this statement. It was due to the fearful catastrophe that visited Messina in the autumn of 1894, and which was repeated about two months ago. It had increased the leakage by 3·02 per cent.; and it had been a wonder to him how any gas had been conducted through the mains, considering what had happened at Messina. With regard to Montargis, there had been in the past year, as in former years, a steady increase. It amounted to £138, which was not bad, taking into account the condition of commercial business on the Continent. So much for the two stations of the Continental Union Company. The Chairman of this Company was in a very peculiar position in addressing the shareholders, because he had practically to speak about the affairs of two Companies; and it was because of this fact that he was most anxious on the present occasion to clear the ground, and explain their relations with the Union des Gaz. The capital of the Union des Gaz consisted, as they knew, of a million sterling, comprising 50,000 shares of £20 each; and of these shares the Continental Union Gas Company held 37,000. The Directors of the latter were *ex-officio* Directors of the Union des Gaz; and, as there were nine Directors on the French Board, the Continental Union Directors were always in a majority. The immense influence they had over the Union des Gaz, and what a preponderating voice they had in the counsels of the French Board, would be self-evident. He was happy to say that this had always worked very well. In all questions of importance, they consulted their colleagues, with whom they had ever worked in harmony. Referring again to the report, the proprietors would have heard that the Union des Gaz had obtained a concession for the lighting of Vaucresson, which was near Rueil—a suburb of Paris. At present, they were only doing a comparatively small amount of business there; but there was a great future before it. They had, it was true, to conduct the gas through a long distance of mains. But building was going on there; and the increase would be steady and continuous. The concession they had obtained would last for thirty years. It was his duty to pass on to a matter which had given the Board a good deal of anxiety, and which was alluded to by the Chairman in his speech at the meeting last year. It was the State tax on gas in Italy. When first they were threatened with an infliction of this tax, it was rumoured that it would be as much as 5 centimes on every cubic metre of gas emitted from the works. Of course, the Directors were much alarmed at this. Some strong representations were made to the Italian Government by nearly all the gas companies in Italy, jointly and severally; and he was happy to inform the proprietors that the Italian Government recognized the justice of these representations, and reduced the tax to 2 centimes per cubic metre, giving power to the Company to collect it from the consumers. It was not fit for him to criticize the wisdom of the policy of the Italian Government; but he thought he might say this, that it was an open question whether it was politic to invite foreign capital into a country, and then to tax it heavily, as was being done in Italy. In saying this, he knew he was speaking under a grave sense of responsibility. It was not, however, only the State tax they had to fear, but the municipal taxes, which were not in any way, he believed, authorized by the Italian Government; and in a particular instance, which he was bound to mention—the town of Milan—his tongue was tied, because the matter was *sub judice*. The town of Milan, so far as the suburbs were concerned, had said: "We will levy a tax of 2 centimes on you, without power to reclaim from the consumers." The Directors denied the justice of this claim; and they would fight it by all legal means in their power. He asked the proprietors to remember, with regard to these taxes, that consumers, when they received their gas bills, looked at the total. They saw it was larger; and they either grumbled or burnt less gas, or they did both. The Company would probably be losers in any case. Whether or not they had power to collect from consumers, was not the question. The Company did not want the taxes; they only wished to go on quietly with their business as hitherto. The next matter to which he had to call attention was one in connection with the financial operations which the Board had carried out, but which was not mentioned in the accounts or report, because it was only completed in November; and the accounts were for the year ending June 30. But before referring to this matter, he would ask the proprietors to go back and remember the events of 1891. In that year, for reasons which he need not repeat, but which they would no doubt recollect, the Directors were forced to call up the balance of £6 on the new shares. The late Mr. Backler, with his usual clearness, explained, at one of the meetings, that they had no alternative, after having taken legal advice. The proprietors accepted the statement; and the amount was fully paid up. The result was they obtained £72,800; and he (Mr. Lucas) thought the time had come when the proprietors would wish to know what had been done with the money. At that time and since, the Directors hoped that towns would be submitted to them that they, in their opinion, would consider worth their while to light. Some towns had been submitted to them; but, with great regret, they came to the conclusion that, if they completed the business with the vendors, it would be much more to their benefit than to the Company's. Therefore, since then, no towns of any importance (only what might be called extensions) had been added to their stations. Failing those towns, the Directors had turned their attention to the purchase of gas shares; and, in this way, they had absorbed £35,000 of the money called up on the new shares, which left £37,800. In the summer of this year, the Union des Gaz decided to issue for purposes chiefly of extensions of works and purchases of land, £80,000 in 4 per cent. obligations. He might state, in parenthesis, that the obligations were bonds; they were not quite the same as debentures (so he was instructed by the French law), but they were redeemable, and would be redeemed eventually. This amount was issued in November; and the Continental Union Gas Company were allotted £60,000. They had taken the whole up; and they had paid for them by the above-mentioned £37,800—the balance being made up by the sale of their Local Loan stock, which brought them in £20,000, and by cash which they had on deposit to the amount of £2200. Now the advantage of this operation would be obvious to the proprietors as business men. They obtained less than 3 per cent. by previous investments, which were mainly in Consols and in other stocks. These they were able to sell at a substantially higher price than they had purchased at. They would hold a first claim on the property of the Union des Gaz, and, moreover, a security which was at any time negotiable. Given a settlement of the troublesome tax question, he saw no reason why the future of the Continental Union Gas Company should not be as prosperous as in the past. As had been mentioned

in the report, the increase of consumers had been 5256; the increase in the quantity of gas sold was 5 per cent.; and what was not stated in the report, but would be interesting, was that the cost of this increased amount of gas sold was £2000 less, which reflected great credit on their Engineers. A chairman of a gas company speaking now was in a more favourable position than he was (say) eight or nine years ago, when first the electric light came into prominence, because he thought people now saw that the electric light was not an unmixed blessing. Also, ten years ago, the incandescent gas-light had not come into being, or, if it had been invented, it was not in a state of perfection. It was far more used on the Continent than here; and people had found out that by it they had a continuously brilliant light, instead of a diminishing one as in the case of the electric light, and that it had other advantages. The proprietors would be interested to learn that they had had several instances of large restaurants all over the Continent where they had abandoned the electric light, and returned to gas in order to use the incandescent light. Coupling this fact with the enormous increase of gas consumed for heating and cooking (they used it far more for those purposes on the Continent than in England), and also the fact that gas was employed more and more every day for motors, there was no cause for apprehension as to the future of the Company. The report stated that the average number of years of the concessions was now 28; but for the large towns, it was above 30 years—in fact, more in some instances. If they were only met with the same spirit of fair dealing on the part of the towns as they had had up to the last few years, they on their side would act, as Englishmen had always acted with regard to foreign companies, with energy and honesty. Foreign municipalities knew very well that they could rely on them—whether in times of war or strike, they would do their best to carry out their contracts, not only in the letter but generously in the spirit; and the Board would do their utmost to maintain the high reputation that they had borne on the Continent hitherto. He then moved the adoption of the report.

Mr. N. E. B. Garey seconded the motion, which was unanimously carried.

The dividends recommended in the report were then declared, on the motion of the Chairman, seconded by Mr. R. Hesketh Jones.

The Chairman moved the re-election of the retiring Director (Mr. H. Wollaston Blake). This, having been seconded by Mr. Frederick Tendron, was agreed to.

Mr. R. Stevens proposed, and Mr. Robert Morton seconded, the re-appointment of the Auditors (Messrs. A. T. Eastman and I. A. Crookenden); and this was carried.

The Chairman, in moving a vote of thanks to the officers of the Company and of the Union des Gaz both at home and abroad, spoke of a tour he had made of the stations in France, and stated that he was immensely struck with the way in which the work was carried on. The whole *personnel* there and at home was of excellent quality—men devoted to their duty and enthusiastic in the work they had to perform.

Mr. Garey seconded; and the motion was heartily agreed to.

The thanks of the proprietors were also accorded to the Directors, on the proposition of Mr. A. F. Phillips, seconded by Mr. J. Soutter; and this concluded the proceedings.

THE PROPOSED ALTERATION IN THE ELECTRIC LIGHTING REGULATIONS.

The Report of the Board of Trade Committee.

As mentioned in the Journal last week, the Committee appointed by the Board of Trade (consisting of Lord Kelvin, Mr. W. H. Preece, C.B., and Major Cardew) to consider the desirability of altering the limit of low pressure as defined by the electric lighting regulations, have presented their report, the text of which is as follows:—

That it is expedient to alter the definition of pressure in the above-mentioned regulations, as follows: First, omit the following words: "Pressure on any alternating-current system being taken to be the equivalent of pressure on a continuous-current system when it produces an equal heating effect if applied to the ends of a thin stretched wire or carbon filament." Secondly, in place of paragraphs (*a*), (*b*), and (*c*), substitute the following: (*a*) Where the conditions of the supply are such that the pressure may at any time exceed 500 volts if continuous or 250 volts if alternating, but cannot exceed 3000 volts whether continuous or alternating, the supply shall be deemed a high-pressure supply; (*b*) to be worded as existing; (*c*) omitting "or the equivalent of 3000 volts."

The Committee further advise that the following amendments should be made in the proposed regulations: (*a*) Regulation (1) to read as follows: "Save as hereinafter provided, the pressure of a supply delivered to any consumer shall not exceed 250 volts at any pair of terminals." (*b*) Regulation (31) add, "No such conductor shall be at a higher pressure than 300 volts from earth." (*c*) Regulation (6) for supply omit the words "or less than 45 volts if continuous, or the equivalents thereof respectively if alternating." In place of "150 volts" read "250 volts." Add at the end the following proviso: "Provided that no change shall be made in the pressure of the supply to any consumer in consequence of the issue of these regulations, except with his consent."

With reference to the suggested alteration to regulation (31) for safety, the Committee are of opinion that, to enable the use of 500 volts continuous pressure between the outer conductors of a three or five wire system with bare conductors laid in conduits, the Board of Trade may give provisional sanction to an earth connection being applied to one point of the middle conductor in any case in which they are satisfied that a high insulation is maintained on all other points of the system, and that suitable and sufficient means are provided for the immediate detection, localization, and correction of any fault of insulation.

The Committee consider that, in making the above suggestions, they have indicated clearly how, in their opinion, the question of limitation of pressure should be treated to adequately secure the safety of the public, and to meet the requirements of electric lighting undertakers and the convenience of their customers. They do not, however, wish to insist upon the exact wording suggested, and would leave the final drafting of these amendments, and any consequential verbal amendments of the draft regulations, in the hands of the Board of Trade.

ELECTRIC LIGHTING NOTES.

The Fareham District Council have held a meeting to consider what course they shall take in view of the judgment against them in the action brought by the local Electric Lighting Company to rec damages in respect of the breach of the contract entered into by the Council's predecessors to purchase their undertaking. It will be remembered that the judgment was that the Council should pay damages (£3800) and costs; but time was given them to decide whether they would pay these, or take over the undertaking. At the meeting of the Council, the Clerk read a report on the value of the works prepared by Messrs. De Ferranti and Manville, who expressed the opinion that the undertaking was a losing concern, with no prospect of ever becoming a paying one. If the Council took it over, they considered this could only be justifiably done on the basis of what the plant would fetch if sold by public auction. Under the most favourable circumstances, they valued the plant at £1450, with £300 the cost of obtaining the Provisional Order. If the plant was purchased by brokers, it would not fetch more than about £750. Messrs. Ferranti and Manville having assessed each item in the schedule attached to the proposed contract at what they considered a fair trade price, valued the whole thing as a going concern at £3164; and they could not understand how it was the Arbitrators assessed the concern at so high a figure as £4866. If the Council took over the undertaking, the Board of Trade would be almost certain to order that the wires be put underground, and duplicate machinery provided; while the Local Government Board would not sanction a loan for more than seven or eight years. Some of the members considered this report fully justified the action of the Council; and it was resolved that a poll of the ratepayers should be taken before deciding to pay the damages or complete the purchase.

The Eccles Town Council have been advised by their Electric Lighting Committee to provide the electric light themselves in the borough rather than risk the possibility of power being granted to a Company. They have also recommended that the tender of the Manchester Edison-Swan Company, Limited, to carry out the works for £13,792 be accepted, and that application be made to the Local Government Board for power to borrow £20,000 to enable them to carry out the scheme.

The electric light contagion has spread to Newington, for the local Vestry, sitting at the Walworth Vestry Hall last Wednesday, received a special report from their General Purposes and Lighting Committee on the subject. It should, however, be incidentally mentioned that this go-ahead Vestry would not have thought about the adoption of electricity as an illuminant, had not the County of London and Brush Provincial Electric Lighting Company, Limited, and the Capital and Counties Electricity Supply Company, Limited, first applied to the Board of Trade for a Provisional Order to supply current within the area of the jurisdiction of the Vestry. This audacity on the part of mere registered commercial undertakings fired the Vestry with indignation, and induced them to take the course they did; and the motion that the applications of these two Companies be opposed by the Vestry was almost unanimously agreed to. The Committee also recommended—"That a memorial be sealed and forwarded to the Board of Trade, applying for a Provisional Order under section 4 of the Electric Lighting Act of 1882, for the supply by the Vestry of electricity for lighting purposes, both public and private, within the area of the parish." This memorial is a lengthy document of seven folio pages, and is signed by the Vestry Clerk (Mr. L. J. Dunham). Among the more interesting points it raises are these: That the London Electric Supply Corporation, Limited, were empowered to supply current in the parish by the Act of 1889, but had not completed the mains within the specified time; that the Vestry feel that the time has arrived for them to secure competitive powers with the Corporation; and that "if the main roads of the parish were lighted by electricity, trade would improve, and shopkeepers and others be induced to take the light in preference to gas, more especially if they were benefited in price by the amount of energy supplied." In the discussion that ensued, Mr. R. C. Davis described the proposed Provisional Order as the "thin end of the wedge;" and, though electricity might be a very fine thing, he thought the parish could not afford such a luxury. He hoped the Vestry would pledge itself not to go any further in the matter until the question had been thoroughly threshed out; and thus disarm opposition. Electric light might be made to pay in some districts more fortunately situated than Newington, where some of the streets could not even afford to have gas. St. Pancras had spent £100,000 on electric lighting; and Newington would have to spend £30,000 or £40,000. In Islington, something like £90,000 had been sunk before the installation was opened; and some of the promoters were getting quite alarmed at the way expenses were increasing. In conclusion, Mr. Davis said the Vestry ought to hesitate before putting these burdens on the shoulders of the ratepayers and the working men. Mr. W. Westcott maintained that the object of the recommendation was to keep out a monopoly, and not to follow the example of Leeds and Liverpool, where the ratepayers had to buy out the electric light companies at a high price. Electric light would be made to pay in five years. Mr. Smithers was very enthusiastic over the prospect of the Vestry owning their own electric lighting installation; and he talked glibly of the time "when the whole of the public lighting would be provided for nothing, and a large sum derived in aid of the general rates" from the profits of the undertaking. Further discussion was then stopped by the closure; and the memorial was agreed to and sealed.

At the close of the article in last week's Journal on "The Right of Gas Shareholders to Vote upon Electric Lighting Questions," it was stated that the Reigate Town Council had resolved to apply to the Board of Trade for an Order to enable them to supply the electric light. The Sub-Committee upon whose recommendation the resolution was passed had previously consulted Mr. F. H. Medhurst. The system he advised them to adopt was the high-tension alternating current system. Referring to the district which he suggested should be lighted, he said that the lighting of 117 gas-lamps in the area cost at present £351; and if these were replaced by 117 incandescent lamps of 16-candle power each, the cost, at 3½ per unit (exclusive of lamp renewals) would be £315 per annum, assuming that the lamps were in use ten hours daily. Lamp

renewals would amount to an additional £25 per annum. He estimated the output for private lighting at 80,000 units per annum; and for public lighting, at 21,500 units. His estimate of the capital expenditure was £15,000; of the revenue, £2351; of the working expenses, £1505; and interest and sinking fund, £787. Deducting the two latter items from the revenue left what Mr. Medhurst cautiously termed a "net probable profit" of £58.

It would appear that the St. Pancras Electricity Committee are troubled with a pricking conscience, or to what can one attribute the reason that prompted them to recommend to the Vestry, on Wednesday, that current should be supplied to churches and chapels at a reduced rate—*i.e.*, that charged for public street lighting? It seems that only one church in the parish is so lighted; and the Committee "are of opinion that some concession should be made to further this object." Hence the recommendation, which was further strengthened by the plea that "the mains now extend over a considerable area, and several churches and chapels are in close proximity thereto; and the authorities would doubtless avail themselves of the improved method of lighting the buildings under their charge, if special facilities are offered to enable them to do so." There was little practical opposition to the proposal; but Mr. Vicars thought the ecclesiastical bodies should not pay less than shopkeepers. Dr. Smith and Mr. Menzies strongly supported the recommendation; the latter gentleman using the curious argument that several of the electrical staff were practically idle on Sunday evenings, and would thus be profitably employed. After this proposal was agreed to by a large majority, the eternal "explosion" question again cropped up. It appears that, after the disastrous occurrences of last winter, the London and North-Western Railway Company "made representations" to the Vestry as to the probable effects of an explosion on the Hampstead Road Bridge, should the structure be damaged. The Committee state that "the mains across the bridge are bare copper strip, laid in cast-iron pipes. The Chief Electrical Engineer (Mr. Baynes) reports that this is an unsatisfactory combination; and he recommends that insulated cable be substituted for the bare copper strip, and the ends of the pipes plugged to prevent the influx of gas." Verily, the sad experience of the past is making the Vestry careful; for they agreed to this alteration, which will cost the nice little sum of £170. Nor was this the only amount which the ratepayers had to provide to alter work executed by their own electric lighting representatives. Another trifling item of £260 was asked for because the Regent's Park station is so badly constructed that the Phœnix Fire Office has had to call the attention of the Vestry to the fact that the cables from the switchboard run under the floor of the engine-room. The Chief Electrical Engineer recommends a concrete flooring, and advises "that a fireproof chamber enclosing the cables under the flooring should be made, with a special water service for immediately flooding the chamber should a fire break out;" and the Vestry could not but agree to this expenditure also. The ratepayers must surely regard the Electric Light Department as an expensive, and not particularly astute, body.

The Chairman of the Hampstead Vestry made a startling admission at last Thursday's meeting. He said that the arc lamps for street lighting in the parish "had not hitherto proved a success," and that to increase this system, as urged by a member, would be "a great mistake." Other installations were successful with regard to public street lighting, so there "must be some fault somewhere." To remedy this sad state of things, a representative of the Vestry had an interview with Messrs. Siemens Brothers in order to arrange with them "to take over the entire charge of the whole of the public arc lamps in the Finchley Road for a period of eight weeks, at a reasonable cost." This Messrs. Siemens (who, by the way, constructed the lamps, &c.) agreed to do for the sum of £35 10s., to include all necessary carbons and labour for trimming, &c.; two employees of the Vestry to be temporarily transferred to their staff, and new globes to be charged at 15s. each. After the letter from Messrs. Siemens embodying these terms had been read, Mr. Johnson inquired whether this was really the total cost to the Vestry, or whether a proportion of the firm's engineer would not have to be added to it. The Chairman of the Lighting Committee replied that the charge was inclusive, and was about the same as the Vestry would have incurred themselves. Mr. Farmer thought it was time the High Road, Kilburn, was lighted by arc lamps; but after the Chairman's frank admission, reported above, he sat down a sadder and a wiser man. Nor did the subsequent action of the Vestry tend to raise the spirits of the electricity enthusiasts; for it was decided to "pay the account of Mr. W. H. Preece, Consulting Electrical Engineer, amounting to £150, for preparing plan and detailed estimate of the extension of high and low pressure mains, and arc lighting plant and mains, to the High Road, Kilburn, and West End Lane." So end the financial troubles that had arisen between the Vestry and the eminent electrician; but who but the most sanguine will prophesy a cessation of other troubles in the Hampstead Electricity Department's affairs?

Torquay is still unable to make up its mind upon the question of the electric light. A considerable body of opinion is opposed to the proposal for establishing the generating station underneath the Bath Saloons; and this opposition has been fortified by the receipt of notice from the owners of some neighbouring property, that they will seek compensation if any nuisance is created. On the other hand, a Sub-Committee have reported that in London, where they visited several private electrical stations, they did not find anything objectionable in the working of dynamos near a large concert-room. Another question of interest to the ratepayers of Torquay is whether the works, if established, will prove remunerative. At a private meeting of the Council held a few days ago, the opinion is reported to have been expressed that the estimate of Messrs. Trentham of the cost of lighting the compulsory area would be largely exceeded, but that the town could very well afford to bear the expense. The outcome of much deliberation was a resolution to start anew. The Electric Lighting Committee are to make fresh inquiries as to a central station, the cost of the necessary works, and the probable number of consumers, and in all this they are to have the assistance of another expert.

At the meeting of the Court of Common Council of the City of London last Thursday, Mr. Brooke Hitching asked, in view of the high price charged for the electric light in the City (8d. a unit, in place of 6d. in other districts), whether the Commission of Sewers had the right of purchase at short notice and on equitable terms. Mr. H. T. Gordon, the Chairman of the Commission, said they were about to enter into a contract for public lighting; but it could not be completed until they had decided which was the best system of lighting the minor streets. The Commission would have the option of determining the contract at the end of 7, 14, or 21 years, and, at the end of 21 years, of purchasing the undertaking outright. Meanwhile, the Company would have a monopoly. Alderman Bell, dissenting from Mr. Gordon's view, said there was nothing to prevent any other company from coming forward; and the Commission of Sewers had no power to grant any exclusive right to a particular company. Mr. C. T. Harris said that, though it might be true that any other company could come in, the Commission of Sewers had bound themselves to oppose them; so that practically there was a monopoly.

The following interesting paragraph from last Friday's *Western Mail* does not require comment: "The Town Clerk of Newport (Mr. A. A. Newman), at a recent meeting of a local authority, declared with a good deal of *nonchalance*, with reference to the installation of the Town Hall with electric light, that the Corporation had 'burnt their boats'—meaning that they had absolutely discarded gas. His Honour Judge Owen, who sat at the Town Hall on Thursday, can hardly be expected to join in the exultation with which the Town Clerk viewed the situation. When the Judge entered the court at 10.30, the place was in grey, weird darkness. It was a wet, miserably depressing morning; and to enter the court unable to see the characters in a book, or discern the features of persons six feet away was, to say the least, irritating. His Honour remarked that he considered it very discourteous on the part of the Corporation officials that, knowing the Court had to sit on that day, they did not make any arrangements for having the place lighted in any way. He would retire until there was some light by which the business could be conducted. Collins, the Town Hall keeper, found himself unable to turn on the electric light, because new connections were being made from the main from which the Town Hall was supplied; and the current was temporarily withdrawn. While his Honour was away in his retiring-room, a couple of penny candles were procured, and placed on the bench opposite his Honour's seat, and a couple of others were placed on the Registrar's desk. The Court commenced work amidst this eerie scene; the light being at intervals reinforced by the arrival singly of oil-lamps."

A COMPARISON OF GAS AND ELECTRIC LIGHTING AT HASTINGS.

Mr. A. P. Trotter, B.A., Assoc.M.Inst.C.E., M.Inst.E.E., has presented to the Hastings and St. Leonards Electric Light Company a somewhat elaborate report, in which certain comparisons are made with respect to the photometric power of the electric light and gas light, as found by him on various visits to the seaside places concerned. The report, however, contains so many qualifications, that it is really not worth very much as an index to the standard of the two illuminants. Indeed, Mr. Trotter begins by stating that his tests are supplementary to some made by the Resident Engineer; and he concludes by confessing that a comparison is impossible without further data.

The first important tests were made at the works, where a door had been fitted in the doorway, with an opening to allow of the light shining down a dark passage, in which a 10-feet batten was fixed to the wall for the purpose of forming part of a photometer-bar nearly 200 inches in length. On this bar there travelled a carriage, on which was mounted a "relief" photometer designed by Mr. Trotter, and constructed "somewhat resembling a Bunsen, but giving considerably greater sensitiveness;" while suitable black screens were provided. The standard was a Hefner amyl-acetate lamp, the value of which Mr. Trotter took as 0·877 of a standard candle. The instruments for measuring the electric current and pressure were provided at the works; but as alternating currents were used, Mr. Trotter admits that errors of from 0·5 to 1 per cent. "are not unlikely." Neither does he consider that the measurement of the gas consumption was satisfactory; an ordinary 5-light dry meter and a pressure-gauge being used. The upper dial of the meter, registering 2 cubic feet for one revolution, was read, and the time for each quarter revolution taken in minutes and seconds, for purposes of check; and readings by a stop-watch of a number of revolutions were used for obtaining the consumption—the conductor of the tests considering that "errors of 5 per cent. are not unlikely, and even 10 per cent. is possible." The electrical pressure was from 102 to 103 volts, which is higher than usual in the district; and the gas pressure commenced at 35-10ths of an inch, but was much lower when the trials were finished after midnight.

The tests with three Edison-Swan 16-candle lamps gave the following results: 103 volts, 1·82 ampères, 187 watts, 61 total candles, 20·3 candles each lamp, and 3·2 watts per candle; one Edison-Swan "Sunlight" 100-candle lamp gave 102 volts, 2·46 ampères, 251 watts, 103 candles, and 2·43 watts per candle; three "Gabriel" 16-candle lamps gave 102 volts, 1·7 ampères, 173·4 watts, 52·5 total candles, 17 candles each lamp, and 3·03 watts per candle. With gas lighting, a "Christiania" burner showed for a consumption of 6·2 cubic feet per hour 13·4 candles, or 2·16 candles per cubic foot per hour; a similar burner with globe, 6·2 cubic feet per hour and 7·9 candles, or 1·27 candles per cubic foot per hour; Bray's burners, 3·4 cubic feet per hour; 39 total candles, 13 candles each, or 1·15 candles per cubic foot per hour; a batswing burner, 1·6 cubic feet per hour and 38 candles, or 2·38 candles per cubic foot per hour.

As a result of his tests, Mr. Trotter says the cost of 1000 candle-hours in each case is to be compared; and he does this as follows: "Let gas be at 3s. 2d. per 1000 cubic feet as at Hastings and St. Leonards, and let the gas burners give 2 candles per cubic foot. Then 1000 candle-hours evidently cost 1s. 7d. Again, let the price of electric supply be 6d. per unit, and let the lamps take 3 watts per candle. Then 1000 candle-hours cost 1s. 6d. To this must be added lamp renewals, which may be taken at 1½d., making a total of 1s. 7½d. But Mr. Trotter does not let the thing stand at this, for he urges that the

comparative cost of lighting must be considered on a wider basis than that of light for light, and he brings in the "saving" in the cost of re-decoration and the "absence of injury" to "delicate goods" as an argument in favour of electricity. He then boldly ventures to assert that there must be an especial advantage for the electric light in Hastings, "where the very high pressure of the gas doubtless forces much unconsumed gas into the air." The fact of shopkeepers rejecting the electric light because it does *not* suit "delicate goods" is not referred to; nor are the various other disadvantages which are associated with electric supply as at present understood.

Mr. Trotter compared the cost of lighting the sea-front by arc lamps with equivalent lighting by Welsbach incandescent gas-lamps. Taking 33 cubic feet of gas as giving 500-candle power, he made the cost 1·254d., or with renewals 1·43d. for a naked light of the above-named power for an hour, exclusive of the cost of lamp-lighters, cleaners, damage by wind and water, repairs, and interest on capital outlay. Mr. Trotter was given to understand that each arc lamp takes 15 apparent ampères at 50 apparent volts, or 600 true watts, and that for a service of 160,000 lamp hours per annum, including the supply of carbons, trimming, cleaning, repairs to 52 lamps and lanterns, and interest on capital outlay for lamp-posts, transformers, and mains, the sum of £1300 is paid. This comes to 3¼d. per unit, or 1·95d. for a light, reduced and diffused by corrugated glass, of a mean of about 500-candle power for one hour. If incandescent gas-lamps were used, a larger number of smaller lights would, he says, be employed in order to obtain better distribution, as it would be obviously impracticable to group burners together to give 500-candle power. All the incidental expenses would thus be increased in proportion, although, owing to the better distribution of light which would then be possible, some deduction might be effected in the total light. He concludes that comparison is impossible without further data. But he says it is clear that the difference of 0·52d. would not cover the incidental expenses; and that, if the two systems of lighting were placed on equal conditions, the cost of gas lighting would largely exceed that of the contract for electric light.

The Gas-Works Purchase Question at Ossett.—The Ossett Corporation yesterday week resolved that a statutory meeting should be convened for the purpose of considering the question of the promotion of a Bill in Parliament, either alone or conjointly with the Horbury District Council, for the purpose of acquiring the works and plant of the Ossett Gas Company, compulsorily or otherwise.

Gas Affairs at Newcastle-under-Lyme.—The Newcastle-under-Lyme Town Council have agreed to make application to the Local Government Board for sanction to the borrowing of £2500 for the following purposes: (1) The laying down of a new 6-inch gas-main to Keele village, £1500. (2) The extension of the gas-main at Basford, £500. (3) The enlargement of the gas-main in Liverpool Road, £420. (4) The purchase of a piece of land near the gas-works, £80. The extension to Keele village is subject to a proper agreement being executed by Mr. Sneyd, whereby he agrees to pay a minimum rental of £250 a year for ten years, for a gas supply to Keele Hall and village. Regarding the illuminating power of the gas, the Gas Manager (Mr. W. Winstanley) has been instructed to consider the best method of raising the illuminating power of the gas 2 candles for the next two months. The minimum illuminating power allowed is 14 candles; but for last month the average has been very slightly under 16 candles.

The Ystrad Gas and Water Works Purchase Bill.—The Bill which is to be promoted in Parliament by the Ystradyfodwg District Council, in which they seek powers to purchase the Ystrad Gas and Water Company's property, and to construct additional works, has been submitted to a meeting of the ratepayers. Mr. W. Jenkins, the Chairman of the District Council, presided, and proposed a resolution consenting to the Bill. The new works, he stated, would be erected near Craig-y-Llyn, and would cost about £70,000. Several of the ratepayers present objected to the purchase of the gas-works, in consequence of the "fact" that the electric light was rapidly "superseding" gas-light in the largest towns in the country. Other ratepayers from Rhondda Fach opposed the resolution, because they were supplied by the Pontypridd Water Company with water, and if the works were bought, they would have to bear a portion of the financial burden. Several speakers upheld the action of the Council; and eventually the resolution was carried almost unanimously.

The Birmingham Corporation Water Bill.—A meeting of ratepayers of Birmingham was held last Saturday week to authorize the application to Parliament in the ensuing session for an Act empowering the Corporation to make certain deviations of the aqueduct sanctioned by the Corporation Water Act of 1892, to construct an additional short line of railway, to acquire additional lands, and for other purposes. The Mayor (Mr. J. Smith) presided. The Chairman of the Water Committee (Alderman Lawley Parker) made a statement regarding the proposed powers, which are already well known to interested readers. With regard to the land required for depositing spoil, Alderman Parker said they needed one or two acres of land for every mile of aqueduct, which would amount to a considerable aggregate. They had instances of landowners whose property was very far removed from any large centre, asking six or seven times as much for their land as the Corporation had paid for land within six miles of the Town Hall. He did not hesitate to say that the very announcement of their intention to go to Parliament had already effected for them a saving which would more than pay for the Bill itself. The short length of railway they desired to lay down was required to carry material from their quarry at Rubery to the service reservoir at Frankley. It would take 200,000 tons of stone to form concrete to line the reservoir; and 200,000 tons of cement, sand, bricks, ironwork, coal, and other things would also be required. In the opinion of the Engineers and the Water Committee, the saving which would result by the laying down of the railway would pay its cost, and at the finish they would have it for other purposes. No further capital expenditure would be necessary in consequence of the Bill; on the contrary, they believed capital expenditure would be saved by it. After some discussion, the resolution was carried, with only one dissentient.

SOUTHWARK AND VAUXHALL WATER COMPANY.

The Half-Yearly Ordinary General Meeting of this Company was held last Tuesday at the Offices, Southwark Bridge Road—Alderman Sir H. E. Knight in the chair.

The Secretary (Mr. Alfred Jelley) read the notice calling the meeting; and the report of the Directors was taken as read.

The Chairman observed that during the many years he had presided over them, he had never attached his name to a more important report than that which they were about to consider. It contained business of a very large and complicated character, and he thought it was thoroughly satisfactory in itself; for although they were living in times of great pressure for all water companies' undertakings, yet the report detailed circumstances showing that their Company was in a thoroughly sound position. Turning to the accounts, he stated that the charges under the head of maintenance in the past half year had been £48,847, against £41,276. The excess of £7571 was explained by the three items against which asterisks were placed, indicating that the large increase had been caused by the extraordinary expenses arising out of the long and exceptionally severe frost of last winter. These three items amounted together to £29,690, or £7282 more than the combined sum in the corresponding period of 1894. The remaining £300, making up the increase of £7571 under the head of maintenance, was due to the increased amount paid to the Thames Conservators. The total charges under the head of management amounted in the past half year to £9282, against £7936 in the September half of 1894, or an increase of £1346. If, however, they referred to the item of law and parliamentary expenses, they would find that the amount paid in the past half year had been £2959, or £1666 more than in the corresponding period of the previous year. The increase in this item alone therefore exceeded by £300 the total increase under the head of management. He hoped they would pardon him if he again referred to what he called the iniquitous manner in which expenses were thrown upon the Water Companies by the London County Council. The expenditure forced on them by that body had been no less than £10,000 in the past five years; and in the present half year, the outlay which they had been put to had been £3000. Similar expense had been incurred by all the other Companies. It was, he maintained, iniquitous that men who were striving hard to do their duty to supply the public with one of the most important articles they required, should be subjected to these attacks, and mulcted in such enormous expenses in defending what the shareholders, on the faith of Parliament, regarded as their own. The County Council had also been harassing them by endeavouring to get the flush for water-closets increased from two to three gallons; and the scientific evidence which the Company had had to produce before the Local Government Board would cost them about £400 more, if not a still larger sum. This only showed the character of the attempts which were made to carry out the principle of spoliation towards the Companies, with a view of buying their undertakings cheaply—a principle which he had condemned, and which every honest man, he believed, must in his heart also condemn. If they multiplied their own expenses by those of the eight Companies, and added on those incurred by the London County Council on their side, they would find that about £250,000 had been squandered through the action of the Council, without one iota of good having been done. The expenditure to which the Companies were put came out of the pockets of the shareholders; but ultimately it came from the consumers, as the expenditure deferred the time when the Companies could reduce their charges. He believed that but for the cost which had been thrown upon them by the County Council, they would be paying a dividend of 10 per cent. to the shareholders and charging less to the consumers. The attack on the Companies was a public scandal; and it ought not to be permitted to go on. The amount available for transfer to the dividend and interest account was £60,713, against £65,606 a year previously. This showed a decrease of £4893. But as they had paid in the increased expenses he had referred to no less than £8917, their position was so sound that they had been able to discharge out of the revenue £4000 for the extraordinary charges mentioned, so to say without feeling it. The revenue for the half year had been £122,396, compared with £118,821 in the September half of 1894; and he considered this increase of £3575 was highly satisfactory. It was only a temporary cloud which had been hanging over them; and it was now disappearing. The increase in their revenue for the three years 1893, 1894, and 1895 amounted to £14,607, or an average improvement of nearly £5000 per annum—a fact which was most satisfactory to him, because years ago, when he was fighting their battle, and substantiating the value of their property in the arrangements made with the late Mr. Smith, he only took £4000 as their average annual improvement. His calculations generally had been based on that rate of progress; and therefore he thought he was within the mark in any financial statement which he had put before them. Out of the £60,713, they had first to pay the interest and dividend on their debenture and preference stocks. The balance applicable to dividend was £32,152, from which they proposed to pay a dividend of 6 per cent. per annum; leaving £1291 to be carried forward, as compared with £5169, making a difference against them of £3878. On the other hand, however, they would have the increase of revenue which would accrue in the coming six months, although next half year they would experience a very tight pinch. They could not have paid the 6 per cent. dividend now proposed had the whole of the expenses which had been thrown on them by the frost been brought into account—namely, £27,000. At their last meeting, he said he thought that the amount would be £20,000; but he had not realized at the time, nor had their officers, the expense which would be required to repair the roads. They had thus had to pay this half year on account of these extraordinary expenses £17,000, instead of the £10,000 he had expected. They felt that it was hardly fair to put the whole of this expense on the shareholders in any one year; and the Government Auditor (Mr. Stoneham) had consented, after a good deal of explanation and argument, to allow £10,000 to be carried to suspense. He wanted them, however, clearly to understand that the Directors would be bound by the arrangement made with Mr. Stoneham to pay off this amount next half year. He saw no reason

why they should not do this; but they would only be able to do so by reducing the dividend next time to 4 per cent. per annum. He hoped that after that they would again revert to their 6 per cent. He thought it was highly satisfactory that their business was in such a prosperous condition that it enabled them to meet such a large expenditure with the sacrifice of an average of 1 per cent. dividend for two years. They had paid £17,000 in the past half year towards these expenses, or £7000 more than they had anticipated. But for this, they would have had the additional £7000 to carry forward. Passing to the report, he stated that the increase in the domestic supplies in the half year numbered 947, giving them an estimated annual additional rental of £1994. Considerable progress had been made with the reservoirs at Hampton. They told Parliament that they intended to push on as quickly as possible with these works, in order to meet the requirements set forth in the report of the Royal Commission of 1893. They applied for powers to construct extra reservoirs, giving them storage capacity of 546 million gallons, which would represent about 15 or 16 days' supply, whereas at the time they only had 1½ days' storage. Since then, they had completed a reservoir holding 90 million gallons, or 3 days' supply; and another reservoir was progressing very well, which would give them 300 million gallons, or something like 9 days' storage—making in all 13½ days' supply. He thought that Parliament would say they had behaved thoroughly satisfactorily in the way in which they had carried out these works. There was no doubt that the report of the Royal Commission of 1893 was a most able one, and one which would carry more weight with it than any other report on the water supply. The Commission was composed of men who understood the matter; and he was quite satisfied that the House of Commons would always treat the conclusions arrived at with great respect. What the Company had so far done was to obtain powers to construct works which were urgently necessary; and they had carried out their promise to Parliament to proceed with the works with every rapidity. They would, however, only carry the Company on to about the year 1900 or 1902. But they were determined to be ahead of any possible future requirements in their district, and they therefore felt that the time had arrived when they must go to Parliament again with a complete scheme based on the recommendations of the Royal Commission, which would carry them up to the year 1940, the date with which the Commissioners dealt. They could do nothing less than this if they wanted to reply to the charge so frequently made against the Water Companies—especially by the London County Council—that they were not taking those steps which they ought to take to meet the requirements which would come upon them, and that they were effete, and unable to supply their districts. Their desire was to submit to Parliament a scheme which would show that they were not only not effete, but fully alive to the responsibilities of their position. They realized the emergency of the situation, and were prepared to do what the Royal Commission said that they ought to do—construct works by degrees, as the population increased, and thus allay any fear on the part of anyone that they would be unable to supply their district fully with water. That was why they stated in the fourth clause of their report that they were going to Parliament for a Bill, which would be explained at a Wharncliffe meeting to be held at a later date, when he would go more fully into what the Bill proposed. It would not be in good taste for him to express any opinion with reference to the result of the inquiry as to increasing the flush of water from two to three gallons for water-closets. This would, he contended, be nothing more nor less than an exorbitant waste of water.

A SHAREHOLDER: If the flush is properly constructed.

The CHAIRMAN assented. Continuing, he expressed a hope that there would be no alteration in this matter. The eight Bills which were introduced into Parliament last session by the London County Council for the transfer of the undertakings of the Metropolitan Water Companies were not to be pushed forward, as they saw by a report which had appeared in the newspapers of that day. The reason of this was simply that the County Council could not get their obnoxious views agreed to. The cost of defending the interests of their Company alone in connection with these Bills had been £3000, the whole of which had been wasted. As regarded their debenture stocks, they had all been converted into one, known as debenture stock "A," and had been put on a sound basis. A Stock Exchange quotation had been obtained; and they at present had only one class of debenture stock. With respect to the question of superannuation, there were four gentlemen in their service whose ages ranged from 68 to 73, and who had rendered the Company efficient and good service—some of them for as long as 40 years. The Directors thought it was only right, and in the interests of the proprietors, that those gentlemen should now be allowed to retire. They were willing to do so, and were grateful to the proprietors for entertaining the question of their retirement. The Board would not have made this recommendation unless they had been enabled, owing to their possession of such an excellent staff, to adopt a system of promotion by which they would be able not only to pay the proposed pensions to those who retired, but also to get their offices filled by younger and more energetic men. In these days, they required all the energy they could obtain. They would, too, be able to effect a saving in salaries; so that, in addition to the advantages he had mentioned, the Company would be benefited to the extent of about £400 a year as a financial transaction. This was a position which a large Company ought always to be in. Special resolutions would be submitted to them with respect to these proposals. The pensions were based on the Government system of so many sixtieths, which they felt that no one could cavil at. He had no doubt whatever that the shareholders would agree with what was proposed; but the matter rested with them entirely, as did also the salary of the Secretary. He concluded by moving the adoption of the report and accounts.

Mr. C. M. VIALLS seconded the motion.

Mr. W. B. JEFFREYS said that the Chairman had been good enough to explain various matters of great interest to them; but he thought it was premature to state that the dividend would have to be reduced next half year to 4 per cent. per annum, in view of the increase in their income and the savings which would be effected in those items of expenditure against which asterisks had been placed. The whole of this additional outlay had been stated to be exceptional; and therefore they might hope to escape them in the coming half year. He quite agreed with the recommendations of the Directors regarding their old servants.

Mr. CLENDON called attention to the waste of water, especially in the winter, and said he believed that in the provinces the municipalities who had control of the water supply sent round notices to the consumers that if they wasted the water they would be fined. He believed, too, that fines were imposed.

The CHAIRMAN stated that that was so.

Mr. CLENDON said he had no doubt that was what would happen in London if the water supply got into the hands of the County Council.

The CHAIRMAN said that he believed that would be so. He trusted that the anticipations of Mr. Jeffreys in connection with their next dividend would be realized; and he (the Chairman) would do his best with that object. It had, however, been his duty, as Chairman, to tell them what he thought might be the case. He then put the resolution, which was carried unanimously.

Resolutions were afterwards passed declaring the dividends recommended, and re-electing the retiring Directors (Mr. S. Green and Mr. N. Whiting) and the retiring Auditor (Mr. T. P. Child).

Further resolutions were subsequently passed permitting the Secretary, the Supervisor (Mr. G. N. Paine), and Mr. Henry Phillips and Mr. W. B. Pembrooke (Collectors) to retire as from the end of the current year on pensions arranged on the basis mentioned by the Chairman. The proposed salary of the newly appointed Secretary (Mr. Montague Watts) was also approved; and further resolutions were next passed assenting to a donation of 20 guineas towards the maintenance of the Hampton schools for the year 1896, and an annual donation of 5 guineas, on certain conditions, towards the maintenance of the Hampton Hill schools, to commence from the 1st prox.

An Extraordinary General Meeting was held subsequently, and

The CHAIRMAN proposed a resolution authorizing the creation, issue, and disposal of the £750,000 debenture stock sanctioned by the Company's Act of 1894. He explained that it was not necessary to take a special vote on every £100,000 they wanted to raise. They therefore asked for authority to raise £750,000, and to issue it yearly, half yearly, or as they found circumstances required. The new debenture stock would be termed "B;" and it would differ from the existing "A" stock, which was perpetual and bore 4 per cent. The "B" stock would be redeemable at par in 25 years from the date of issue; and it would have to be issued at a rate of interest which would produce the least possible amount of premium.

Mr. VIALLS seconded the motion, which was carried unanimously.

A cordial vote of thanks was then passed to the Chairman and Directors, and to the Secretary and the Engineer (Mr. J. W. Restler, M.Inst.C.E.).

The CHAIRMAN acknowledged the vote on behalf of the Board, and expressed his pleasure at the names of the Secretary and the Engineer having been included in the vote.

The SECRETARY said he was greatly indebted for the vote which had just been passed; and he also desired to thank them sincerely for the kind manner in which they had agreed to the resolution which the Directors had been good enough to recommend to them respecting the retiring pensions.

The proceedings then terminated.

GRAND JUNCTION WATER-WORKS COMPANY.

The Half-Yearly General Assembly of this Company was held at the Offices, No. 65, South Molton Street, last Wednesday, under the presidency of Mr. FREDERICK TENDRON.

The SECRETARY (Mr. J. Goodwin) having read the notice calling the meeting,

The CHAIRMAN said he was quite sure that the consumers of water in the neighbourhood of London, and in London itself, would not soon forget the terrible frost of last February. He referred to this matter at their meeting in June; and he also mentioned the serious loss which it would cause to the shareholders of the London Water Companies. At the time, they had but little idea that it would amount to so large a sum. As regarded their Company, the loss was not less than £20,600; and it had to be distributed among the various classes of shares. Their Act of Parliament very clearly defined the manner in which the dividend was to be paid; and the point of the "C" and "D" shareholders having to bear their proportion of the loss when the profit was not sufficient to pay either 7 per cent. or 7½ per cent. was as clear as possible. Unfortunately, both had suffered—the "C" shareholders to the extent of 1 per cent.; and the "D" shareholders to the extent of ½ per cent.—representing respectively £1540 and £1000. The balance—over £18,000—was to be borne by the "A" and "B" shareholders. This was equal to a dividend to them of 2½ per cent.; and as they paid for the year 6½ per cent., it showed that—apart from the exceptional frost, and the weather in the early part of the year—they would have earned more than the 8½ per cent. dividend which for many years they had been accustomed to receive. Unfortunate as was the money loss, he unhesitatingly said that, as far as the feelings of the Board were concerned, they had suffered more from the distress which they knew had been caused throughout the suburbs of their district. Among the misfortunes which had fallen on them, was the shortening of the life of their late esteemed Engineer, Mr. Alexander Fraser, who, in spite of all the difficulties against which he had to contend, was always so kind, willing, and hard-working that, although the consumers frequently used (both in writing and speaking) harsh and sometimes very bad language to that gentleman, they generally apologized afterwards, soothed by their late Engineer's urbanity. There was not a member of the Board who had not regarded Mr. Fraser as a personal friend. But for the fact that they had faced the difficulties lately experienced, and had determined to lower their mains, and thus prevent the freezing of the smaller pipes in their suburbs, he should never feel safe from one year to another from the effects of frost. He had, however, been told that it would not matter if the mains were lying in the road exposed to frost, so long as a constant flow of water was kept up in them—that the

reezing of their smaller mains was chiefly owing to the freezing of their connecting pipes, thus checking the circulation of the water. They hoped to be able to keep the actual cost of lowering the mains to about the sum mentioned in the report—£15,000. How much of this sum would have to be charged to capital, and how much to revenue, would very much depend on the view taken by the Government Auditor, Mr. Stoneham. Some of the rich London Companies might like to have the whole of the expense debited to revenue—this would, for instance, suit the West Middlesex Company admirably. But he did not think it was at all a right principle. It would operate rather prejudicially to the view of the Directors of the Grand Junction Company, that half of the amount should be charged to capital and half to revenue. However, whatever the figure might be that was arranged with Mr. Stoneham—who always discharged his duty with great firmness, but at the same time with much consideration—they would charge half in the first half year, and the other moiety in the second half year. He contended that, as their Act of Parliament prescribed that the dividend on the various classes of their shares was to depend on the earnings of the year, nothing could be fairer or more desirable in the general interest than that an exceptional charge like this should be spread over the whole year. One of the great advantages of this was that the price of their shares in the market was not so much affected; and although this did not concern the Board, who would not think of selling their shares—and very few of their shareholders thought of doing so—yet none of them liked to see their shares go down if this could be avoided. In spite of the smaller dividend, their "A" shares stood in the market at 110-15 for the £50 share, which was precisely the price at which they stood two years ago; while the "D" shares were quoted very much higher than they were two years ago. The last transaction in them which he saw was at 98½; whereas the highest price at which the "D" shares were issued was 92. They were at the present time very anxious to have some more money. There never was a big Company like theirs which had so small a cash balance; but they had felt that they could not ask the public to buy their 7 per cent. shares until they saw that they were certain of getting that rate. They had therefore gone on as best they could. But now they were through their recent difficulties, and saw that the 7 per cent. was more than earned, they would offer by public auction, as Parliament required, possibly some £20,000 of the "D" shares; and thus put themselves in the financial position which they ought to hold. If they had suffered very much from the frost and the temporary indignation of the public—indignation which was not justifiable but excusable, although the public had put the blame upon the Companies instead of upon circumstances—he unhesitatingly said that they now held a much better position towards the public and in Parliament than the Water Companies had held for years. They had also to congratulate themselves on the altered nature of the London County Council. At present, that body seemed to indicate a desire to deal with the Water Companies on a juster basis than formerly; whereas their one effort previously, as far as one's experience went, had been to depreciate the value of the property of the Water Companies as much as possible, so as to buy it as cheaply as they could. He was sorry also to observe that there was just a little touch of that feeling still animating the London County Council; because the present policy of the Council was to negotiate for the purchase of the Water Companies' property, and to hold over the Companies' heads the threat that, if they did not succeed in these negotiations, their policy would then be to agitate in Parliament to get greater power of control (as they called it) over the Water Companies. All this meant, "Get power over the Water Companies; intimidate them if you can; and buy them as cheaply as possible. No matter whether you are acting on a right principle or not, get them cheaply under any circumstances." He feared that this would always be the spirit of a purchaser, and even of the regenerated London County Council. If, however, he complained a little of that body, he had to complain most bitterly of the conduct of their ambitious officers, who were mainly responsible—on account of the advice they gave to the Council—for the treatment the Water Companies had had to undergo, and for the enormous parliamentary and other expenses to which they were constantly being put. At the Wharncliffe meeting to be held later on, a resolution would be submitted to the shareholders in connection with the Staines scheme, which he would deal with only briefly on the present occasion. The main principle of the scheme was to bring the water by its natural flow of gravitation from above Staines to the reservoirs that would be made upon their ground, so that the three Associated Companies—the New River, the West Middlesex, and themselves—could get their supply from a higher point of the river, where it was less open to surface deterioration, than where they were obtaining their present supply from. It was also intended only to take the water at its natural flow, when the river was running its normal course, which might be taken at something like 600 million or 700 million gallons per day of 24 hours. There were times in very dry months when the flow of the water was inadequate for the supply of London and for maintaining the navigation; and this would be taken into account by them. There was also another very unfavourable time for the Companies to take the water—that was when the river was in flood. For the purposes in view, a large reservoir divided into two, and capable of holding 2500 million gallons, would be made and kept charged with water; and when the river was in flood or affected by drought, instead of the water running from the river, it would be closed off and allowed to flow from these reservoirs. He now asked the meeting to give special attention to what he was going to say. The Engineer of the London County Council, making a report upon the Staines scheme in its entirety—for at one time it was supposed that six of the Companies would take part in it—put the supply of water required daily at 240 million gallons; and he estimated the cost on a method of his own (which he was pleased to say was based on the various Companies' figures) at £21,250,000. In addition, Mr. Binnie put the annual cost for pumping and maintenance at £430,000. He (the Chairman) thought that even the public would admit that, when an Engineer of position gave certain figures, the question was not on what he based them, but on their reliability to convey right information, and not to mislead. Mr. Binnie's estimate was on a daily supply of 240 million gallons. The present scheme framed by Mr. Hunter and Mr. Middleton was for a daily supply of 85 million gallons for the three Associated Companies—consequently for a supply of more than one-third of that contemplated for the six Companies; and, in addition, they were to have a larger proportion of water storage. Nevertheless, the estimate of Messrs. Hunter and Middleton for the whole expense, including the purchase of the land, was under £1,000,000. These were the plain facts; and he (the Chairman) only hoped that they would go before the members of the London County Council, and that some inquiry would be made into this matter; because it was abominable that the public should be deceived, and put in enmity towards the Water Companies, merely to satisfy the ambition of individuals. Mr. Binnie's estimate of the cost of maintenance and of pumping was, as he had said, £430,000 per annum; whereas the estimate submitted to the Directors for over one-third of the quantity of water originally contemplated was under £10,000. He would leave Mr. Hunter to fight out these figures with Mr. Binnie, with the same satisfaction and assurance as he had in the result of the fight "A Water Director" recently engaged in with Mr. Cripps in the columns of *The Times*. After expressing his readiness to answer any questions, the Chairman concluded by moving the adoption of the report and accounts.

Mr. Francis Tagart seconded the motion. He observed that, with the exception of Mr. Noel Whiting and of Lord Knutsford (whose absence he was sure they all regretted, as it arose from illness), he was their oldest Director; and, as their Chairman for some time, he was brought into constant and immediate contact with the late Mr Fraser. He, therefore, was fully aware of the great value of that gentleman's services to the Company. Like many modest men, he was a very able man; and he placed his services, and his whole heart, at the disposal of the Company. He had left their works in excellent condition. When he was Engineer, he never incurred any unnecessary expense; being always economical, although he never scrupled to recommend an outlay which he thought was necessary for the well-being of the Company, and to enable them to discharge their duty to their customers. Their deceased friend, in brief, did his duty both to the Directors and the shareholders.

Mr. R. A. M'Lean desired to point out that the Company's net revenue in the past half year was only £42 less than that of the September half of 1894. He wished to mention this, as some of the absent shareholders, who did not understand the position of things, might take an erroneous view of the decline in the dividend, which had been entirely caused through the exceptional expenditure on account of the frost in the previous half year. As regarded the action of the London County Council, that body had from time to time attacked the Water Companies, causing them to expend thousands of pounds every year in order to defend their property. If an action were brought against one individual by another, the plaintiff would not be allowed to retire from his action till he had paid the costs of the defendant. So far, however, as the Water Companies were concerned, the County Council could attack them *ad lib.*, and could put their hands in the ratepayers' pockets to pay the costs. Apparently, it was a principle of our law that there was no grievance without a redress; but so far as the action of the London County Council towards the Water Companies was concerned, it seemed to him that the Companies had a grievance, and that they had no redress. He hoped that some of the legal luminaries on the Board would devise some scheme by which this state of things could be altered.

Hon. Sydney Holland (a Director) remarked that it was not to the interest of "legal luminaries" to do so; in fact, they believed that the London County Council existed as a sort of Barristers' Benevolent Institution. (Laughter.)

Dr. Leeson urged the lowering of certain mains in particular, and expressed a hope that there would be no turning off of the water this year; it being, he said, owing to this circumstance that a great deal of distress was caused in the late frost. When the water was kept running through the main, there was a very fair chance of people getting the supply they required. He felt that he could not sit down without adding his personal tribute to the great loss which the Company had sustained by the death of Mr. Fraser, whom he knew for 35 years.

Mr. Walter Hunter, M.Inst.C.E., stated that the mains were receiving every attention. Dr. Leeson might rely upon it that everything would be done to put them in the best possible position; and they would be lowered wherever it was necessary to do so. He quite agreed with what had fallen from Dr. Leeson with respect to keeping the water running in the pipes. They were making special arrangements, so that even if the water was turned off at the houses, a certain amount of water would run through the Company's pipes. He thought the experience of most companies last year—companies in country places—was that, if they kept the water flowing, there would be less chance of the pipes freezing than if they turned the water off. This was even more important than lowering the mains.

The Chairman then put the motion, which was carried unanimously; and, subsequently, he proposed the payment of the dividends recommended. In answer to a question, he stated that in future the "C" and "D" shares, in Statement No. 1 of the accounts, should be respectively so indicated.

An Extraordinary General Meeting of shareholders was then held.

The Chairman stated that the meeting was in connection with the superintendence of the engineering department, as to which promotion had been given to various officers of the Company. Mr. Goodman, who had long had the superintendence of the works at Kew, and had of late years control of the works at Hampton, was now the general surveyor of all the works of supply; while the works of distribution had been put into the hands of very old servants of the Company—Mr. Leggatt and Mr. Peck, with the general supervision of Mr. Alfred Fraser, the son of their late Engineer. It had, however, been felt absolutely necessary to have the services of an experienced Engineer. A man who would give his whole time to the Company was not easily to be found; and they felt it would be of great advantage to the Company at present to obtain the willing services of their friend and colleague, Mr. Hunter, who had had much experience of their works, and who, as they were all aware, had rendered enormous services, in conjunction with the late Mr. Fraser, to all the London Companies. He had not intended to say so, but Mr. Hunter had never received a

shilling of remuneration for these services; the amount contributed by the London Water Companies, after a great deal of pressure, being so disgracefully small that Mr. Hunter declined to take any of it, and it was all handed over to their late Engineer. He trusted that by the adoption of the Staines scheme, Mr. Hunter would have some pecuniary profit—at all events he would have his pride and ambition gratified in having introduced a scheme which was so beneficial to the Water Companies—beneficial, however, not pecuniarily, but as enabling them so much better to discharge their duties to the public. He concluded by proposing the following resolution: "That, in consideration of the time and attention which Mr. Hunter will, during the vacancy in the office of Engineer, devote to the supervision of the engineering department of the Company, the proprietors hereby authorize the Directors to pay to Mr. Hunter special remuneration at the rate of £500 per annum, pending the filling up of the office of Engineer." The amount mentioned was very small; but nevertheless Mr. Hunter was satisfied with it.

Mr. TAGART seconded the motion, which was at once carried unanimously.

Mr. HUNTER, in reply, expressed his gratitude to the shareholders. He had taken all along a very deep interest in the Company and its affairs; and he would do his best to safeguard their interests in every way from an engineering point of view. He afterwards paid a warm tribute to the late Engineer, whom he had known for 30 years.

A cordial vote of thanks to the Chairman, Directors, and staff was afterwards passed.

The CHAIRMAN, in reply, assured the proprietors that the Directors would continue to fight the Company's battle to the best of their ability. If their opponents counted on intimidating them, and getting their property from them because they were afraid, he could only say that those gentlemen were utterly mistaken. He had full confidence in Parliament. If property like theirs were taken away from them, the circumstance would weaken property throughout the kingdom. The one thing against which they had to guard was being frightened.

The proceedings then terminated.

THE WATER QUESTION AT EASTBOURNE.

Considerable correspondence has taken place between the Duke of Devonshire, the Chairman of the Eastbourne Water Company, and the Eastbourne Town Council, in respect of the water affairs of the borough; the Council having given notice of an application to Parliament for acquiring powers to establish their own water-works, as previously reported in the JOURNAL. In the first letter, signed by the Mayor (Mr. J. A. Skinner), the Council state that owing to serious complaints, the water supplied by the Company had been examined by several eminent chemists; and the complaints had been ascertained to be well founded. "The Corporation are advised," the letter proceeds, "that it is absolutely necessary to obtain a new source of supply; and it would appear from the communications which have been sent to the Council, that the Company are advised to the same effect." The Water Company are then requested to receive a deputation from the Council, for the purpose of discussing the position and the terms upon which the Company are prepared to sell their undertaking to the Corporation. The Duke of Devonshire, in reply, says: "I observe that the terms of the notice given by the Corporation of their intention to apply to Parliament for a Bill to acquire the undertaking appear to indicate the intention on the part of the Corporation to take advantage of the temporary difficulties recently encountered by the Company with the view of depreciating the value of the undertaking in the event of its being ultimately acquired by the Corporation. Under these circumstances, and having regard to the fact that the Company are not desirous of disposing of their undertaking, it appears to me that, until the proposals of the Corporation and the Company are more clearly defined by the Bills which they respectively intend to submit to Parliament, a meeting such as is suggested would be premature." The Town Council next informed the Company that there was no thought or intention of limiting the discussion in any way by anything contained in the parliamentary notices, which, as usual in such cases, had been framed to meet all possible contingencies, and were therefore drawn in very wide terms; and the Council expressed their anxiety for an interview, in the hope that an exchange of opinions might lead to an amicable arrangement. The letter concluded by again asking that an interview should take place, with the understanding that, if it was not satisfactory, no future reference should be made to it, so that the interests of neither party might be prejudiced by what had been said. This is how the matter stands at present, with the additional fact that the Eastbourne Medical Society have passed resolutions approving of the action of the Council.

Vaughan and Brown, Limited.—The Directors of Vaughan and Brown, Limited, have declared an interim dividend for the six months ended Sept. 30 last, of 7 per cent. per annum on the preference shares, and 5 per cent. per annum on the ordinary shares.

The Chemical Works of the Bradford Corporation.—The Bradford Town Council last Tuesday approved of resolutions adopted by the Gas and Electricity Committee, accepting the offer of Messrs. G. Scott and Son, of Liverpool, to supply and fix at the Frizinghall Chemical Works, for the sum of £1350, plant required in an extension of the works, and advancing the salary of Mr. Wyld, Manager of the works, by £30 per annum.

Dorking Water Supply.—The Dorking Water Company are now making investigations for the purpose of acquiring a new source of supply from Betchworth Park. They have already entered into negotiations for the purchase of the powers to obtain additional water from the Deepdene Estate; and in consideration of this action, the Dorking District Council have resolved to postpone for three months their proceedings to establish water-works of their own, in order that the Company may not be hampered in their efforts to provide an adequate supply of water to the entire district.

METROPOLIS WATER SUPPLY.

Proposed Constitution of a Public Water Authority.

As briefly mentioned in the JOURNAL last Tuesday (p. 1191), the London County Council had presented to them on that day by the Parliamentary Committee a long report on the water supply of the Metropolis, in which it was proposed that a Public Authority should be constituted by the Government to acquire the existing undertakings and generally carry on the business. In view of the importance of the report, we reproduce it in full.

On Oct. 15, 1895, the Parliamentary Committee submitted the following recommendation to the Council: "That, desiring that the supply of water in the Metropolis and the surrounding districts should be in the hands of a Public Authority, and with a view to a complete agreement with all parties concerned over the entire area supplied, the Council do invite Her Majesty's Government either to deal with the question themselves or to appoint a Royal Commission to do so." The following amendment to that recommendation was moved by Mr. Stuart, but rejected: "That the Bills for the purchase of the London Water Companies be proceeded with." The debate on the recommendation having been adjourned, the Council on the 22nd of October adopted the following amendment: "That, the Council having decided not to proceed with the suspended Water Bills, and desiring that the Council should be the Water Authority for London, it be referred to the Parliamentary Committee to report to the Council, without delay, the lines on which they suggest that the Government should be asked to legislate."

As regards the decision of the Council not to proceed with the Bills, it will be remembered that, as introduced, the Bills contained in clause 6 an express direction that the Arbitrators, in determining the value of the undertakings, should have regard to various circumstances tending to lower such value, and further provided that no addition should be made in respect of compulsory sale, and that no allowances should be made for back dividends beyond a period of six years, or in regard to any assumed increase of rateable value. The Committee of the House of Commons did not adopt the proposals contained in this clause, but stated, through the Chairman, that they "wished the Arbitrator to have it in his discretion to accept all the evidence, if any, and to give such effect, if any, to the considerations submitted to him as he in his discretion should think right."

The Chairman subsequently re-affirmed this view, and stated the decision of the Committee—"not in any way to fetter or reduce the power of the Arbitrator to consider fully whether he should give any, and what, sum, and on the question of whether any addition shall be made to the fair and reasonable value of the undertaking in respect of compulsory sale, if in his discretion he should think fit to do so. Our object is to leave the Arbitrator as perfectly unfettered with regard to that question as can be."

The Council thereupon submitted a substituted clause, to the effect that, in ascertaining the value, the Arbitrator should consider all the circumstances of the case and the contentions of both parties, with power to deal with the same with an absolute and unfettered discretion, and as fully and as effectually as could be done by Act of Parliament. This clause would have committed the ratepayers of London to purchase the undertakings at whatever price the Arbitrator in his discretion might award; including, if he thought fit, an allowance for compulsory sale and back dividends. Purchase on such terms would be contrary to the policy which has hitherto prevailed at the Council, and ought not to be undertaken without full consideration of the probable financial effect of such purchase upon the rates.

The following quotations from reports of the Parliamentary and Water Committees presented respectively in February and September, 1891, show the strong feelings entertained against an arbitration such as was proposed by the Metropolis Water Supply Bill introduced by certain Vestries in that year. The Parliamentary Committee pointed out that such an arbitration "would impose on the trustees the trust not only of purchasing the whole of the existing works, but also of constructing new water-works and supplying water from new and independent sources—a policy to which it can scarcely be conceived that the inhabitants of London ought to stand committed. It is probably no exaggeration to affirm that, whereas a totally new and satisfactory series of works might be provided at an estimated cost varying from £10,000,000 to £15,000,000, this extraordinary scheme might cost London, if carried out as proposed by the Bill, some indefinite sum approaching £50,000,000." The Water Committee stated that, if the Companies' undertakings were purchased on ordinary arbitration terms, "it is no exaggeration to say that London might in this manner be made to pay from 30 to 40 millions in purchasing the undertakings of the Companies, and might then find itself obliged to spend from 10 to 20 millions more in providing a new supply. This would in all probability be the result of an obligatory immediate purchase on arbitration terms; and such a purchase must therefore be resisted at all hazards."

The Parliamentary Committee, in recommending the Council on the 15th of October last to invite the Government to deal with the question, were actuated by considerations which it is desirable to explain. The County of London, for which the Council in its resolution of the 22nd of October expressed the desire to be the Water Authority, is one-seventh only of the area of which the water requirements, according to the report of the Royal Commission of 1893, have to be considered. The area of possible supply of the eight Water Companies is 620 square miles in extent, of which that of the County of London is 121 square miles only. The area of Greater London *i.e.*, the City and Metropolitan Police district—embraces 701 square miles. Outside this area again are certain outlying districts covering about 144 square miles which, in the opinion of the Commissioners of 1893, should be included within the water area. The total area, the water requirements of which have to be considered, is therefore 845 square miles. For the purpose of this report, we describe this area as "the water area."

The districts outside the county, though only containing at present a population of 1¼ millions, or one fourth of that of the County of London, may by 1931 (in the event of the estimate of the Commissioners

as to the total population of the water area by that date proving correct) possess a population exceeding that of London. It is largely the growing needs of Outer London that will render the provision of new or improved sources of supply necessary. The water question is one of the greatest importance to Outer London as well as to Inner London; and as suburban villages are rapidly growing into populous towns, the necessity for providing efficient means of preventing pollution of sources of supply is of increasing importance in the interests of all concerned. It is therefore essential for the complete settlement of the question that a body should be created which shall represent the interests and command the confidence of the water consumers throughout the water area. The experience of the Council in connection with the Water Bills of last session proves the justice of this view.

The system of water management and distribution which was contemplated by the Council when it resolved on July 3, 1894, that the Bills should be prepared, is shown by the proposals submitted by the Council to the conference of representatives of the outside authorities held on July 30, 1894. The proposals were as follows: (1) That the Council should be placed under the obligation to supply water to the local authorities outside the county, but within the area at present supplied by the Metropolitan Water Companies, upon such terms as may be agreed or decided by arbitration. (2) That any local authority outside the county should have the option either (*a*) of purchasing on suitable terms so much of the works of distribution as is appropriated to the district of such local authority, with the right to a supply of water in bulk from the London County Council on terms to be arranged; or (*b*) of having water supplied direct by the Council.

It is clear from these proposals that the Council had then in view the system which has been generally adopted in provincial towns. The corporations of such towns in many cases supply the consumers of the outside districts direct; in other cases, they supply the district authorities with water in bulk, for distribution among their own consumers. In almost every case, however, the control of the sources of supply remains in the hands of the corporation; so that, while there may be several distributing authorities, there is but one supplying authority. There is, no doubt, much to be said for this system; but the fact must be faced that the authorities of the districts surrounding London were practically unanimous in declining to accept it when put forward by the Council. The Chairman of the Middlesex County Council stated that the proposals of the London Council were "entirely unacceptable, not only to Middlesex, but also to Surrey and Kent;" and he contended that, "inasmuch as the sources of supply are beyond the County of London, and are within the Counties of Hertford, Middlesex, and Surrey, those counties should have the right, if they think fit, of purchasing, by such machinery as should be approved, the portions of the undertakings appropriate to the county."

In consequence of this contention on the part of the outside authorities, the Council consented to a most serious departure from the system originally contemplated. The London Council agreed to give to the Surrey County Council the option of purchasing not only works of distribution, but also a portion of the sources of supply. That principle having been once conceded, the Council were committed to the policy of complete severance of the outside districts from London; and agreements having that object were accordingly entered into, or were under consideration, with various authorities. The question of apportioning sources of supply presented considerable difficulties; and it has yet to be shown that these difficulties could have been settled to the satisfaction of all parties. Even assuming that the difficulties could have been ultimately overcome, the result would have been to create several Water Authorities, and to sacrifice all the advantages in the direction of uniformity and economy which would be secured by unification of the supply.

Regarding the matter from the point of view of the agreements actually entered into, and supposing it conceivable that similar terms could have been arranged with the other authorities, we contend that those agreements would have been of doubtful advantage to the London ratepayers, seeing that they dealt only with the present sources of supply, and left the most important and pressing question of future supply untouched.

Having regard, therefore, to the existing circumstances of the case, we recommend that the Government be asked to constitute by Act of Parliament a Public Authority for the whole water area. As regards the composition of that authority, we do not think it desirable at the present moment to indicate any specific lines on which the Government should be asked to proceed. For the Council to propose any scheme would probably be at once to invite opposition on the part of the other authorities concerned; whereas the Government could approach the subject from an entirely independent and impartial point of view.

As, however, the Council will doubtless look to us for some expression of opinion on the subject, having regard to the desire expressed by the Council that it should be the Water Authority for London, we may quote the words of the report of the Select Committee presided over by Sir William Harcourt in 1880, as fairly representing our views: "Without prescribing the composition of such body, your Committee are of opinion that it should include elements to be derived from the Corporation of London and the Metropolitan Board of Works, together with a due representation of the districts at present supplied by the Metropolitan Water Companies which lie beyond the jurisdiction of the Corporation and the Metropolitan Board." Taking this proposal as a basis, we would suggest a body composed of members nominated by the London County Council, the City Corporation, and the Home Counties, with the addition of nominees of the Local Government Board, and of a sufficient number of co-opted members possessing special knowledge and qualifications. No doubt special provision would have to be made in any case for such authorities as Croydon, Richmond, and Tottenham.

We propose that the Act creating the Water Authority should confer upon it full power to purchase the undertakings of all or any of the Companies by agreement, and, failing agreement, to apply to Parliament to determine in what manner and on what conditions purchase shall be effected. Pending purchase, the Water Authority should be invested with the powers of control now exercised by the Metropolitan Authorities under the Metropolis Water Acts and certain of the powers of the Local Government Board, such as the power of instituting inquiries into the quality and quantity of water. We believe that there would be distinct advantage to the water consumers if those powers were now concentrated in the hands of a single authority, as it would tend to simplify and expedite procedure. In the event of purchase of all or any of the Companies not being effected, an inquiry should be held into the statutory powers and obligations of the Companies and the control exercised over them, with a view to Parliament being asked, if found desirable, to make the obligations and control more complete.

Pending the constitution of the Water Authority, we think the Council might usefully take steps with a view to facilitating the acquisition of the undertakings of the Companies. In February, 1894, prior to the introduction of the Transfer Bills, the Council authorized negotiations to be entered into for the purchase of the undertakings, or one or more of them, at a fair and reasonable price; but they at the same time insisted on certain conditions as the basis of such negotiations, which conditions in themselves involved the more serious points at issue affecting value. The bare resolution was communicated to the Companies, whose replies made it evident that they were not prepared to negotiate on these terms, though some of them expressed willingness to consider any definite proposal which might be made to them.

According to our view, no serious attempt has hitherto been made by the Council to negotiate with the Companies; and we think that every consideration now points to the desirability of this course being taken without any delay. Notices have just been issued by three of the Companies—viz., the Grand Junction, New River, and West Middlesex—of their intention to introduce a Bill into Parliament next session for the construction of large storage reservoirs to carry out the Staines scheme; and the Council will have immediately to consider the course to be taken with regard to the Bill. If the Council should adhere to the opinion expressed by the late Council in February, 1895—that the true solution of the problem of future supply is the provision of a new source rather than the extension of present sources—it might be necessary for the Council to oppose the Bill. Such opposition would involve a long and expensive contest before Committees of Parliament; and it would obviously be to the advantage of all concerned if, by friendly negotiations, agreements could be arrived at between the Companies and the Council for the transfer of the undertakings. Such agreements could be embodied in the Act constituting the new authority, but would, of course, be provisional until sanctioned by Parliament. We recommend that the Council authorize negotiations to be initiated by the Parliamentary Committee with the Water Companies, for the purchase of their undertakings; and we suggest that negotiators be appointed to act on behalf of the Council.

As regards the question of future supply, we think it highly important, especially in view of the Bills being promoted by the Companies, that the Water Committee should bring up its report on the subject with the least possible delay, in order that the Council may be in a position to take such action as may be necessary for the due protection of London. If the Council is satisfied that no scheme for storage of the Thames and Lea waters would adequately meet the future wants of London, and that resort to a distant source is the only alternative, then it may be the duty of the Council to take steps to secure the requisite water areas before they are absorbed by other large communities. The acquisition need not involve any obligation on the Council or the new authority to undertake the expense of bringing the supply to London. This might be postponed; the essential thing being to secure the area required.

The following are the recommendations which we think the Parliamentary Committee should submit to the Council:—

(1) That Her Majesty's Government be invited: (*a*) To constitute by Act of Parliament a Public Authority for the water area defined above. (*b*) To vest in such authority, when constituted, the powers now exercised by the Metropolitan Authorities under the Metropolis Water Acts in reference to the Water Companies, and certain of the powers now possessed by the Local Government Board, with a view to improved administration and efficient control. (*c*) To confer upon such authority power to negotiate for the purchase of the respective undertakings of the Water Companies, and to give effect to such purchase in such manner as may be found expedient, and, if thought fit, to seek parliamentary powers for the acquisition of the undertakings otherwise than by agreement, and for dealing with the whole question, including that of future supply.

(2) That, pending the constitution of such authority, the Council do authorize negotiations to be initiated by the Parliamentary Committee with the Water Companies for the purchase of their undertakings.

(3) That, with a view to the Council coming to a decision on the pressing question of new sources of supply as compared with a scheme of storage reservoirs, the Water Committee be instructed to report their final conclusions without delay.

The consideration of the report was adjourned till to-day.

Colonel Hughes has given notice to move as an amendment to add the following words: "And that the operation of the following clause in the order of reference to the Water Committee be suspended until further resolution of the Council thereon—'the Committee shall conduct any negotiations with the Water Companies for purchase or otherwise which may be authorized by the Council.'"

The Metropolitan Vestries and the Water Question.

A Conference of Metropolitan Local Authorities, convened by the Vestry of Kensington, was held at the Kensington Town Hall last Tuesday, "to consider the desirability of legislation being promoted to secure for the ratepayers adequate control and supervision over the water supply of the Metropolis." Out of the total of 43 Local Authorities in London, only 16 were represented; the absentees including such important and populous districts as Islington, Battersea, Bermondsey, Hackney, Shoreditch, Mile End, and Lambeth. Major-General WEBBER, R.E. (Kensington), presided.

The CHAIRMAN, in opening the proceedings, remarked that the question of the water supply of the Metropolis was one which presented difficulties of a most intricate character. There was in London a population of 5,400,000, of which number the River Thames supplied 54½ per cent.; the Lea, 27½ per cent.; and wells, &c., 18 per cent.

The eight Water Companies of the Metropolis supplied, on an average, 28·29 gallons per head per day for domestic uses; and that employed for public purposes was a little more than half this amount. With regard to the quality of the water, which had of late been much canvassed, the report of Professor Frankland was most encouraging. It was necessary, while taking into consideration this subject, to have regard to the point as to where new sources of supply were to be found. Calculating up to 1930, supposing there were an extension of London boundaries, there would be a population of something like 11 million. It was a fact, however, that the sources of the Thames and Lea had never been fully investigated, and their resources never fully taxed. For the purchase of the Companies between £40,000,000 and £50,000,000 would have to be raised. The eight undertakings of the London Water Companies had spent something like £15,500,000. The shareholders should not be deprived of their just rights and revenues; and consequently the question of compensation would arise. They must not lose sight of the fact that, out of the £15,500,000, a very large proportion was underground in the shape of mains, &c., the value of which was very deceiving. The origin of the present conference lay in a series of resolutions passed by the Kensington Vestry with respect to the London Water Supply. These resolutions expressed the desire that some authority should be constituted which should have control of the eight Metropolitan Water Companies, but that the authority should not be the London County Council. The Vestry were of opinion that the purchase of the Companies' undertakings by that body was most undesirable. What they wanted was the creation of some authority which, while giving the ratepayers supervision over the water, and having power to inquire into the supply, should not take from the Companies their rights and privileges. The question of compensation for the loss sustained by the Companies was, of course, one for arbitration.

Mr. G. N. Watts (Kensington) moved the first resolution, which was as follows: "That, in the opinion of this Conference of Metropolitan Local Authorities, it is desirable that any legislation dealing with the water supply of the Metropolis should be in the direction of the passing of an Act which, without unduly hampering the operations of the several Companies, shall provide for the supervision and control of the existing undertakings, rather than for their purchase."

Mr. T. Huggett (Kensington) seconded the motion.

Mr. J. Liddiard (Wandsworth) moved, as an amendment—"That, in the opinion of this Conference of Metropolitan Local Authorities, it is desirable that any legislation dealing with the water supply of the Metropolis should be in the direction of the passing of an Act which shall provide for the constitution of a Water Trust, to consist of persons to be elected by the London County Council, the Corporation of London, the Thames Conservancy, and the sanitary authorities north and south of the Thames within the area of Greater London referred to in the report of the Royal Commission, which Trust shall have all the powers necessary to control and manage the water supply within such area."

Mr. H. J. Hunter (Hampstead) seconded the amendment.

On being put to the vote, the original motion was lost by a large majority; and the amendment then became the substantive motion. On its being submitted,

Mr. W. R. Sayer (Fulham) moved an amendment to the effect that the Water Companies should be bought out, and that the governing authority should have on it a majority of representatives of the London County Council.

This amendment was defeated; and the substantive motion was thereupon put and carried.

The following resolution was agreed to without discussion: "That, in the interests of the Metropolis, it is expedient that Her Majesty's Government should forthwith promote legislation for the carrying out of the proposal indicated in the foregoing resolution, and for the creation of the necessary authority, which should, in its constitution, be representative of the ratepayers of the areas supplied by the London Water Companies."

After adopting a resolution providing that copies of the foregoing resolutions should be sent to the Prime Minister, the President of the Local Government Board, the London County Council, and the various Metropolitan Authorities, the conference closed.

ALLEGED DEFECTIVE RESERVOIRS IN CORNWALL.

The St. Germans Rural District Council have been peculiarly unfortunate in their schemes of water supply. Frequent reference has been made in the Journal to the defective state of the reservoir which has been constructed for the supply of Millbrook; and it now appears that a leakage has been found in the reservoir which supplies Torpoint, another of the villages on the Cornish bank of the Tamar. At a meeting of the Council last Thursday, reports were presented with reference to both matters. In accordance with the decision of the previous meeting (see *ante*, p. 1040), a deputation visited the reservoir, and also waited upon Mr. H. Masterton, the Engineer. Mr. Parsons, a member of the Council, said a visit to the pure water chamber of the reservoir revealed the fact that the water was coming in on all sides to a very large extent. They were all satisfied that the work was very incomplete, and that there must be a considerable outlay in order to put the reservoir in a proper state. Mr. Masterton, whom they afterwards saw, admitted that there was a grave defect as far as the pure water chamber was concerned; and he proposed that it should be remedied by certain work being done. He also admitted that other parts of the works were defective, including the filter-beds; but he said that this might be accounted for by subsidence of the land. The deputation left Mr. Masterton with the impression that he would go carefully through the whole of the work, and report to the Council as to what should be done. As to the Crafthole reservoir, which supplies Torpoint, a report was made by Mr. S. W. Jenkin, C.E. This stated that a shaft had been opened at the back of the outlet well, in order that an examination might be made of the mouth of the adit through which the main pipes run. This shaft was filled with good puddle; a brick wall at the back of it closing the mouth of the adit. The water came freely into this shaft from the reservoir on both sides, and rose immediately to the same level as the water in the reservoir; thus showing that the pitched slopes were not water-tight. Openings had been made in the pitching along the south-west side of the reservoir; and the clay puddle had been found to be of very inferior quality, and very irregularly laid—apparently following the slope of the natural ground instead of being laid underneath the pitching. This portion of the reservoir could not be considered water-tight. Two or three shafts had been sunk along the puddle wall and the large bank. This was found to be good up to a certain height, above which ordinary peat soil had been used, which was not water-tight. The result of the examination had been to confirm the opinion that the most serious leakage took place at or near the outlet of the reservoir, and began when the depth of water had reached 10 feet. To remedy it, he suggested that a layer of concrete a foot thick should be placed over the pitching, and carried to the level of the overflow, so as to make it water-tight; the inferior material in the puddle wall of the tank to be removed, and replaced with good puddle, and the imperfect pitching to be taken up and reset in good puddle. The cost of these works would be £300. Mr. Jenkin also pointed out that the mode of taking water into the main from the reservoir was open to objection, because all the water was drawn from the bottom of the reservoir instead of from various heights; and he recommended that a cast-iron outlet tower, with proper valves, should be provided. It was decided that Mr. Jenkin should carry out the works he suggested.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

At the present moment, the electric light is being boomed in Edinburgh by the Corporation Committee. The occasion is a proposal to double the producing plant. Professor Kennedy has been applied to; and he has furnished a report which is written in a spirit of gleefulness at the success which has attended the venture. He recalls that in his former report he proceeded on the assumption that in three years the Corporation might have 40,000 lamps wired; whereas they have now, in a fourth of that time, equivalent to 45,600 lamps wired. He gives figures as to the working, showing that, in the 37 weeks to the end of this year—the summer half year—during which the installation will have been running, the income, including the amount derived from public lighting, will have amounted to £7750, which is at the rate of 4·85d. per unit; and that the expenditure will have been £8252, or at the rate of 5·14d. per unit. He does not say whether the income, so far, has been actually received, or if it is only a computation from the number of units which are, or will be, indicated as having been sold. But in the matter of expenditure, he gives a proportion corresponding to the period run for the charge in respect of interest and sinking fund, so that the figures he gives are admittedly problematical. He does not call attention to the fact; but it is manifest from his figures that there will be a loss on the working of about £500. I suppose he expects that the profits during the winter months will come in more freely than during the summer; and he goes on to say that by the middle of April, by which time the installation will have run a year, there will be a credit balance of between £2000 and £3000. He recommends, and the Committee have adopted the recommendation, that about £30,000 should be expended in extending the plant, most of which will be required for new boilers, engines, dynamos, and electrical plant in the works. This will enable them to supply current to about 50,000 additional lamps. It is to-day announced that the Electric Lighting Committee have resolved to recommend that the charge for current be reduced from 6d. to 5d. per unit, and that £2 less be charged for the current supplied to each public lamp. This proceeds upon the expectation that there would be a gross profit of £8000 in the course of next year, if prices were to remain as at present; and the reductions will absorb £4820 of that. It is then added that, "according to the best tests, it is considered that the price proposed to be charged will be, light for light, equal to the Edinburgh gas." This makes the Edinburgh installation quite unique. No other corporation installation was ever known to secure a profit during the first year. To be sure, the profit has not yet been earned; it is only brought out by a process of counting eggs not hatched. The figures submitted by Professor Kennedy show that the Corporation contribute about one-third of the revenue for public lighting; and they are about to extend the public lighting installation. That is a large customer to begin with; but otherwise than in public lighting the Corporation are not very good customers to the Lighting Committee, because they have refused, on the ground of cost, to introduce electric lighting to the offices of the municipal departments. That is rather a commentary upon the statement that the cost will be, light for light, equal to that of Edinburgh gas. The proof of any such assertion will soon be had. Already, I hear, there is grumbling at lighting accounts having risen enormously. I learn that some have found the charge for electric lighting to be seven or eight times what they paid for gas; but, of course, we shall never be likely to hear of any such matter through the Electric Lighting Committee.

Lord Kingsburgh (the Lord Justice-Clerk of Scotland), who is a scientist of some standing, lectured to the Royal Scottish Society of Arts in Edinburgh on Monday, on the subject of "Electricity in the Home." Of course, he spoke most approvingly of the use of electric light. He made the extraordinary statement that had gas been in existence 300 years ago, not one of our Raphaels would have come down to us; and they must congratulate themselves that the day had arrived when there was some chance of their being preserved. As to cost, the highest that he went was to say that, taking into consideration the number of savings which could be effected in the use of electric light, he thought it would be found that the expense would not be seriously greater than that of gas. But it has to be remembered that the Lord Justice-Clerk would, according to his own showing, have us to live in houses which would be a maze of mechanical appliances for automatically turning the light on and off; and thus, supposing that the actual charge for light should not be much more than that for gas, there would be a heavy outlay upon engineering repairs, and servants would require to be skilled persons before they could profitably work all the little appliances which his Lordship described.

The Town Council of Brechin and the Gas Company are proceeding in an unusually frank manner to discuss the subject of the suggested transfer of the Company's undertaking to the Council. At the request of Provost Vallentine, the Secretary of the Company sent to him a copy of the last balance-sheet. Of course, the Provost wanted it for the purpose of picking holes in it, which work was deputed to the Treasurer, who proceeded to do it at a meeting of the Council on Wednesday. He had not, he said, had time to analyze the balance-sheet; but it was quite evident that it contained some very interesting facts. The nominal capital of the Company was £7000, of which, however, £300 had been withdrawn. They would have to recollect that somewhere about £2700 of that was capital which was merely in existence on paper, and not in money. This therefore showed, roughly, that the Gas Company had sunk £4000 of money. In addition, they had a reserve fund of £5871. The net profit last year was £361, which, on the nominal share capital, was equal to a rate of 5 per cent., but which, on the real capital, was equal to a rate of about 15 per cent. The works and properties of the Company were valued at £11,334. He suggested that it should be remitted to the Lighting Committee to consider, and report upon, whether the Council should acquire the undertaking, or come to an arrangement with the Company as to the gas supply. This was unanimously agreed to. There was a meeting of the Police Commissioners of Brechin the Monday night previous, at which the Treasurer (Mr. Aird) said that at a public meeting some weeks ago a resolution was adopted with acclamation, to the effect that the gas supply of the burgh ought to be tested in accordance with section 103 of the Police Act. The gas, until very recently, was far from satisfactory; and it was their duty to see that the supply in the burgh was of a proper standard. He moved that they make application to the Sheriff to have a gas-tester appointed. Dean of Guild Scott seconded. He suggested that the gas-testing appliance should be put in the police office or municipal buildings, so that any inhabitant could see that the gas was up to the standard; and he further proposed that the standard gas supply should be reported on along with the other municipal reports. Bailie Murray said that, before supporting such a motion, they should know the cost of the testing apparatus. This, he understood, would amount to between £80 and £100; and it would take a good many years before they could recoup the outlay. He moved that in the meantime they do not adopt the resolution. Councillor Moir seconded Bailie Murray's motion. On the suggestion of the Provost and Mr. Aird, both motions were withdrawn; and it was remitted to the Lighting Committee to investigate as to the cost and report. Just so; it is always better to look before you leap. The public meeting was quite delirious in its enmity to the Gas Company, and would have supported any proposal, however wild, which might have been made. But there is a limit even to frenzy; and the heads of the community, on sober reflection, have found that it may not be altogether profitable to go to very extreme measures against the Company, even though they may have before them the ulterior object of acquiring the undertaking on easy terms.

Mr. W. Ruxton, assistant to Mr. Carlow, the Manager of the Arbroath Corporation Gas-Works, has been appointed Manager of the Berwick and Tweedmouth Gas Company, in succession to Mr. A. B. Walker, who has gone to Walker and Wallsend. Mr. Ruxton is well known to gas managers in Scotland, as he has, since Mr. Carlow was appointed Secretary of the North British Association of Gas Managers, attended to the taking of subscriptions and the like at the meetings of the Association. This is another instance of the educated young man coming to the front. There were about 70 applicants for the post at Berwick, many of whom must have been men holding office, who wished a transfer; yet the post has gone to a candidate who is only 31 years of age, and who has had a distinguished student career. Mr. Ruxton was born in Glasgow, but has lived with his parents in Arbroath for eighteen years; during the last twelve of which he has been under Mr. Carlow at the gas-works. From Mr. Carlow, he received a sound training in all the departments of gas management; and at the same time, he attended science classes in the Dundee Technical Institute and the Dundee University College. He won several valuable prizes; and is the holder of South Kensington certificates. He deserves the greater credit in that his studies were prosecuted under the disadvantage of his requiring to attend to his daily duties in the works. Many will be glad to hear of his promotion, and will wish him success in his new and responsible position.

At a meeting of the Montrose Police Commissioners this week, it was reported that the Gas Company had declined to lay a new gas-main to Rossie Island in the meantime; and that, in consequence, the Commissioners could erect no more lamps on the Island. At the same meeting it was reported that, on a recent examination, it was found that out of 54 streets there were only eight in which there was no water passing in the mains at night. It was estimated that 60,000 gallons of water were being wasted every 24 hours. The Commissioners resolved to issue warning notices.

The stoppage of the gas supply in Broughty Ferry on Thursday of last week formed a subject of consideration at the Town Council on Monday. A Committee who had considered it, reported that they had heard the Manager (Mr. A. Waddell) and the foreman in explanation of the incident; and that the foreman took the whole blame for it on himself. He admitted his negligence in omitting to turn on the reserve gasholder when the other was nearly exhausted. There were, however, exceptional circumstances that day to be considered. On account of an alteration of some of the pipes, the retorts had been off from noon to 6 p.m.; and when the manufacture of gas was resumed, the Manager thought it desirable to pass the newly-made gas into the reserve holder. The foreman did not understand that this was being done, but thought the gas which was being made was passing into the ordinary holder in the usual way. Mr. Machan, the Convener of the Committee, was in the Manager's room at the time the gas went out; and he stated that Mr. Waddell at once conjectured the cause, and had the gas immediately turned on. There was sufficient gas to supply the town. He did not think the Manager could in any way be blamed for the occurrence. The Committee recommended that an automatic arrangement be adopted for turning on the gas from one holder before the other is exhausted; that the foreman be required to visit the holders once every hour, and record the contents of each holder at the time; that more light be thrown on the holders and valves; and that the Manager be instructed, when any of the retorts are laid off, to see that all the holders are full. These recommendations were adopted; and the Committee were instructed to have them put in force. They are rather too severe; I should say the periodic visitation of the holders would be sufficient. The last of the recommendations is out of the question, and will be impossible to keep. The first will be also almost useless.

Perhaps arising out of this incident, one of the Commissioners gave notice of a motion for next meeting, to the effect that they employ a gas engineer to report as to the quality of the gas and the general condition of the works. This is some new-fangled zeal, which should be repressed, as there is no necessity for any such inspection. The gas undertaking is in a thoroughly healthy condition.

Sir James Bell, Bart., the Lord Provost of Glasgow, has just prepared his third annual statement on the local municipal trusts and the progress of the city during his third year of office as the Chief Magistrate. One of the many subjects which he deals with is that of the supply of gas and electric light to the city, on which he makes the following remarks: The expenditure in the Gas Department on capital account during the past year was £53,630, and consisted principally of the balance of the cost of erecting new retort-houses and connections at Dawsholm, which had been in progress during the preceding two years, and of the cost of extending the gas-mains for the purpose of improving the supply. Five miles of new mains, 24 and 18 inches in diameter, were laid in different districts, at a cost of £13,000. An additional gasholder, capable of containing 5 million cubic feet, contracted for in March last, is now under construction at the Tradeston works. To meet the rapidly increasing demand, extensive additions will require to be made to the manufacturing plant; and in the opinion of the Manager (Mr. W. Foulis), the construction of an additional gas-works cannot be much longer delayed. The revenue last year showed an increase over that of the previous year to the extent of nearly £60,000, one-half of which arose from the additional consumption of gas; the augmentation being fully 267 million cubic feet, or 7·11 per cent. on the total quantity, and requiring for its production 29,352 tons of coal. The other moiety of the increase in revenue arose from the enhanced value of residuals, and was a matter for congratulation, as indicating an improved state of trade both within and beyond the city. The reduction in the price of gas which was made at the commencement of the current financial year, from 2s. 6d. to 2s. 4d. per 1000 cubic feet, brings the price to the lowest point it has touched in the history of the gas undertaking; and it is equivalent to a saving to the community of from £32,000 to £33,000 per annum. The market value of the gas annuity stock has risen since last year to the extent of £77,000, which is practically an increase of the liabilities of the department, and is a sum greater than the reduction of capital during the year by the amounts set apart from ordinary revenue to meet depreciation and sinking fund. While there is a limit to this appreciation of stock, it yet emphasizes the inadequacy of the amount required by statute to be set aside towards the repayment of capital expenditure, and raises the question whether the fixed statutory rate should not be increased, and the reduction of debt no longer left subject to the fluctuating circumstances of the department, or to the ideas of expediency which may obtain from time to time. The additional capital expenditure during the year in the Electric Light Department was £20,524. To meet the increased demand, two new Babcock and Wilcox boilers, two 300-horse power Willans engines, and two dynamos, each equal to 3000 lamps of 8-candle power, have been brought into operation; while the extension of the mains to the West-end Park district has been completed. The aggregate number of consumers has increased from 488 to 725; and the number of 8-candle power lamps wired, from 59,543 to 68,550.

I understand that an action for £500, as damages for alleged slander, has been brought by a workman who was recently dismissed from the Forfar Corporation Gas-Works, against the Convener of the Works Committee.

The list of places where Hislop's patent regenerative system has been adopted, which I gave last week, was not quite complete. The Inverness Town Council have resolved to introduce it to a bench of 32 retorts.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 14.

Sulphate of Ammonia.—There is rather a steadier feeling; and a fair amount of business has been concluded, at prices last recorded, so that no further shrinkage in values has taken place during the week just passed. Makers are adapting themselves to the present order of things; and when the holdings are somewhat lightened, a better state of affairs may reasonably be counted upon. Very low quotations are still disseminated abroad for delivery over the spring months at the equivalent of about £8 15s. to £8 17s. 6d. f.o.b. at the ports; but any marked demand from consumers would immediately dispel these tactics. Prompt parcels are quoted at £8 11s. 3d. to £8 12s. 6d. Leith and Hull, and £8 15s. f.o.b. Liverpool.

Nitrate of Soda has a better tone, with a slight advance in prices; quotation on spot being 7s. 7½d. to 7s. 9d. per cwt.

LONDON, *Dec.* 14.

Tar Products.—Benzols continue steady, and in fair demand at the improved prices mentioned previously. In sympathy with this upward movement, toluol, solvent naphtha, as well as crude naphtha, are all quoted at higher prices. Creosote and common tar oils, with the single exception of heavy oil for grease purposes, are dull and unsaleable. Important business is reported in creosote salts, which is welcomed by distillers, as it in some measure relieves their large stocks of creosote. There is some inquiry for prepared and refined tar for foreign consumption. Anthracene continues in good request; and the Committee controlling this article have no difficulty in maintaining the prices quoted. Some outside lots of anthracene, however, are reported to have been sold at quite 1d. below the Committee's prices. A little more is doing in carbolic acid and its products; but no marked improvement in value is recorded. The following prices have been current

during the past week: Tar, 18s. 6d. to 24s. Pitch, nominal, 33s. 6d. west coast; 36s. east coast. Benzols, 90's, 2s. 4d.; 50's, 2s. 1d. Solvent naphtha, 1s. 4d. Toluol, 2s. Crude, 30 per cent., naphtha, 9½d. Creosote, nominal, 1d. Naphthalene, pressed, 45s.; drained, 27s. 6d. Cresylic acid, 1s.; crude, 9d. Carbolic acid, 60's, 1s. 8d.; 75's, 1s. 11d. Anthracene, "A," 11d. to 1s.; "B," 9d. to 10½d. All prices subject to usual discount.

Sulphate of Ammonia keeps flat; makers holding off for higher prices. Considerable stocks are reported to be held by large makers. The quantities, however, have been much magnified, by interested dealers, as, in one case at least, where large stocks are held, the producer has important contracts waiting shipment, which will more than take up the stock. Except Beckton, which is quoted £9, this week's value has been £8 12s. 6d., less 3½ per cent. at all ports. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Only a limited business is stirring in the coal trade here, notwithstanding the advent of winter; and pits in many cases continue on short time. The demand for house coals is much below the average for this season of the year; and prices are not more than steady at about late rates, with no indications of any upward movement. Common round coals, suitable for iron-making, steam, and general manufacturing purposes, continue very bad to sell; and to move away surplus quantities, lower prices than ever have in some instances been taken. At the pit mouth, round coals remain at about 10s. to 10s. 6d. per ton for best Wigan Arley, with only a very limited business at the maximum figure; 8s. 6d. to 9s., for second qualities of Arley and Pemberton four-feet; and 7s. to 7s. 6d., for common house-fire coals. For ordinary inland sales, 6s. to 6s. 6d. per ton at the pit are the full average figures for good qualities of steam and forge coal, with 1s. less taken in some cases for shipping orders. Increased supplies of engine fuel are now offering in the market; some collieries having to stock a good deal of their present output. Common sorts are offering at very low figures, especially from outside districts, and are obtainable at from 2s. 6d. up to 3s. 6d. per ton at the pit; but the better qualities are fairly steady at 4s. 6d. to 5s. per ton. Extreme depression continues the general report as regards the shipping trade; and business is only practicable at excessively low figures. The prices at which orders for common steam coals could in some instances be placed are, if anything, less than those ruling recently; these qualities being obtainable at as low as 6s. 9d. to 7s. per ton, with better descriptions quoted at 7s. 6d. to 7s. 9d., delivered at the ports on the Mersey.

Northern Coal Trade.—A rather better demand has been experienced for coal generally this week; but the stormy weather has made the arrivals of steamers rather irregular, and hence collieries have in some instances been idle from this cause—steam coal collieries suffering the most. Best Northumbrian steam coal is still quoted at 8s. per ton f.o.b.; but the pits do not find much more than work for three-quarter time. Second-class steam coals are 7s. 6d. per ton; and steam small coals, 3s. 9d. to 4s. Manufacturing coals are generally quiet. The chief contracts for locomotive coal for next year have now been concluded. They are for the supply of the North-Eastern Railway; and on the average the price will be 7s. 6d. per ton, free on the Company's line, which is about 6d. per ton below the present contracts. In the household coal trade there is less alteration; the demand being steady, and prices unchanged at about 10s. to 11s. per ton f.o.b. for shipment. Gas coal collieries are working well; and in some instances the whole production is taken up by contracts for two or three months ahead. For odd cargoes, the price varies from 6s. 6d. to 7s. 3d. per ton f.o.b. Coke is very steady in price; the usual decrease in the exports at this season being met by the enlarged quantity sent to the north-west, where additional blast furnaces are being put into operation.

Scotch Coal Trade.—Trade is still unsatisfactory; and as the engineering dispute seems to be entering upon a new lease of life, while the holidays will be on in little more than a week, no improvement need be looked for. The prices quoted are: Main, 5s. 10d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the past week amounted to 144,175 tons—a decrease on the preceding week of 21,393 tons, and compared with the corresponding week of last year of 6861 tons. For the year to date, the total shipments have amounted to 7,051,014 tons—an increase over the same period of last year of 2,079,193 tons, but a decrease as compared with 1893 of 395,642 tons.

Prepayment Meters at Dukinfield.—Mr. Harrison Veevers, the Gas Engineer, has reported to the Dukinfield District Council that the number of prepayment meters in use on the 2nd inst. was 341, of which 201 were new consumers; and that he estimates each of these will take 7000 cubic feet yearly, or a total of about 1,500,000 feet, giving a gross profit of £750. Since the 2nd inst. there have been eleven more fixed, of which ten are new consumers.

Gas Consumption at Halifax.—During the week ending on the 5th inst., a "record" in the matter of gas consumption was made at Halifax—at any rate, for November and December. During the week ending Nov. 21, the consumption was 20,542,000 cubic feet; whereas in the same period last year, the total was rather over 2 million feet beneath these figures. The output rose to 21,288,000 feet in the succeeding week, and the gain was about the same. In the week ending the 5th inst., however, the consumption rose to 21,690,000 cubic feet, or 1,251,000 feet in advance of the corresponding week a year ago. Together, the figures of this year's consumption, in the three weeks named, give a total of 63,525,000 feet, against 58,904,000 feet last year, being an increase of 4,621,000 feet, or 7½ per cent. The greatest quantity of gas ever sent out to consumers in seven days was during the week ending Jan. 17 this year, when the total was 22,188,000 feet. The Corporation Gas Engineer (Mr. T. Holgate) estimates that Halifax will this year have increased its consumption of gas by close upon 50 million cubic feet.

The Water Supply of Halton.—A Local Government Board inquiry was held at Halton last Tuesday, into an application by the Lunesdale District Council for power to borrow £1200 for the purpose of providing a water supply for Halton. The Engineer of the scheme is Mr. W. Harrison, of Preston; and he explained to the Inspector (Colonel A. G. Durnford) that an arrangement had been entered into to take a supply from the Thirlmere aqueduct. A connection would be made at a point about a mile north of the place where the aqueduct crossed the Lune. The pipes were to be 3-inch cast iron, socketed with lead jointing. A receiving tank was to be constructed at 460 feet above sea-level; and the lowest point at Halton was 40 feet above sea-level. It was stated by Mr. Blackstock, of the Manchester Corporation Water Department, that the charge stipulated was to be 8d. per 1000 gallons, subject to the Council fixing a price when the contract was finished. It would probably be from 8d. to 9d. A large amount of evidence was given by opponents who favoured a scheme for obtaining a supply from the Caton Water-Works.

The Dover Gas-Works Reading and Recreation Room.—The eighth anniversary of the opening of this room was celebrated last Tuesday, the Chairman and Directors of the Dover Gas Company being present. The room was tastefully decorated. The principal part of the entertainment consisted of a lecture entitled "A Holiday Trip to Scotland," given by Mr. W. Mannering, the Chairman of the Company, and illustrated with lantern views kindly exhibited by Mr. E. Mannering. The audience followed the description with much interest; the views lending reality to the narrative. A hearty vote of thanks was accorded. After the lecture, there was a smoking concert, at which refreshments were provided by Mr. W. Mannering; and not only were those present at the entertainment thought of, but also the men on duty. At the conclusion of the concert, cordial votes of thanks were passed to Mr. R. Herring, the Company's Engineer (the President of the room), the Honorary Secretary, and the Entertainment Committee. It may be added that the Chairman and Directors take great interest in the reading and recreation room, and have contributed liberally to the library fund.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1239.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	22½—23½	−½	4 9 5
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	..	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¾—7¼	..	4 9 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	267—272	+10	4 8 3
180,000	,,	,,	9	Do. New	100	207—212	+2	4 4 11
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	124—128	..	3 18 1
320,000	20	27 Sept.	11¼	British	20	54½—55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4 17 10
51,510	10	,,	8½	Do. 7 p. c.	10	18½—19½	−½	4 7 2
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	7¾—8¼	..	4 17 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	30—32	..	5 3 3
550,000	Stck.	16 Oct.	13½	Commercial, Old Stock	100	322—327	..	4 2 7
165,000	,,	,,	10½	Do. New do.	100	250—254	+2½	4 2 8
160,762	,,	12 June	4½	Do. 4½ p. c. Deb. do.	100	143—147	..	3 1 3
800,000	Stck.	12 June	13	Continental Union, Limited.	100	277—282	..	4 12 2
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	215—220	..	4 11 10
535,000	Stck.	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	127—132	..	3 19 6
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4 3 0
354,000	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	293—298	..	4 5 6
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf	100	287—292	+2	3 8 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	282—287	..	3 9 8
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	168—172	+1½	3 9 9
1,061,150	,,	12 June	4	Do. 4 p. c. Deb. Stk.	100	137—142	..	2 16 4
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	147—152	..	2 19 2
908,000	,,	,,	6	Do. 6 p. c. do.	100	202—207	..	2 17 11
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	235—240	..	5 0 0
75,000	5	26 June	6	Malta & Mediterranean, Ltd	5	0—0½	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb	100	113—116	..	4 6 2
541,920	20	14 Nov.	5	Monte Video, Limited	20	16½—17½	..	5 14 3
150,000	5	28 Nov.	8	Oriental, Limited	5	7¾—8¼	..	4 16 11
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb	2	Para, Limited	10	1¼—1¾	−⅛	11 8 6
420,000	100	2 Nov.	6	People's Gas of Chicago – 1st Mtg. Bds.	100	105—110	..	5 9 1
500,000	100	9 Dec.	6	2nd Do.	100	100 105*	+1	5 14 3
150,000	10	16 Oct.	7	San Paulo, Limited	10	11½—12½	..	5 12 0
500,000	Stck	29 Aug.	15½	South Metropolitan, A Stock	100	375—380	+5	4 1 7
1,350,000	,,	,,	12	Do. B do.	100	308—313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325—330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk	100	175—178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	230—235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	26 June	10¼†	Chelsea, Ordinary	100	297—302	..	3 7 10
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	215—220	..	3 3 7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	26 June	6½†	Grand Junction	50	112—116	+1½	2 16 0
708,000	Stck	29 Aug.	12	Kent	100	310—315	..	3 16 2
1,043,800	100	26 June	7¾†	Lambeth, 10 p. c. max.	100	247—252	..	2 17 8
406,200	100	,,	7¾†	Do. 7½ p. c. max.	100	210—215	..	3 7 6
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
500,000	100	14 Aug.	12¾	New River, New Shares	100	380—390	..	3 3 7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,400	Stck	12 June	6†	S'thwk & V'xhall, 10 p.c. max	100	152—157	+7	3 16 5
126,500	100	,,	6†	Do. D 7½ p.c. do.	100	140—145	..	4 2 9
1,155,066	Stck	12 June	10	West Middlesex	100	293—298 *Ex div.	..	3 7

† Next dividend will be at the rate.

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THE "JOURNAL" OFFICES.

The rebuilding of the "Journal" Offices having been completed, the Editorial and Publishing Departments have been transferred from Temple Chambers and No. 1, Gough Square, to No. 11, BOLT COURT, FLEET STREET, E.C. Correspondents and friends calling will kindly note that this will in future be the ONLY ADDRESS for "Journal" business.

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Telephone Number, 65,121.

EDITORIAL NOTES.

The South Metropolitan Bill.

AMONG the firstlings of the new crop of Gas Bills to come to hand is that of the South Metropolitan Gas Company, which declares the expediency of effecting the following alterations in the statutory settlement of the undertaking. The authorized capital with a standard rate of dividend of 10 per cent. is to be converted into a capital of one and the same class, but of two-and-a-half times the amount, having the uniform standard rate of dividend of 4 per cent. The authorized amount of debenture stock is to be converted into a substituted stock bearing less than 5 per cent.—the present rate—and not less than 3 per cent. interest. The sliding-scale is to be corrected to a rise or fall of one shilling per cent. of the new stock for the half year for one penny per 1000 cubic feet of gas. A scheme may be prepared by the Directors, "as and when they "deem expedient," for the purpose of enabling employees holding stock under the profit-sharing arrangement to the nominal amount of £40,000 "to elect one or more of their "number, but not exceeding three, to take part with the "Directors in the management of the Company." Any such scheme is to be submitted to a special general meeting of the Company, which may adopt it either with or without alteration, and also to the Board of Trade, under the same condition. The scheme, when it is approved, is to be published in the *London Gazette;* and it is then to remain in force for three years and no longer. If during this period the amount of the investment of the employees in the stock of the Company falls short of the nominal sum of £40,000, the scheme is to terminate. On the cesser of such scheme by efflux of time, a new one may be prepared and carried into effect in like manner; and so on from time to time. The qualification of an Employee Director is to be fixed by the scheme, subject to the limitations of his having been not less than seven years in the constant employ of the Company, and holding for a year previous to his election £80 nominal stock. He is to be disqualified by ceasing to be in the Company's service or to hold the requisite amount of stock. The fees of such Director are to be fixed by the scheme, and will bear some proportion to the amount of the qualification—not being less than his ordinary day's pay nor more than four times that amount. He is to perform his ordinary duty except on Board-day. A schedule to the Bill makes regulations for the transfer and paying off of profit-sharers' stock. According to the capital clauses of the Bill, the existing stocks of the Company will become £5,400,000 of fully paid-up ordinary 4 per cent. stock; and the unissued proportion of the existing "C" stock will be replaced by the equivalent value of the same stock, so as not to increase the capital powers of the Company. All this stock is to be issued in multiples of five pounds. When any additional stock is to be issued, the Company, before offering it to the holders of other stock or for sale by auction or tender, may (with the approval of the Board of Trade) offer it to the consumers and employees of the Company at not less than the average market price for the previous month. Stock remaining unsold after having been offered for sale by auction or tender, may be offered at the reserve price to stockholders, consumers, and employees. The whole of the purchase-money for stock is to be paid within a month. We have nothing to offer at present by way of comment upon the proposals of the Bill, beyond drawing attention to the way in which the capital and sliding-scale are to be modified, and expressing satisfaction that our hint of the 26th ult., in regard to the rate of debenture interest, has been acted upon.

Two Provincial Gas Bills—The Rate of Dividend for Consolidated Gas Capital.

THE Bill which the Cheltenham Gaslight and Coke Company are promoting in Parliament is the first they have needed for some twenty-four years; their last Act being dated 1872. They are at the end of their stock-issuing resources; but they have only £17,500 of debenture stock issued, and do not owe anything on mortgage. The authorized capital consists of three classes of stock—the £25,000 original 10 per cent. stock of 1856, the £50,000 of 7½ per cent. stock then sanctioned, and £80,000 of new "A" 7 per cent. stock of 1872. Thus the proportion of

debenture stock to this £155,000 of ordinary capital is extremely modest; and one of the first questions that will be addressed to the Company's witnesses when they get to Westminster will in all probability be as to the why and the wherefore thereof. The Bill proposes to consolidate all the classes of stock into an equivalent amount of 5 per cent. stock, and to take powers to raise £100,000 of additional capital of the same class; borrowing powers to the old proportion of one-fourth of the stock capital being asked for. It is intended to enlarge the works, acquire more land, and make a railway siding into the gas manufacturing station from the Midland Railway. Practically, this is the Bill; and it expresses all the Directors hold to be necessary in order to meet future requirements. At the same time, the Cheltenham Corporation are promoting a Bill to enable the ratepayers to obtain possession of the undertaking—a step which we have ventured to characterize as superfluous. The only pertinent questions concerning the Cheltenham gas supply could be fully gone into upon the Company's Bill. When the position of the undertaking comes to be explained to the Committee, we have not the smallest doubt that the property will be proved to be a very fine one indeed, and such as any municipality might be glad and proud to possess. The works are an embodiment of the personality of Mr. R. O. Paterson, who is acknowledged to be one of the most accomplished and careful of gas engineers and managers in the kingdom. What the Committee will think of the actual and proposed capital arrangements of the Company may be shrewdly suspected. Such modern inventions as the sliding-scale and auction clauses have been warded off from Cheltenham to this day; and even now the Directors will only admit so much of these new-fangled administrative arrangements as they cannot keep out. It would be a correct description of the Company's condition to say that, with the newest and best of works and plant, they have the oldest scheme of finance to be found anywhere. This state of things is "racy of the soil;" for, without a suspicion of old-worldliness, nothing belonging to Cheltenham would be in keeping with the town.

Leamington is like Cheltenham in several respects; and this session the two "inland watering-places," as the geography books used to classify these towns, are to rejoice in the prosecution of gas purchase schemes of identical character. It will be interesting to follow the fortunes of the would-be bargainers in both places. Newcastle-upon-Tyne and Gateshead are also to engage the attention of Parliament next year in respect of gas supply. The Company—one of the most successful undertakings of the kingdom—want more money and larger works. They were last in Parliament in 1879, when their stock capital was settled at £750,000; and, in addition, they have raised on mortgage and by debenture stock £175,000. The Bill proposes to create additional 5 per cent. preference capital to the amount of £500,000, with power to borrow £150,000. It is a natural reflection upon these two Gas Bills—the Cheltenham and the Newcastle-upon-Tyne—that there is a perplexing want of agreement among gas directors as to what are the most desirable financial conditions to be sought for at any particular juncture. The difference of opinion is further accented by reference to the proposals of the South Metropolitan Board. Supposing all three of these Bills to go before the same Committee, how puzzled the good gentlemen would be to reconcile the divergent proposals for attaining ostensibly the same end. South London, Cheltenham, and Newcastle all presumably want the same treatment in the matter of gas supply. They want the best service that can be had at the lowest price; and the interest of capital is in all cases the same. Why, then, must the Committee be persuaded—possibly by one and the same Counsel—that it is expedient for one locality to be provided with 4 per cent. ordinary consolidated stock, another with 5 per cent. ordinary consolidated stock, and yet another with 5 per cent. preference stock? Of course, there is no concerted action among the promoters of Gas Bills relating to different undertakings. We believe that if other Gas Companies had tried last session, like the South Metropolitan, to consolidate their capitals upon a 5 per cent. basis, and had failed, they would go like them for a 4 per cent. stock next time. It seems extravagant to say so; but, really, if first-class gas stocks go on rising in value as they have done of late, it will not long be 4 per cent. that will serve to bring them equivalent substitutes down to a little over par value. This is, of course, the principle of the whole movement. There is no special validity in 5 per cent., 4 per cent., or any other standard rate of dividend that might be chosen for a consolidated gas stock, beyond its approximation to the actual return on the investment. If a purchaser of such stock can only get it at such a price as represents a return of 3½ or 3 per cent. upon the purchase-money, then this should naturally be its denomination. Of course, these steps must be taken carefully, and only so far as may be warranted by the facts and by the likelihood of their continuance. For the present, 4 per cent. is quite low enough for an ordinary gas stock; but this is as reasonable and proper a rate now as were 10, 7½, and 7 per cent. in past times.

After all, alterating the standard rate of dividend to suit the financial circumstances of the day is only acting in the spirit of the pioneer legislators on gas supply in this country. This proceeding is open to the criticism that it fixes the "unearned increment" of value for all future time. But this is only true in name, not in fact. It is impossible to make people pay more for a thing than they think it is worth, whatever designation it may bear. But it is to be hoped that, whatever course may in future be followed in classifying gas capital, the divergence of the real from the nominal value will never be allowed to get so far as it has done. Indeed, this would be impossible. There are prudent friends of the gas industry who hold the opinion that Gas Companies' capital already stands at far too high a price in the market; and this is very likely true. These things cannot be helped, however. Gas stocks are very high-priced just now; but there is no inflation in the values. What they are, that they are likely to remain under the ordinary vicissitudes of the gas industry; and this is the justification of the South Metropolitan Directors for adopting the new standard rate of dividend they have selected. It is nearer the truth than any other equally convenient figure; and they do not want any more premium capital.

The Inconvenient Conveniences of Modern Civilization.

A HUMOROUS, yet withal pathetic, complaint has been uttered in a letter to *The Times* by Mr. Harry Furniss, respecting the irritating inconvenience caused by so-called "modern conveniences" which do not always act satisfactorily. His grievance is against telephones, the working of which he characterizes as a farce; the electric light, which he has known to go out "four times in one "week;" and the District Messenger system, which frequently breaks down. He sums up the whole case against these "modern improvements" by declaring that "the "electric light kills our sight; the telephone destroys our "temper; the District Messenger call ruins our dinner; "and, conjointly, they waste our time and deplete our "purses." There is in all this a reminiscence of the "vanity of vanities" complaint of a much more distinguished pessimist; but—"happy thought!" as another humorist might say—there is an obvious remedy for these disappointing modern improvements, which is to do without them. After all, people are not bound to plague themselves with telephones, phonographs, electric light, or district messengers. Most imaginative writers who attempt to forecast the future, are very prone to indulge in visions of a state of civilization when improved mankind will only have to "press a button," and something or somebody else will "do the rest." It is at least open to question whether, if this dream were actually realized, the improved man would be the better or happier for it. In the meantime, it is certain that all attempts to make social existence easier for the individual, by offering to do for him by mechanical appliances or by organized services offices which he previously lacked or did for himself, cause more annoyance when they fail than pleasure when they act in the manner and to the end designed. This effect belongs to their very nature. There is nothing in such arrangements or appliances capable of giving a sense of pleasure to the user. They can but promise to save time, spare exertion, and generally absolve the individual from being compelled to do things for himself. In nine cases out of ten, he does not know the want of them until he is provided with, and has formed the habit of relying upon them; and then, if he is suddenly and unexpectedly deprived of them, he rages against the whole scheme of such things, like Mr. Furniss.

It is impossible to ensure that modern improvements shall not occasionally break down; and when this happens,

the resultant inconvenience is in geometric ratio to the satisfaction produced by their proper operation. At the present season, who regards the prospect of a repetition of last winter's intense frost with greater equanimity—the householder who has enjoyed for months the convenience of a complete system of hot-water circulation, or he who never had a circulating boiler in his kitchen range? The gas consumer who has known what it is to have a wet meter frozen hard and fast on the very day chosen by his family for celebrating the "festive season" in the traditional manner, is not to be comforted by the reflection that he has had no such trouble with his gas for a whole twelvemonth. It is doubtless handy to be able to turn on an electric light at will, as on entering a bedroom after dark. But when the current refuses to attend the summons, the disgusted victim of modern improvement is apt to reflect bitterly upon the time when he carried a candlestick upstairs as a matter of course. The wise man is he who can with sincerity, like the Greek philosopher, look upon many things in the market-place without feeling need of them. Wiser, perhaps, is he who recognizes the limitations of his servants, and remains master of himself even though accustomed facilities fail.

Income-Tax Payable by Foreign Traders.

JUDGMENT was given in the House of Lords last week in an appeal case of particular interest for English companies and individuals trading abroad. The action was between the San Paulo (Brazilian) Railway Company, Limited, who have a registered office in Gresham House, London, and a Surveyor of Taxes; and it raised the question of the liability of the Company to pay income-tax in England upon the full amount of their profits and gains, wherever made. The Company in question have constructed and own a railway in Brazil, which is worked at a profit. The supreme control and direction of the railway are from the London head-quarters, where the meetings of Directors and shareholders are held. But a superintendent residing in Brazil manages the line, and sends the net gains home for distribution as dividends. The Directors contended that the liability to pay income-tax in England was only in respect of the full amount of the actual sum received in the United Kingdom upon an average of three years, which was found, as a fact, to be £295,070 and no more. The Commissioners of Income-Tax were of opinion that the Company are chargeable under the first case of Schedule D; and they confirmed the assessment that had been made by the Surveyor of Taxes in this classification upon the full profit of £370,122. A special case was stated for the consideration of a Divisional Court, with the result that the Commissioners were held to be wrong. Then the Court of Appeal in turn set aside this decision; and from this judgment the Railway Company appealed to the House of Lords. The final result is, that the Company are found to have been rightly assessed; so that their appeal was dismissed with costs. This decision goes a long way to strengthen and define the law of income-tax assessment; and it will be welcome to the general body of taxpayers of the United Kingdom, whatever may be felt by the traders affected by it. In delivering judgment, the Lord Chancellor observed that all cases of the same kind that have been dealt with by the House of Lords have gone to establish the proposition that, where trade is wholly or partially carried on in this country, the trader is liable to pay income-tax on his profits. In the case in point, the fact of the Railway Company having a "residence" in England is sufficient evidence that their "trade," such as it is, is carried on here; and that, consequently, they must pay on all their profits. In another column we give the observations of the Lord Chancellor, Lord Watson, and Lord Davey in full. These are of great weight, as settling the question of where a trade is carried on, which is held to be wherever the supreme control is exercised. It does not matter what the operations may consist of, or where they are conducted. It is the head of the business that makes the profits; and, consequently, where the head is, there the profits are made. As Lord Watson remarked, the case did not involve any controversy upon the construction of the Income-Tax Acts, but turned upon the single issue of fact, which it certainly appears to us could not be rightly determined in any other way than that taken by their legal Lordships. It remains to be seen what difference this decision will make in future income-tax returns.

WATER AND SANITARY AFFAIRS.

IT would seem at the present time that the London County Council scarcely know what to do with the water question. In the middle of October, the Parliamentary Committee recommended that the Council should invite Her Majesty's Government either to deal with the question themselves, or to appoint a Royal Commission for the purpose. Mr. Stuart moved, as an amendment, that the Purchase Bills should be proceeded with. This proposal was rejected; but a week later an amendment was duly adopted, calling upon the Parliamentary Committee to report to the Council the lines upon which they would advise that the Government should be asked to legislate. In response to this demand, the Committee drew up a long report, which was finally dealt with last Tuesday. As we anticipated, the chief recommendations contained in this report were rejected. In fact, the pith and marrow of the report were thrown out. In preference, Mr. M'Kinnon Wood's amendment was adopted, by which the Government are to be asked whether they will promote or assist legislation dealing with the Metropolitan Water Supply, on certain specified lines. Mr. Wood's amendment was not remarkable for brevity; and the Earl of Onslow not inaptly described it as a "lengthy conundrum." The policy to which the Council are now committed is that of asking that the entire control of the water supply within the area of the County of London "shall be in the "hands of the London consumers," who are to be "directly "represented by the County Council in conjunction with "the City Corporation." This is admirably devised as a bait to catch alike the consumers and the ruling power of the City, though as we proceed farther, it will be seen to what an impracticable issue the scheme is conducted. This "entire control" of the water supply—which really means its possession—is to be bounded by the limits of the Administrative County. Beyond those limits, as within, the control of the supply is to be in the hands of the consumers, represented, in the outer areas by the Local Authorities. No doubt, it is expected that the consumers in these regions will be very much pleased. But, on the whole, we can hardly think that the Council are serious in proposing such a polyglot scheme. There is to be an excision—a lopping off—of some hundreds of square miles of territory, now subject to the parliamentary powers of the London Water Companies; and there is to be a dissection of the outer area with a number of independent divisions. As remarked by Lord Onslow, instead of eight Water Companies, there will be sixty or seventy different bodies. That is to say, such would be the case; but the chance of ever seeing it is utterly remote.

How does it come to pass that the County Council see fit to adopt such a miserable scheme? All the advantages to be expected from consolidation and unity are thus to be sacrificed. Even if the outer areas were to be aggregated under one authority—or say, two or three—there would be no coherence in the arrangement. The Parliamentary Committee, representing the views of the Moderate party, recommended that there should be one Water Authority for the entire area comprehended in the report of the Royal Commission. Nothing more facile can be said to offer itself; and if the Council were to adopt it, such a proposal would commend itself to the approval of Lord Salisbury and Sir Matthew Ridley. Mr. Wood contends that his way of dealing with the question is practically carrying out the recommendations of the Select Committee presided over by the present Home Secretary in 1891. This is only partially true, for the Committee recommended that there should be a purchase in the first instance of the entire undertakings of the eight Water Companies; while any transfer of works connected with the outside areas to the local authorities was to be a matter of negotiation some time later on. This did not necessarily involve the surrender of all the outer areas, but simply such as it was found might be advantageously dealt with in that manner. It is curious that the Progressives were willing, in the recent debate, to take a leaf out of the Moderates' book, and refused to forego the second and third recommendations of the Parliamentary Committee, by one of which it was provided that, pending the constitution of the Water Authority, the County Council should authorize the Parliamentary Committee (for which the Water Committee was finally substituted) to initiate

negotiations with the Companies for the purchase of their undertakings. This throws us back into the past; and we may predict that the result will be as before, unless the unreasonable and fatal conditions laid down by the Council on the former occasion are now abandoned.

The amendment adopted provides that the purchase price shall not be assessed under the provisions of the Lands Clauses Consolidation Act, but "shall be based "upon the fair and reasonable value" of the undertakings. That is to say, there is to be no allowance for compulsory purchase; and the property is to be parted with at a sacrifice. The judicious proposals of the Moderate party are denounced by the Progressives as "a great and intentional "betrayal' of Metropolitan interests. Mr. Wood is candid enough to say that he would rather leave the Water Companies as they are, with the Local Government Board and the Council "looking after them," than see created a great Trust "which would never represent the "true interests of London." No doubt, the Council have a horror of being overshadowed. Such, at least, is the sentiment which governs the Progressives. They cannot leave the water question alone, though it is fast travelling beyond them. Lord Onslow has reminded them that the Water Companies are "themselves bringing measures "into Parliament." If these measures are carried, there must be an end to the Welsh scheme of supply; and the Council will find themselves left where Mr. Wood has portrayed them—joined with the Local Government Board in "looking after" the Companies. Lord Onslow is not desirous for the question to remain where it is. He agrees with an application to the Government; and this appears to be the last hope of the Council. But his Lordship urges that the Government should be approached with something "likely to meet with success." The Council gained nothing but "a bare and cold acknowledg-"ment" of the letter in which they asked Lord Salisbury to undertake the problem of unification. Lord Onslow, in view of this rebuff, asks whether the Council are "going to "continue to plough the sand." It would seem so.

These are troublous times for the Water Companies; but perhaps it is not often that a Company which has been endowed with parliamentary powers meets with such sad experiences as have fallen to the lot of the South Kent Water-Works Company. The proceedings in the Chancery Division which were reported in the last issue of the JOURNAL are not without an element of the ludicrous. The Company, it seems, was incorporated in 1889; but, according to the plaintiffs' Counsel, the only customer up to July, 1895, was the South-Eastern Railway Company, who paid, it was said, £4 per annum for water supplied to their station at Paddock Wood. It cannot be described as a colossal income; and there is very probably no local authority, howsoever eager to command the water supply and pocket its profits, that would seek to wrest the undertaking from its present proprietors. However, the South-Eastern Company are no longer the only customer of the South Kent Water-Works Company; and the Manager of the latter body, without disputing the poor quality of past results, anticipates better things in the near future. Meantime, certain creditors of the Company want their money, and cannot tell where to find it. An execution lodged at the London office produced only the discouraging return of *nulla bona;* and what the Sheriff found at the works was unsaleable. Nevertheless, the Company may presently emerge from all their embarrassments; and Mr. Justice Vaughan Williams has counselled the creditors who sought to obtain a winding-up order to exercise a little more patience. The awkward thing is that the Company have no borrowing powers; and to raise additional share capital will necessarily prove to be a somewhat difficult financial feat in the circumstances above mentioned. However, the petition is to stand over for a time.

The Managership of the Lea Bridge Gas Company.—Mr. F. W. Cross, of Wellington (Salop), has obtained the appointment of Engineer and Manager of the Lea Bridge District Gas Company, rendered vacant by the death of Mr. W. Thorman. After completing his articles with Messrs. Willey and Co., of Exeter, Mr. Cross was appointed assistant to Mr. T. Canning, Assoc.M.Inst.C.E., of Newport (Mon.). Subsequently he was for several years in Hong Kong, as Engineer and Manager of the works of the Hong Kong and China Gas Company; and he entered the service of the Wellington Gas Company some time after his return to England.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1310.)

IT is a long time since the Stock Exchange has received such an electric shock as that which was administered to it last week by President Cleveland's Message. Matters were proceeding quietly and cheerfully, when the "bolt from the blue" fell upon the markets. The effect produced is perhaps not quite that which the author expected. It is not so much the fear of war as financial distrust of the United States. The American market went all to pieces, and dragged others down in its fall. But the boomerang recoiled upon the thrower; and, bad as things were here, the havoc it wrought in Wall Street was ten times worse. What the end of it may be, there is no telling; but it will be a very long time before European gold flows westward. Prices, of course, are bad all round; the Foreign Market being the hardest hit next to "Yanks." The Money Market profited by the occasion, and did better business than it has seen for months. The Gas Market pursued the "even tenor of its way" undisturbed by the troubles of its big neighbours. Business was quieter, showing an unmistakable disposition to slacken off for Christmas. But the market was very strong; and advances in quotation are many in number, and considerable in extent. In Gaslights the "A" opened gaily, with a mark of 297; and, though not particularly active, it pushed steadily on till it fetched 299½ on Friday. Business in the secured issues was almost at a standstill; but several of them advanced their prices. South Metropolitans were more active, and seemed at first as if they were going to rise in price, but later in the week they relaxed their efforts. Commercials again were very strong. The old and new stocks each gained a point, while the debenture made a large advance, and now figures among those securities which return less than 3 per cent. for money. The Suburban and Provincial class is full of interest. Brentfords continue steadily to advance. Bromley new does the same; a considerable number of shares having changed hands outside the market at high figures, in addition to the new issue being well taken up. Tottenham and Edmonton, which rarely come into the market, realized a very high price at the Mart, sufficient perhaps to justify even a higher quotation than we accord them this week. The Continentals did not do well; Imperial being further depressed, and Union losing a point. None of the rest offer much for remark; but San Paulo had a slight fall. Business in the Water Companies was very slack. But the general tendency was fair on the whole; and Southwark had a small advance *ex div.*

The daily operations were: The Gas Market was extremely quiet on the opening day; but the general disposition was strong, and several quotations improved. In Gaslights, the "A" rose 1; "J," 5; and "K," 1. Commercial debenture was 2¼ better *ex div.* There was more business doing on Tuesday, especially in South Metropolitans, which were firm. Commercial debenture rose 4½ more; and Brentford old, 1. Wednesday was fairly active; and prices mostly were good. Brentford new rose 2½; and Commercial old and new, 1 each; but Continental Union dropped 1. Transactions fell away considerably on Thursday. Gaslight "A" improved 1; and Bromley new, ½; but Imperial Continental receded 2; and San Paulo, ½. Friday was a more active day, and prices were good; but Continental Union fell 2. Saturday was unimportant; and quotations did not move.

ELECTRIC LIGHTING MEMORANDA.

Major S. Flood Page on the Fire Risks of Electric Lighting—The Fire Risks of Various Lighting Systems—The Risk of Increased Voltage.

THE redoubtable Major S. Flood Page has come to the fore again in the columns of *The Times* with one of his cogent letters; this time with the double object of proving the safety of electric lighting by statistics of fires occurring during the last three years in the Metropolitan area, and of cautioning the public against the proposed increase of voltage in low-pressure supplies. He has to acknowledge the awkward fact of two electric lighting central stations and one electric engineering works having recently been burnt down, which has very naturally "created an unfavourable impression in the minds of fire managers in regard to this class of risk;" but he protests against any reflection of this impression on the minds of householders who have electric light upon their premises. Figures obtained from Captain Sexton Simonds, the Chief Officer of the Metropolitan Fire Brigade, are quoted to show that during the last three years there have been in London 2714 fires caused by the means of lighting, of which 576 were caused by candles, 833 by gas, 1305 by lamps, and only 9 by electricity. The writer points to these figures as sufficient to "allay any feeling of anxiety in the minds of users of electric light as to there being any practical danger from electric light properly installed in their houses. They will," he thinks, "serve to enforce the argument that by far the safest artificial light ever introduced into common use

is the electric light." We do not contest this conclusion; though, to complete the demonstration, it would be necessary to show the ratios which the numbers of houses lighted by the different methods bear to those of the fires reported. But the figures are capable of more interpretations than the single one upon which the writer insists. They show even more strikingly that considerations of safety from fire alone do not weigh much in the public mind. People who use candles continue to do so, oblivious of the fact that they cause about 200 fires every year in the Metropolitan fire area alone. And what is to be said about oil-lamps, which are responsible every year for more fires than all other means of lighting put together? Only that people do not think twice about such a consideration, notwithstanding the knowledge they must have that the mineral oil-lamp is the most dangerous means of lighting that can be taken into a house.

In the year 1892, oil-lamps caused 373 fires; next year the number rose to 456; and last year it rose again to 476. And this despite the fact that these years witnessed a great expansion of both gas and electric lighting. Fires traceable to gas, by the way, were 265 in 1892; the following year they numbered 284; and last year they were exactly the same. So that, though so much more is burnt for various purposes, the fire risk from gas is becoming proportionately less; whereas the danger from oil-lamps grows graver year after year. It should be borne in mind, moreover, when these figures are considered, that the Metropolitan fire area is much smaller than the Metropolitan police area. If the whole of Greater London were embraced in these returns, the case against oil-lamps would be much blacker. So much for the statistics of fires caused by means of artificial lighting. It may be freely conceded that the figures are creditable to the electric lighting undertakings, and even more so to the fire offices, and particularly the Phœnix, which was the first office to draft rules for interior wiring. It is stated that, thanks to the firm stand this office made in this matter in the early days of electric lighting, it has not had to pay, from the commencement up to the present day, "one single sovereign" as loss in connection with any fire caused by electricity in a building wired in accordance with its rules.

Major Flood Page goes on, however, to confess that he views with alarm "the efforts of some electrical engineers who are advocating an increase, and in some instances actually increasing, the pressure at which they deliver the current of electricity to 220 volts, while the ordinary current has been 100 to 110 volts." He, as representing the Edison and Swan lamp manufacturing interest, avers that the question of making a suitable lamp is the smallest difficulty in connection with this change. A far more serious question, he contends, and one which touches very closely upon fire insurance, is whether houses wired with fittings and switches manufactured for 100 volts can safely carry 220 volts. He is evidently inclined to answer this question in the negative; but he contents himself with expressing the opinion that "it is far better that we should, for many a day yet, at any rate, be content with the useful safe pressure under which we have obtained the most satisfactory reports which these figures of the Metropolitan Fire Brigade show in connection with fire risks and electric light." The further question is suggested as to whether those central station engineers who are advocating this increased pressure are legally entitled to do so, inasmuch as the Electric Lighting Act, under which they are all working, provides that the undertaker "shall not be entitled to prescribe any special form of lamp or burner to be used by any company or person, or in any way control or interfere with the manner in which electricity supplied by them, under this Act and any Licence or Special Act, is used." The primary purpose of this provision undoubtedly is to prevent the undertakers from unduly favouring the lamp of any particular maker; but it certainly seems also to bear the interpretation put upon it by Major Flood Page, which is that the undertakers may not arbitrarily compel customers to change their lamps, as must necessarily be done if the voltage is to be doubled. This point, however, has not been lost sight of by the Board of Trade, who are advised to include in the new regulations to be issued under the Electric Lighting Act, a provision requiring the consent of the consumer to be obtained before any alteration is made in the voltage of the current. The gist of Major Flood Page's communication upon this subject is to urge that all users of electricity should give the matter of voltage their most careful consideration before they consent to its increase, "no matter what inducement may be held out by those who advise them to make the change." And to the advisers of electric lighting undertakers themselves he represents the unwisdom of raising the question "at the very moment when the insurance offices are somewhat uneasy as to the risk involved in central stations and electric works." This is putting a "spoke in the wheel" of the electric lighting engineers, with a vengeance. It cannot be doubted that the caution, coming from such a quarter, will be taken to heart by those whom it concerns. As we have already argued upon the same side, users of electric lighting have nothing to gain from an increased voltage, which is advocated solely in the interest of the suppliers of current from central stations. Why they should trouble themselves in the matter at all is only to be explained on the assumption that, by consenting to the proposals of the undertakers, they would help the latter to make their business pay better than is possible under the old conditions—thus ensuring a cheaper supply of current. This reason would be good enough if it were tenable. But even then the prospect of ulterior benefit would have to be weighed against the certainty of immediate increased cost for lamps and risk of trouble with the connections. A 100-volt supply is trying enough in some circumstances; and one contemporary, claiming to have experience on the point, goes so far as to assert that whoever has heard a 220-volt fuse go with a bang "like a pistol-shot" will be chary of believing in the harmlessness of such a current. Now, anything that "goes off with a bang" is greatly disliked by the average householder, and especially by his womenfolk, whose susceptibilities require the more consideration the higher the household stands in the social scale. On the whole, therefore, our further inquiry into the new scheme of progress in electric lighting tends to confirm the judgment we have already expressed regarding it—that the average consumer has nothing to gain and a good deal to risk by encouraging it, at any rate for the present.

GAS MANUFACTURE AND CHEMISTRY UP TO DATE.*

The title we have chosen for our notice of Mr. Butterfield's book may be regarded as a sufficient commendation of the work; and we are not disposed to say anything to materially qualify this initial testimony to its character. It is only fair to the author and his publishers, however, as well as to readers of the Journal, that we should proceed to give such further account of this important book as will serve to indicate the grounds upon which our appreciation of it is based. First, there is to be considered the need for such a work at all, as to which there cannot be two opinions. It is true that there are a great many books appealing to the limited purchasing powers of students and followers of every modern industry, gas manufacture not excepted. But it is equally true that the number of really indispensable manuals relating to the latter industry is small. In the current "Programme" of the Technological Examinations of the City and Guilds of London Institute, only eight text-books are catalogued for the guidance of candidates in "Gas Manufacture," and of these but three deal specially with the chemistry of the industry. We have not many more works of reference of the same order upon our bookselves; the latest and most notable being the "Gas Engineer's Laboratory Handbook," by Mr. J. Hornby, which is also mentioned in the "Programme." This, like the one now under review, is a bye-product of the Beckton establishment. In his preface, Mr. Butterfield duly acknowledges the value of Mr. Hornby's work, which is, as he says, well qualified to serve for an introduction to his own larger treatment of the subject of gas manufacture from the point of view of the chemist in the works, as well as in the laboratory. What was needed, therefore, after Mr. Hornby, was an authority to discourse acceptably on the chemical aspect of the industrial operations by which those products of coal carbonization of which the analyst in his laboratory takes account, are obtained on the large scale. We were quite prepared, from previous knowledge of Mr. Butterfield and his work, to welcome in him the authority called for; and we trust to be able to show our readers that his book is worthy of the theme and the author. Mr. Butterfield's aim is high; for it is no task for any other than a master-hand to lay bare the underlying chemical principles of the gas manufacturing operations of the present day. The duty of a critic of any book pretending to do this is, moreover, not light; inasmuch as while no work should be accepted as a text-book without sufficient justification, almost as much knowledge of the subject ought to go to the criticism as to the writing thereof, and few there be who would care to pretend to such mastery of an industry which has not by any means been reduced to an exact science.

The science of chemistry and the industry of gas manufacture have both made such strides during the last few years, that old books dealing with the chemical side of gas making are of little use to the modern student. The question of carburetting, for instance, interests gas manufacturers nowadays in a very different way from anything of which their predecessors, for whom Lewis Thompson and Hartley wrote, had cognizance. The chemical effects of forcing the gas-making capacity of retorts, as is done in connection with the use of stoking machinery and gaseous firing, are problems peculiar to the experience of the modern gas manager. The question of carburetted water gas is one of yesterday, to-day, and to-morrow. The problem of the most advantageous grade of illuminating gas to be supplied under given conditions, calls for the assistance of the chemist in its solution. A good book on gas-works chemistry should be a perfect arsenal of weapons wherewith such difficulties as the gas manager may expect to encounter in approaching these and other problems might be attacked; and this requirement is fairly satisfied by Mr. Butterfield's work.

The author begins at the beginning, with the raw materials of

* "Gas Manufacture: The Chemistry of. A Practical Handbook on the Production, Purification, and Testing of Illuminating Gas, and the Assay of the Bye-Products of Gas Manufacture. For the Use of Students, Chemists, and Gas Engineers." By W. J. Atkinson Butterfield, M.A., F.C.S., Head Chemist, Gas-Works, Beckton. With numerous illustrations. London: Charles Griffin and Co., Limited; 1896.

gas manufacture, which he classifies upon a new plan into materials for (1) the production of coal gas, (2) the production of water gas, (3) the production of oil gas, and (4) enriching gas of low illuminating power. He then proceeds to define the nature of the materials thus classified. He approaches coal through the preliminary forms of cellulose, peat, and lignite; and he considers it primarily under the heads of "Caking," and "Non-Caking" coals—reserving the richly bituminous cannels to the end of the section. It is admitted that the phenomenon of caking, which eventuates in coking, does not appear to have anything to do with the ultimate composition of the coal, but rather depends upon "the forms of combination of the elements existing in it." The author has some valuable practical hints to give respecting the analysis of gas coals, and also as to the evaluation of the data derived from analysis and laboratory testing. Here speaks the expert, with unexampled clearness and point. If Mr. Butterfield's work contained no more than this matter, so fresh and good is it that the book would be worth its cost on this account alone.

Mr. Butterfield appears to know all about gas oils; and what he knows he tells in a style intelligible to the youngest student. He fully discusses "carburine" and other volatile petroleum essences used for carburetting gas, and recognizes the promise of benzene in this capacity. He devotes a separate chapter—of great value, though short—to the subject of "Enriching by Light Oils," which fully acknowledges the advantages of the carburine method, and leaves the value of the benzol process an open question. It may be remarked here that the claims of 90 per cent. benzol—the best grade of the commodity for the purpose—must be seriously prejudiced by the present unsteady market value of it compared with the more abundant petroleum spirit.

In treating of gas manufacturing plant, Mr. Butterfield betrays the fact of his being upon shakier ground than when discussing chemical matters. For example, he tells his readers with truth that while the D-shaped retort is most employed, "occasionally retorts of oval or even circular cross section are used, but do not give such high results in gas made, though some engineers consider the oval-shaped retorts rank with the D-shaped in this respect;" and he gives 20 in. by 13 in. as the "usual dimensions" of the D retort, admitting, however, that 22 in. by 16 in. are "now common." He says that single retorts are only adopted "where the number of stokers does not allow of charging from both ends simultaneously. Wherever this is possible, though 20-feet retorts are used, as they are more economical of heat, and give less trouble in scurfing." The word "though" is, of course, a misprint for "through"—the misprint occurring, as generally happens, to spite author and proof-reader, in an awkward place. The truth of this business of retort sizes and sections is not fully expressed here. It is a source of complaint by the manufacturers that there is no agreement among gas managers with regard to the best size and form of retort; but 13 inches is too low for comfortable drawing with a full-sized rake. Also, a circular retort of rather small diameter is by no means such a bad gas maker as Mr. Butterfield appears to think. And what about the dividing of through retorts so as to meet the difficulty of stopped pipes? By the way, what is Mr. Butterfield's position, as a works chemist, upon the latter point? We have failed to find any expression of opinion regarding it in his book, which is a pity. He dismisses the subject of gaseous firing, also, in a very summary fashion; merely observing, by way of introduction, that "generator furnaces on the regenerative principle are now almost universally used, but the number of systems of applying it is legion. In some few works, direct firing is still in use; but it is uneconomical of fuel. In others, a compromise is made by using a shallow generator, and admitting a small supply of secondary air." This is true enough; but might not the student ask what these terms mean? Could not the author have paused here to explain the difference between a generator and a direct furnace, and to describe when air is "secondary," and why? This slightness of treatment of a highly important point of technics is disappointing. It is the same with regard to the hydraulic main. This piece of apparatus is dismissed in a paragraph of twenty-three lines, which might have been written by anybody as well as by a chemist, who should have allowed himself space to discuss the chemical aspects of wet and dry main working, which Mr. Butterfield has utterly neglected. He thinks that mechanical devices for enabling the hydraulic seal to be dispensed with "have not, up to the present, presented an alluring aspect to English gas engineers." The remark, besides being clumsily worded (a rare fault with this author), betrays a limitation of knowledge. Some of the best gas managers in England believe in, and work with, a dry main, which can be done with the greatest ease, although possibly not with the safety of the hydraulic main in such a huge establishment as Beckton. There are those who say, however, that "they don't know everything down" at Beckton. Our general complaint against Mr. Butterfield's treatment of the various departments of a gas-works is, in brief, that he sinks the chemist too completely when cursorily describing plant which, while designed to conform to physical and mechanical ends, has yet a chemical side; and, to be plain, we prefer him in his capacity of chemist, when he writes with a degree of authority which is not apparent in his handling of engineering topics. Thus, it is not sufficient for a writer upon retort-stoking machinery to remark of a particular system that it "has probably been more extensively tried than any other"—an ambiguous way of putting it—and that certain makers' plant "has been brought by them to a high state of efficiency, productive of great economy." The technician wants figures to show what the machine is capable of doing. Again, it is stated in the book, with reference to inclined retorts, that "it is asserted that the make of tar is somewhat lower than with horizontal retorts, and this points to a greater production of gas." Is this quite a worthy way of treating the point? Is there not more definite information respecting the working of inclined retorts to be obtained by a chemist of Mr. Butterfield's undoubted standing and opportunities?

We like the passages of the book treating of the chemical points of coal carbonization, and more particularly the chapters relating to the testing of materials and products. Here the author is at his best; and his best is very good indeed. His criticisms upon the ordinary methods of carbonizing coal, upon the possibility of improving the yield of ammonia, and upon purification problems, are distinctly fresh and helpful. His modernity may be inferred from his suggestion that something might be done with a combination of Weldon mud and oxygen. Upon carburetted water gas, as made in English gas-works, Mr. Butterfield is in the happy position of being the first systematic writer in text-book form. He seems to be a safe guide through the niceties of carburetted water-gas practice; but he avoids criticism when describing the various oil-gas processes, proprietary and otherwise, that he finds worthy of mention. The latter half of the book is devoted to gas analysis, photometry, the applications of gas, and bye-products. These subjects are all treated in an original, and some of them in a masterly manner.

In conclusion, we can strongly recommend the book to our readers, with the assurance that it is by far the best work of the kind we have ever had the pleasure of reviewing. It is not faultless, of course; but where the author fails, it is in consequence of his natural limitations as an expert gas-works chemist. In pointing out these shortcomings, we have been inspired by the hope of seeing them made good in a future edition. The illustrations are for the most part from original drawings; but they do not constitute the most admirable feature of the work. The author's easy style of composition renders reading him pleasant; and he has provided his volume with a full index, which is of great convenience in a work of this character.

Institution of Civil Engineers.—An interesting memorandum has been issued by the Secretary of the Institution of Civil Engineers (Mr. J. Forrest), giving the names of those who have belonged to the Institution for upwards of fifty years, and of others who were elected between the years 1845 and 1850. In the former list, we find the names of Dr. W. Pole, F.R.SS. L. and E. (Honorary Secretary), Mr. T. Dyne Steel, and Mr. A. Upward; and in the latter, Sir R. Rawlinson, K.C.B. (Past-President), Mr. H. Robinson, and Sir Douglas Galton, K.C.B. At their first meeting after the Christmas recess—on the 14th prox.—the members will read and discuss a paper by the Hon. R. C. Parsons, M.A., entitled "The Sanitary Works of Buenos Ayres: Sewerage, Drainage, and Water Supply."

The Assistant-Engineership of the Calcutta Corporation Water-Works.—As will be seen by an advertisement which appears elsewhere, a vacancy has occurred in the water-works department of the Calcutta Corporation, consequent upon the death of Mr. Dickson, C.E., who for many years occupied the position of Assistant-Engineer. The appointment is an important one, having regard to the magnitude of the works, which are capable of supplying 25 million gallons of water per day, the greater part of which has to be filtered; and the whole is distributed on the constant supply system. There are seven pumping-stations, with an aggregate of 3450 indicated horse power, which is considerably larger than the majority even of the London Water Companies. Messrs. Joseph Quick and Son, of No. 39, Victoria Street, Westminster, are Consulting Engineers to the Calcutta Corporation.

Personal.—Mr. W. J. Atkinson Butterfield, M.A. (Oxon.), has resigned his appointment at the Beckton Gas-Works. He was the only officially appointed "Chemical Assistant to the Engineer" (to quote the terms of the Directors' minute) on the small staff of those works, which of course are quite distinct from the Tar and Liquor Works also belonging to The Gaslight and Coke Company.——The Hinckley District Council have resolved to increase the salary of Mr. G. Helps, the Manager of the gas-works, by £30 per annum. Since Mr. Helps commenced his duties in 1893, the output of gas has augmented by 3,253,000 cubic feet, with an increased revenue of £1567 for gas and £437 for residual products.——Mr. H. J. Clarson, C.E., of Tamworth, has been engaged to advise the Ibstock local authorities as to a water supply scheme for the district.——Mr. H. Airey, whose relinquishment of the position of Chief Inspector of the Spitalfields gas-meter testing-station of the London County Council was mentioned in the JOURNAL for the 10th inst., has been awarded a pension of £141 13s. 4d. per annum.——The Paris Academy of Sciences has awarded the Lecomte prize of 50,000 frs. to Lord Rayleigh and Professor Ramsay, for their researches which led to the discovery of argon.

NOTES.

Testing Cement for Resistance.

Discussing the utility of heat tests of portland cement, M. Le Chatelier, who was appointed by a French Government Commission to inquire into this subject, points out that, in course of time, all hydraulic cements and limes employed in building and engineering construction become disintegrated by various natural influences. The longer a cement resists disintegration in this way, the better it is; and it therefore seems to be the first requirement in cement testing that the methods employed should be calculated to show the degree in which the test sample possesses the power of resistance. Yet, as a rule, tests of cement have not been specially directed to the determination of this degree. The causes of the disintegration of cement are many; but they are divisible into two great classes. The first comprises those influences which apply only in certain circumstances, as the action of sea water, frost, the sun's heat, and so forth; the second refers to those which act under all conditions, as water and carbonic acid. The latter are less energetic in action than the former. In durability or resistance tests, the cement is usually moulded into pats, with thin edges. After twenty-four hours, the pats are tested by comparative experiments with cold water, in air, in kilns heated to 120° C., in a gas-flame up to red heat, in water brought to the boiling-point in an hour and a half, and kept boiling for at least six hours. Professor L. Tetmajor found in this way that, out of 139 samples of cement, only two showed signs of disintegration after lying in cold water for three years. In the air, 18 samples altered completely, and seven showed less marked deterioration. The boiling test destroyed seventeen samples completely, and developed cracks in eleven others. All the cements that disintegrated in air suffered sudden destruction under the boiling test, with the difference that, while in air the mischief did not become apparent for a year, it was developed in six hours by boiling. It is important to notice that a certain agreement showed itself between the times necessary to reveal disintegration in air and in water respectively; but the results obtained do not admit of the deduction of definite relations in this regard. The kiln and red-heat tests yield results identical with the boiling-tests. It is concluded that, the boiling test is excellent for portland cement, inasmuch as it shows in six hours what the cement would be like after a year's exposure to air. No bad cement or hydraulic lime can withstand the boiling test; but the converse has not yet been established—that all cements unable to stand the test are really bad.

Coal Conveying by Flume.

It is reported that a peculiar kind of coal conveyor is employed at some mines situated at Horr, Montana. It was found by the mining company that any tramway system for conveying the small coal the distance of 8400 feet from the washing-plant to the coke-ovens would be too expensive when of sufficient capacity. It was accordingly decided to try the experiment of water carriage; the small coal being borne along a "flume" constructed of planks made of 2-inch fir boards nailed together to form a rectangular trough 8 inches square in section. The line has a minimum gradient of 2·8 per cent. The arrangement is stated to work splendidly; carrying over all the coal that is put into it without cost, except interest upon the outlay on construction. At the end of the shoot, the coal and water are received in settling-tanks arranged in pairs, so that one can be emptied while the other is being filled. When the first tank fills, and the water begins to overflow, it is perhaps one-third full of coal; and the overflowing water carries with it into the bottom of the second tank a quantity of very fine particles of coal, almost as fine as flour. This small stuff makes good coke. All the coal is coked for metallurgical purposes. Where the flume had to be laid at a steep gradient, the wood was lined with sheet iron to prevent excessive wear. The company are contemplating the erection of another large flume to convey the lump coal.

A Large Water-Main.

One of the largest jobs of water-main laying in the world is in progress in connection with the water supply of the city of Allegheny, Pennsylvania. The trunk main is of steel, 60 inches diameter, and 10 miles long. It was planned by Mr. Robert Swan; and it is expected to convey 50 million gallons of water per day. The metal for its construction is specified to be soft, open-hearth steel, having a tensile strength of from 55,000 to 65,000 lbs. per square inch; elastic limit, 32,000 lbs.; elongation, 25 per cent. in 8 inches in the longitudinal direction, and 22 per cent. across the direction of rolling; reduction of area, 50 per cent. The metal is not to contain more than 0·05 per cent. of sulphur, phosphorus, or silica; the content of carbon being limited by the physical requirements. The plates must allow cold scarfing to a fine edge without showing signs of fracture. The shop rivets are to be of the same metal as the sheets. The pipe is made up in the shop in lengths of four plates—inside and outside courses alternating. In the trench, the pipe is laid so that the longitudinal seams of all inside courses on the straight are in line, with the caulking edges facing upward. The sheets are 1½ inches thick; and the whole pipe-line will weigh 3500 tons. The edges of the plates are planed to a bevel of 63° with the flat, and after riveting and caulking, as in boiler work, the whole pipe is japanned by the Sabine process.

Electrolysis in Boston.

It is reported by Messrs. Stone and Webster, to the Water Department of the City of Boston, that the trouble in connection with electrolysis of the pipes buried in the city streets has practically been cured by the improved measures taken by the electric tramway companies. The satisfactory feature of this report, which is summarized in the *Engineering Magazine*, consists in the information it supplies that the electrolysis of pipes can be prevented by the use of proper precautions. It is admitted that, in certain places in the city, electrolytic action is still taking place; but the pipes, which have already been more or less injured, are now merely decaying prematurely. Excavations which have been made in different localities, for the purpose of inspecting the pipes, have given only negative results; revealing nothing in the way of distinct action, and yet not supplying proof that the natural decay of the metal is not being accelerated by electrolysis. Action of a serious character is confined to particular places, where, owing to certain peculiarities of the railway system, abnormal currents are flowing through the earth; but, as a whole, the action has been reduced to so small an amount as to be difficult of detection. In the places where much action is found, special precautions in regard to the provision of return feeders, and connections of the street railway system to the mains, will be relied upon to reduce it to insignificance. It is thought to be impracticable to entirely eliminate electrolytic action; but by contant inspection of the water-distributing plant as a whole, with the view to locating points where difficulty is liable to occur, and then applying remedies which have become well known, it is considered that the danger can be reduced to a minimum.

Received.—"L'Eau Potable." By F. Coreil, Director of the Municipal Laboratory of Toulon. With 136 illustrations. (Paris: J. B. Baillière et Fils.)——"Calvert's Mechanics' Almanack and Workshop Companion." Compiled and edited by J. Nasmith, Assoc.M.Inst.Mech.E. Thirty-third year. (Manchester: John Heywood.)

Death of Mr. T. S. Weeks, of Torquay. — Mr. T. S. Weeks, Assoc.M.Inst.C.E., the Water Engineer of the Torquay Corporation, died on the 14th inst., at the age of 75. He was the oldest official in the employ of the town, and had managed the local water supply ever since 1858. When he first entered the service of the Local Authority, the water supply was derived from two small local works and from wells. In 1856, an Act of Parliament was obtained, authorizing the construction of the existing works; and with these Mr. Weeks was closely connected to the time of his death. In the recent controversy respecting the water supply, Mr. Weeks played an important part as an advocate of the Town Council's scheme for the purchase of the watersheds. At the funeral last Tuesday, there was a very large attendance, including the Mayor (Alderman E. P. Bovey), members of the Corporation, borough officials, and many prominent residents in the town.

The Proposed Memorial of Mr. Denny Lane.—Last Tuesday a public meeting of the citizens of Cork, convened by the Mayor (Mr. P. H. Meade), in accordance with a numerously and influentially signed petition, was held at the Imperial Hotel, for the purpose of taking steps to perpetuate the memory of the late Mr. Denny Lane, in such form as might be desirable. The gathering was in every way a representative one. The Mayor, in opening the proceedings, referred in appreciative terms to the high qualities possessed by Mr. Lane, who, he said, was a man of whom any city in the kingdom might justly feel proud. He suggested that, as Mr. Lane had devoted his life to science and art, it would be well if they did something towards fostering and helping, as he had done, students of a scientific or artistic turn of mind. The Mayor added that he had received a letter that morning from the Engineer of the Waterford Gas Company (Mr. G. Anderson) enclosing a cheque, and paying a high tribute to his late friend. Mr. Maurice Healy, M.P., proposed the first resolution, which conveyed to Mrs. Lane and the family the heartfelt sympathy of the citizens with them in their bereavement. Mr. Crosbie moved the second resolution, expressing the feeling of the citizens that it was incumbent upon them to recognize in some substantial and permanent manner the many noble qualities and the great ability possessed by Mr. Lane. He said a bust had been suggested by Mr. Lane's friend at Waterford; but he (Mr. Crosbie) was of opinion that it should be supplemented by something calculated to perpetuate his memory in gifts such as those he was in the habit of making every year of his life. Mr. O'Brien considered a bust and a scholarship would be an inadequate memorial; and he suggested a public statue in one of the principal thoroughfares of the city. The Mayor thought that the idea suggested by Mr. Crosbie, who was conversant with the views of the family, was the most suitable. This proposition was accordingly adopted; and a Committee was formed to carry it out. A subscription list was at once opened, and it was headed by a sum of £100 from the Cork Gas Company. Mr. G. Lynch, their representative on the occasion, stated that Mrs. Lane and her daughters strongly disapproved of the proposed statue. He thought Mr. Lane himself would have approved of a scholarship, or something similar, being founded at the School of Art. The proceedings closed with a vote of thanks to the Mayor. A sum of upwards of £300 was subscribed at the meeting.

TECHNICAL RECORD.

AMERICAN GASLIGHT ASSOCIATION.

Discussion on Mr. A. C. Humphreys' Paper on Photometry.

In recent issues of the JOURNAL (*ante*, pp. 922, 976, 1034, 1086), we published the paper read by Mr. Alex. C. Humphreys at the last meeting of the American Gaslight Association, on "The Commercial Value of Photometry." We now reproduce from the *American Gaslight Journal* the remarks to which it gave rise.

Mr. CHOLLAR, in opening the discussion, referred in a complimentary strain to the paper, but took the ground that, in spite of Mr. Humphreys' arguments, nine-tenths of those familiar with photometrical work were of opinion that there was something wrong. He said if naked lights were covered by opal globes, the photometer showed that 60 per cent. of the light was lost; but the effect was to make the light softer and more diffusive. He had looked without success, in dictionaries and scientific works, for a specific definition of a diffusive light, and of the property of diffusiveness of light. Here was something which the photometer did not explain. He admitted that light from a point decreases inversely as the square of the distance; but light approaching a point, as in the case of a convex lens, increases in proportion to the square of the distance, otherwise the telescope and microscope would be impossibilities. Without such increase, there could be no focus. Parallel rays, such as the rays of the sun, neither increased nor decreased. Light from a globe gave converging, diverging, and parallel rays; light from a point, only diverging rays. Consequently, it was not diffusive; but light from a globe was soft and diffusive. The definition of diffused light was that it did not decrease in proportion to the square of the distance. Light converging to a point advanced in concave waves—the reverse of light from a point. If one decreased according to the square of the distance, the other must decrease. Parallel rays, as from the sun, reached out indefinitely. The trouble with the photometer was that it took no account of softness of light. A soft light was more like a glow. In the commercial testing of gas lights, the light should be entitled to a correction in proportion to the angle it subtended—in proportion to the size of flame, and inversely with the sharpness of shadow. Light from the electric arc approximated closely to the law of inverse squares, and cast a sharp and intense shadow; but light from the clouds, composed of diverging rays, was soft and diffused.

Mr. HINMAN said he thought the paper left little for remark. He considered Mr. Humphreys had demonstrated the complete accuracy of the bar photometer for measuring the amount of light from different sources. But there were some other things it did not measure, as colour and intensity per unit of source. He thought the much discussed diffusibility was simply a question of intensity. For example, in examining a printed page, the effect depended upon the surroundings. If the eye met a bright light, the page might be insufficiently illuminated; whereas the same amount of illumination on the page in an otherwise darkened room would give a brilliant effect. It was a question of the eye and the surroundings. A light giving less illumination might be more valuable because of more uniform distribution. A light of high intensity within the range of vision confused the eye, and good effects were not obtained. As to shadows, with a large light of low intensity, to obtain the same candle power the flame must be larger, and so the shadows were not so sharp. This question of shadow was practically of great importance. Referring to the details of photometry, various points were to be considered. First, the question of the standard and the test burner. If the law designated a certain test burner, that question was settled. But the legal burner was not necessarily the one employed in practice; and the results obtained were often widely different. He had tested gas in the Argand (which happened to be the one best adapted), and found 16-candle power; while with flat-flame burners he obtained, with the same gas, only 8 or 10 candle power. With regard to standards, whether candles or pentane, he thought there was something to be said on both sides. Candles, properly used, were fairly reliable. He had not used the pentane standard; but there seemed to be no doubt that it was more uniform, though possibly harder to use. With regard to the style of photometer, he preferred the cabinet to the open form; but it was important that the former should be properly and amply ventilated. With regard to the disc, he had used both the Bunsen and the Leeson star disc, and preferred the former; but he thought good results could be obtained with both. He considered it was necessary to use two mirrors; and he regarded the reversal of the disc as of great importance. He had found the readings of the two sides of a disc to vary as much as four candles; and frequently the variation would be one candle. As to corrections for barometer and thermometer, they were necessary for scientific work. But in the United States there were some cities at a great height above the level of the sea; and the consumer was not likely to be satisfied by the statement that at a barometric pressure of 30 inches the illuminating power would be 25 candles. He did not suppose that any companies corrected their bills by the barometer.

Mr. PRICHARD said he became interested in this subject some years ago, and believed that the illuminating value of gas, as measured on the bar photometer, differed from its commercial value. At the time referred to, the arc light had recently entered the field; and the ratings of candle power given out in connection with these lights were an incentive to look into the matter. As he did so, he became more and more convinced of the difference spoken of. That there was such a difference he thought was true, for several reasons; and he considered that Mr. Humphreys' complete paper amply bore out this idea. Mr. Humphreys said: "A measurement of the spherical candle power of the light-source and the determination of its colour composition will, as far as possible, enable us to estimate the light-effect obtainable under varying conditions." Apparently two of the reasons for this difference were here shown. In comparing an incandescent lamp and a gas-flame, the horizontal bodies of rays coming from each lamp were measured, and both were said to be 16-candle power. In the case of the arc, its light was measured at 45° from the horizontal, and then it was claimed to be of 2000-candle power. Such a claim was not fair to the incandescent light and the gas light. If measured spherically, the candle power of the arc would be only 500. While he did not know exactly the spherical candle power of a gas-flame, he thought it varied with the maximum luminosity and with different kinds of flames, and also with the thicker flame of water gas. This one point alone showed the difference between the photometric and the commercial value. He also thought, as suggested by Mr. Hinman, there was a difference as to the area of the light-source. It must make a great difference whether the source was 3 square inches, as in a gas-flame, or 0·0035 inch, as in an incandescent lamp, or 1 inch, as in the arc lamp. To furnish an estimate of the commercial value of a light, the photometer should take notice of this difference of area. If, on entering a room, an arc lamp was found to be level with the eyes, it was not possible to distinguish anything. And so, in a smaller degree, with an incandescent lamp; in a still smaller degree with a gas-light; and least of all with a gas-jet enclosed in an opal globe. This was the reason why the light surrounded by an opal globe was considered as giving a better effect in spite of the photometric value being reduced. As to colour, there should be discrimination. An equal amount of red or green light thrown into the meeting-room would fail to illuminate it as well as the lights then in use.

Dr. LOVE said the paper naturally interested him greatly, for he had been for twenty years engaged daily in photometric work. He thought the theoretical points of the subject could be best discussed by physicists. He agreed substantially with the paper, and thought they were under obligations to the author, who had threshed out the subject so well. He was glad Mr. Humphreys had dealt with the subject from the spherical wave standpoint. It was misleading to consider light as moving in straight lines. He would, with their permission, call attention to his own methods in photometry. For nearly twenty years he had used the star disc enclosed in glass. He first tried the Bunsen, and then the Leeson disc; but he found the latter unsatisfactory on account of the "buckling" of the paper. Mr. Dibdin had not at that time suggested his improvement. He devised the glass enclosed disc eighteen years ago, and had found it satisfactory; and he thought that anyone who used it would never go back to the grease-spot disc. Every disc should be tested by reversing. With the glass-side disc, if once found true, it was apt to remain so longer than other discs; the glass tending to prevent change. The reversing of the entire box was more important than reversing the disc alone. This was a most important suggestion of the Dutch Committee. With regard to candles, in his (Dr. Love's) opinion, the United States was the dumping-ground for all the poor candles made. He thought he had wrestled with this subject more than had the Committee in London. He allowed himself a margin of 6 grains either way from 120 grains. There were some small points—such as particles of inorganic matter on the end of the wick, soot on the wick, and the curling of the wick—which accounted largely for the variation in candle results. Candles burning under these conditions gave unreliable results. With regard to Mr. Dibdin's standard, he thought it was going to be a good thing for those regularly engaged in laboratory work; but he feared it would be troublesome for the gas engineer. No doubt, it would be more reliable for scientific work; but he feared it would be too expensive. As to the objection that the unit was still the candle, he would suggest that all standards were arbitrary.

Mr. SOMERVILLE said he was reluctant to give up the use of the word "diffusive," which was objected to by Mr. Humphreys. It seemed to him that there was a difference in the diffusive qualities of lights. He could tell a gas-lighted store a hundred yards away—the light flooded from the windows. This was not the case with the incandescent electric light. Again, the electric light, as used for lighthouses, was not nearly so efficient as the old oil or gas lamp of much lower nominal power. Was not this due to a difference in diffusive power?

Mr. MILLER felt that nothing he could say could add to the strength of the paper. The ground had been covered, and nothing was left to be said. He would, however, ask Mr. Humphreys what had been the result with him of increase of temperature and poor ventilation in the photometer-room. Did it tend to make the candle power read higher or lower? Some of his experiences appeared to show that the effect was to make the reading against the gas, which to him did not seem to be theoretically correct. With regard to the point raised by

Mr. Somerville in connection with lighthouse work, he thought this was outside the subject. The paper assumed that the atmosphere was transparent. The reason a red light would do better in a fog was because it contained more of the red rays, and they were less refrangible. This was shown in the case of the setting sun.

The PRESIDENT (Mr. Walton Clark) asked Dr. Love and Mr. Hinman to give their experience in connection with the point raised by Mr. Miller, in regard to the effect of a vitiated atmosphere upon the apparent candle power of gas.

Dr. LOVE said he thought that theoretically it should affect both lights alike; but he had not made any exact observation in connection with this matter.

Mr. HINMAN cited a case supporting Mr. Miller's experience—the candle-power reading being reduced by improper ventilation. Whether or not this was a general experience, he was not prepared to say.

Mr. FORSTALL said he remembered that, in a paper read before one of the English Associations by Mr. Methven,* it was shown that an increase of the moisture in the air tended to depreciate the apparent value of the gas.

Mr. EGNER thought there was some optical illusion in connection with these questions of intensity and diffusion. If one looked at a 16-candle power electric light and a 16-candle power gas light, the former dazzled the eye the more because it was more intense. This probably led people to think that gas light was more diffusive. The quantity of light was alike; but in one case the intensity was much greater than in the other.

Mr. HUMPHREYS, in reply, expressed regret that apparently the paper and his object in writing it were misunderstood by some; but the responsibility, he acknowledged, rested upon himself, as he had not been able, through illness, to finish it in time for the members to study in advance. The paper was written with the idea of showing how the eye was deceived, and how discrimination should be made between facts and optical illusions. These modifying circumstances could not be provided against unless they were first located and defined. The eye was deceived, but the photometer was not. The photometer measured light by its effect, but did not measure the light-source. He did not consider there was any such general disbelief in the accuracy of the photometer as Mr. Chollar claimed. As asserted by him, there was a difference in the light effect whether or not a globe was used to enclose a light-source; and he had endeavoured to show the cause of this difference. One reason was that the globe allowed a more uniform spherical distribution. Even a transparent chimney tended to reduce the spherical variation; and a translucent globe had a marked effect in this direction. The shielding of the eye from the direct rays coming from the light-source was another reason for the difference. As to diffusion, he understood that the diffusion of light was its irregular reflection from surfaces other than those of reflectors. To estimate the value of light-sources, the light must be compared before there has been any diffusion; and this was as fair for one light as for the other. As to Mr. Chollar's reference to the use of lenses and reflectors in the case of telescopes, microscopes, &c., he thought there was hardly any necessity for reply. Light from a point would naturally be distributed spherically; but if a larger effect were needed for a special purpose, and the light were required to be sent all in one direction, a lens was used to concentrate or squeeze the light together, and send it forth in the one direction only. But there was nothing in such action to disprove the law of distances. The law could not be employed to measure the light given through a lens, because by the use of the lens the very spherical distribution upon which the law depended was rendered impossible. The rate of variation of intensity where a lens was used depended upon the character of the lens. In the case of the globe, the opposite effect was found, as the tendency was to make the spherical distribution more uniform. It was true that these and other effects were not obtained in the photometer. The measurement was made by comparing the lighting effect of the direct rays upon a white disc, and before any distributing elements had been brought into the comparison. The experiments made in connection with his former paper showed that the same results were obtained from different classes of light-sources. These were balanced against each other at equal distances from the disc. Then they were each moved out a foot from the disc, and the balance was found to be maintained. Again and again the lights were moved away by equal distances, and still no difference was found on the disc. In the recent experiment of the same kind, when comparing the light from flames of gas and kerosene oil, Dr. Elliott, of New York, had agreed with him in failing to find a difference. He would ask the question: "If there is this difference of 'diffusive' power, why did it not show itself on the photometer disc in these experiments?" The diffused light could not be fairly compared. A coloured wall would reflect more or less of the original light falling upon it according to whether the light contains more or less of the rays of that colour. Such conditions could not be provided for in advance, because all sorts of such conditions would be met. The different rooms of the same house, illuminated by the same light-source, would give varying lighting efficiencies on account of the variations in the colour absorption. As to shadow effects, he had simply touched on the subject, as his paper was already too long. Necessarily, as the light-source increased in size, light therefrom would get behind the shadow-making object more or less, and the effect would be softened, and the general illumination be more uniform. This in no way disproved, or had any connection with, the law of distances. The best effects could only be obtained by recognizing the governing laws; then determining the modifying causes; and keeping the latter in mind. Mr. Hinman spoke of a gas tested by an Argand burner showing 16-candle power, and later, with flat-flame burners, having only 8 or 10 candle power. But Mr. Hinman would not claim that this affected the accuracy of the photometer; rather simply that the light-source was reduced in value by the use of an improper burner. This was not a question of light distribution, but of efficiency of application of the gas. He was decidedly of opinion that the improved star disc gave the most reliable results, and especially where there was difference of colour in the lights. The points of the star should be observed. As to correction for the barometer in very high altitudes, he thought two different ones should be made. For local comparison of results, the correction should be made to the average local barometer as recorded at the War Office in Washington. But for general comparison of results—as, for instance, in such an Association as the one then in session—the correction should be made to the standard barometer. In a company he was formerly connected with, controlling many works in different places, this was an important question; and it was settled in the way mentioned. Mr. Prichard had referred to his admission that the measurement of the spherical candle power and the determination of the colour composition of a light-source would, as far as possible, enable one to estimate the light-effect obtainable under varying conditions. This he thought was in accord with the rest of his paper. He was prepared to admit the facts as he found them. If an arc lamp was measured at 45°, and the candle power so determined was taken as that of the lamp, the person accepting such a statement was in the wrong, not the photometer. It stood to reason that, for general illumination, the average spherical intensity must be considered. He could not speak of his own knowledge as to the pentane standard; but the names attached to the report of the Photometric Standards Committee were sufficient guarantee for the claims made in its behalf. He thought Dr. Love rather overrated the complexity of the instrument. As to Mr. Miller's question upon the effect of want of ventilation, in a recent case in his experience, using an open bar photometer in an insufficiently ventilated room, he found the effect was to reduce the candle power of the gas. Mr. Dibdin gave the accounts of results for and against the gas. Referring to Mr. Somerville's disinclination to give up the use of the word "diffusive" as applying to the quality of a light, he (Mr. Humphreys) had also found it hard to settle upon another word, and had been obliged to fall back upon "penetrating power," "carrying power," &c. He thought they should be careful to bear in mind that diffused light was irregularly reflected light, and that this should not be confounded with the improper (as he thought) reference to the diffusive quality of light. He did not think it had been, or that it could be, demonstrated that there was any such difference in the quality of different lights; but, on the other hand, he had been able, as shown, to make experiments to prove that the differences so claimed in certain cases did not exist. As to the relative efficiencies of lighthouse lamps, it was a question of the transparency of the medium. It was asserted that the light from the electric arc would not penetrate fog so well as the light from an oil or a gas flame; and while the assertion was disputed, he believed it to be correct. But this was a question as to the effect of a particular absorbent upon a light of certain colour composition. It was a very practical and important question; but it did not furnish an argument as to the relative diffusibility of different kinds of light.

* See JOURNAL, Vol. LIV., pp. 968, 1011.

The Recent Stoppage of Gas Supply at Broughty Ferry.—In the last two issues of the JOURNAL, our Scotch Correspondent referred to an accidental stoppage of the gas supply at Broughty Ferry, owing to the foreman neglecting to turn on one gasholder before another was emptied. This is an old trouble, and one which is liable to recur. It may therefore not be inopportune to call attention to a device patented some years ago by Mr. Magnus Ohren, Assoc.M.Inst.C.E., for preventing such accidents. His plan renders gasholders self-acting by fixing to the guide-bars, to the columns, to the holder itself, or to any other convenient or suitable place, guards to catch the guide-rollers and stop the ascent of the holder on its reaching the required height. The valves of all the inlets and outlets of the holders being open, the lightest holder will fill first, then the next lightest, and so on in succession, until all the holders in action are filled. During the supply, the heaviest holder will discharge first. This mode of construction will answer for any number of holders, however far apart they may be; care being taken to stop off each holder with sufficient seal, with the exception of the heaviest one, which should not be stopped off at all, so that it may "blow" when all the holders are full. The inlets and outlets being all open, any increase in bulk in a full holder in sunny weather will pass through the outlet, and go away with the make to the holder then filling. Though Mr. Ohren patented the arrangement, it was not with the view of following it up (the patent was never sealed), but of making it more generally known in the profession.

DR. KNUBLAUCH ON THE NITROGEN AND THE NITROGEN PRODUCTS DERIVED FROM COAL.

(*Concluded from p.* 1243.)

Following the course of the gas from the washers to the purifiers, we find cyanogen as well as sulphuretted hydrogen is absorbed in the latter; and thus we are brought in contact with a second valuable nitrogen product. Cyanogen is very susceptible to chemical reactions; and it is not easy to trace its behaviour in the vessels in the presence of carbonic acid and sulphuretted hydrogen. The nitrogen of the coal which formed cyanogen during distillation, was little investigated until a few years ago.

The method which has been most used for the estimation of cyanogen in coal gas is quite unreliable, as it indicates the presence of cyanogen in gas which cannot possibly contain it. It consists in collecting the cyanogen in a solution of silver; but many other constituents of coal gas likewise form insoluble compounds with silver. The method is described in a book of even so late a date as 1890. Much confusion was caused by it; and even now, here and there we find it supposed that the thiocyanate occurring in fouled oxide existed as such in the gas. The quantity of it often considerably exceeds the amount of ferrocyanide. The patent on the extraction of cyanogen applied for by the author in 1888, first cleared up the question of the nitrogen occurring as cyanogen. It embraces a certain method of absorbing the whole of the cyanogen present, and securing it as ferrocyanide. The cyanogen wholly combined in that form is then determined by the method for the estimation of ferrocyanide in spent oxide. At the present time, cyanogen determinations are commonly made according to this method. Without further discussing theories, it may be said that the ferrocyanide, as well as the thiocyanate, is first formed in the purifying material from the hydrocyanic or prussic acid of the gas. If the latter enters into combination with iron, we have ferrocyanide; if into combination with sulphur, thiocyanate or sulphocyanide. Although thiocyanate is formed from hydrocyanic acid, sulphuretted hydrogen, and ammonia, these compounds pass along together in the crude gas without appreciable formation of thiocyanate as far as the purifiers; and even then the formation of thiocyanate is only partial. The feebly acid hydrocyanic acid is doubtless preserved as such by the large excess of carbonic acid. In the purifiers, therefore, we must force the hydrocyanic acid to combine with iron instead of sulphur; and we can readily effect this by fulfilling certain conditions in the process, based on present knowledge. But the results of a large number of tests of fouled oxide prove how incompletely the process is often carried out. The results of ten tests are given in the following table:—

Sample.	Percentages on the Dried Samples of Spent Oxide.							Potassium Ferrocyanide if the Cyanogen were Converted to Ferrocyanide, instead of Thiocyanate.		Percentage of Cyanogen in the Material as—	
	Prussian Blue.	Potassium Ferrocyanide.	Thiocyanic Acid.	Sulphuric Acid.	Ammonia.	Soluble Salts.	Sulphur.	Increase.	Total.	Ferrocyanide.	Thiocyanate.
1	14·06	20·74	0·068	1·735	0·596	3·24	41·15	0·08	20·82	99·6	0·4
2	13·61	20·07	1·290	6·160	2·660	12·00	36·10	1·54	21·61	92·9	7·1
3	13·56	20·00	0·440	6·830	2·620	13·62	30·27	0·53	20·53	97·4	2·6
4	11·85	17·48	2·630	2·150	1·540	7·50	38·35	3·14	20·62	84·8	15·2
5	10·58	15·57	3·270	2·700	1·560	9·50	35·37	3·90	19·47	80·0	20·0
6	10·33	15·23	4·200	3·510	2·550	12·00	30·15	5·02	20·25	75·2	24·8
7	9·06	13·36	4·410	4·500	3·260	14·70	33·57	5·27	18·63	71·7	28·3
8	8·57	12·64	6·960	2·110	2·480	13·50	28·38	8·32	20·96	60·3	39·7
9	8·10	11·93	6·150	10·800	5·510	22·79	32·10	7·34	19·27	61·9	38·1
10	3·38	4·98	13·750	5·380	5·490	28·31	32·30	16·42	21·40	23·3	76·7

The table shows that, beginning with only traces of thiocyanate in No. 1, the amount continually increases, while the quantity of ferrocyanide decreases. Of the total cyanogen, No. 1 contains only 0·4 per cent. as thiocyanate, and 99·6 per cent. as ferrocyanide; while No. 10 contains 76·7 per cent. as thiocyanate, and only 23·3 per cent. as ferrocyanide. The quantity of thiocyanate in sample No. 1 is technically negligible; and as a result of the author's experiments, the conditions are known under which no trace of thiocyanate is formed, but the whole of the hydrocyanic acid is converted to ferrocyanide.

Regarding the quantity of cyanogen formed in the retorts, numerous experiments at the Cologne Gas-Works, carried out at various times with Westphalian coal, indicate that 74 to 79 grains of hydrocyanic acid (HCN) per 100 cubic feet are present in the gas, or about 0·15 per cent. by volume of the acid in a state of vapour. This corresponds to 193 to 205 grains of potassium ferrocyanide, or roughly to 2·9 to 3·1 lbs. of potassium ferrocyanide, per ton of coal. It is generally less at the coke-ovens. Referred back to the coal, the nitrogen of the cyanogen amounts to only 0·02 to 0·03 per cent., corresponding to 1·8 per cent. of the total nitrogen of the coal. In order to illustrate the proportions in which the several constituents occur in crude gas, and in how small a proportion the useful nitrogen is, the average composition of crude gas from Westphalian coal is here given:—

Average Composition of Crude Gas from Westphalian Coal.

	Per Cent by Volume.	
Hydrogen	50·00	
Methane	31·00	
Carbonic oxide	9·00	
Ethylene	2·50	3·75
Benzene, &c.	1·25	
Carbonic acid	2·00	2·75
Sulphuretted hydrogen	0·75	
Nitrogen	2·25	
Ammonia	1·10	1·25
Hydrocyanic acid	0·15	
Sulphur compounds other than sulphuretted hydrogen	0·01	

The so-called diluents, hydrogen, methane, and carbonic oxide, form about 90 per cent.; and the obnoxious carbonic acid and sulphuretted hydrogen, about 2¾ per cent. The most important illuminating constituent, benzene (and toluene) vapour, occupies only 1¼ volumes per cent., and furnishes about 80 per cent. of the illuminating power of the gas; while ethylene (and its homologues) occupies 2½ volumes per cent., and is only responsible for 20 per cent. of the illuminating power. About 2 per cent. represents the free nitrogen; but the errors in the determinations of all other constituents are massed together in this, as there are no means of directly estimating nitrogen in gas. The nitrogen compounds are represented by 1·1 per cent. of ammonia, and only 0·15 per cent. of hydrocyanic acid. It will readily be surmised that the absorption of the latter must present difficulties, as in general the absorption of a gaseous constituent becomes more difficult as the proportion of its volume to the total volume diminishes. But with the hydrocyanic acid, there are other difficulties, due to the sulphuretted hydrogen and carbonic acid amounting almost to twenty times its volume. The materials used practically for extracting cyanogen, likewise take up with great avidity the sulphuretted hydrogen, and partly also the carbonic acid; so that a product is obtained which contains a large quantity of iron sulphide to a relatively small amount of ferrocyanide. It would be too wide a digression here to enter further into the author's experiments, which have resulted in the extraction of the whole of the cyanogen, while the carbonic acid and sulphuretted hydrogen are eliminated from it. On another occasion, we may come back to this process; but the remainder of this paper can deal only with the extraction of ferrocyanide from fouled oxide.

The nitrogen which in gas manufacture forms cyanogen, amounts, as we have just seen, to only 0·02 to 0·03 per cent. of Westphalian coal. But owing to the large consumption of coal, this item becomes very considerable; and the high value of the ferrocyanides renders this nitrogen a source of large revenue. At the beginning of the eighties, we find purification a considerable item of expenditure; and in many gas-works it still remains so. About that time, however, a favourable change was made at Cologne. The material formerly was a troublesome product, and fetched quite a small sum, until in March, 1882, it was sold on the basis of its content of ferryocyanide, after a method of estimating the latter had been worked out. The proceeds of the sale of the oxide (yielding 14 to 18 per cent. of potassium ferrocyanide on the moist material) amounted, for the six years, 1882 to 1888, to about £4400; the average production of gas being 554½ million cubic feet. Deducting the cost of raw material and wages, a considerable profit remained. The prices for rich material have risen since, so that the receipts are now even higher. Works the size of those at Cologne should extract yearly hydrocyanic acid equivalent to about 78½ tons of potassium ferrocyanide; while about half that quantity, according to the process now used, remains in the gas. There are, however, few works which obtain such good results.

We may next consider how much spent oxide is obtained in the purification of a definite volume of gas. As this depends on the quantity of sulphuretted hydrogen in the gas after the scrubbers, it is dependent in the first instance on (*a*) the yield of sulphuretted hydrogen of the coal carbonized, which is variable even with the same kind of coal; (*b*) the more or less complete removal of ammonia before the purifiers; and (*c*) the amount of carbonic acid in the crude gas. It is evident that the ratio of the spent oxide to the volume of gas treated may be very different, even at equally well managed gas-works. A good oxide, if the ammonia is completely removed before the purifiers, takes up at least 40 to 45 per cent. of sulphur, and

cyanogen equivalent to about 17·5 to 21·0 per cent. of potassium ferrocyanide (the percentages being in both cases reckoned on the dried material), before it begins to be troublesome in working. Many Westphalian coals give a yield of sulphuretted hydrogen corresponding to 14 to 17 cwt. of spent oxide, with 20 per cent. of moisture, per million cubic feet of gas. Less material may be used with some coals; but if the washing of the gas be incomplete, or the yield of sulphuretted hydrogen from the coal be greater, considerably more may be used up. Judgment cannot therefore be fairly passed on an oxide simply on the strength of the number of cubic feet of gas purified by a given amount of it. The quantity of material used in a large works during several years affords the best check on it.

The analytical results given above for ten samples of spent oxide, show how different may be the composition even with the same kind of coal. The first nine samples were fouled by gas from Westphalian coal, to which sometimes small quantities of richer coal were added, but to an extent unlikely to affect the results as far as the cyanogen is concerned. The differences in the amounts of ferrocyanide in samples Nos. 1 and 9 are as 21 to 12; but the material may contain even less than No. 9 does. Valued at their ferrocyanide content, and containing about 20 per cent. of moisture, at prices ruling during recent years, samples Nos. 1 and 9 would fetch respectively about £3 10s. and £1 18s. per ton. The total amount of ferrocyanide in oxide is frequently very small. Of sixty samples, four only produced over 15 per cent. of potassium ferrocyanide (over 18 per cent. on the dried material); while four gave under 6 per cent. (less than 7 per cent. on the dried material). Generally about 8·5 to 12 per cent. was obtained. It may be observed that, both in analyses and in commerce, the percentage of ferrocyanide is sometimes stated as Prussian blue. The amount of blue may be found by multiplying the amount of potassium ferrocyanide by 0·678. In the above table, also, the percentages are stated on the dried substance. With 20 per cent. of moisture, sample No. 9 would show 9·54 per cent. of potassium ferrocyanide, or $9·54 \times 0·678 = 6·47$ per cent. of Prussian blue.

The thiocyanic acid varies very much, amounting only to 0·068 per cent. in sample No. 1, and to 13·75 per cent. in sample No. 10. But if we assume that the whole of the cyanogen had been converted to ferrocyanide, instead of partially to thiocyanate, we arrive at nearly the same cyanogen content for all the samples. This is indicated in another column of the table. Reckoned as potassium ferrocyanide, it averages about 20 per cent. This proves that there is no deficiency of cyanogen in the gas, but that only with sample No. 1 did the conditions exist for the formation of ferrocyanide exclusively. How deep seated is the reaction, may be seen from the formation of 10·8 per cent. of sulphuric acid and 28·3 per cent. of soluble salts in sample No. 10. These soluble salts envelop the particles of iron which should enter into reaction; and thus the absorptive power for sulphuretted hydrogen is little, and these salts are necessarily removed and replaced with the material—thus increasing the wages. Moreover the material is much denser; and the gas passes through it with difficulty, causing back pressure. It purifies very badly, and takes up comparatively little sulphur; so that more material is required. While sample No. 1 gives 41·15 per cent. of sulphur, in No. 8 there is only 28·38 per cent., and in Nos. 2 to 10 an average of only 33 per cent.

Why is it that the amount of ferrocyanide from the same coal varies so greatly as in samples Nos. 1 to 9? Experiments and observations show that the ammonia only is to blame. In No. 1, with its large percentage of ferrocyanide, the ammonia amounts to only 0·596 per cent.; while with No. 9, it amounts to over 5 per cent., or almost ten times the quantity in No. 1. The ammonia still present in the mass affords no clue to the amount passed through when it is so high, as in such a case it is not wholly absorbed. Doubtless in Nos. 9 and 10 some ammonia has been left unabsorbed, and would act disastrously on the meters. Ammonia is further inimical to the formation of ferrocyanide in oxide purifiers (the wet process with alkaline or ammoniacal iron proceeds quite differently), but favours the formation of thiocyanate and soluble salts, and therefore causes interruption to the purification in general.

Complete extraction of ammonia means, therefore, the highest possible formation of ferrocyanide; and therefore perfect washing of the gas must be aimed at. We have already seen that the complete removal of ammonia is attended by a very great absorption of sulphuretted hydrogen and carbonic acid; and thus the purifiers are much relieved. At the same time, the cyanogen is compelled to combine with iron instead of sulphur; while the oxide serves for a larger quantity of gas, can remain in the vessels for a longer period, and finally be easily and certainly revivified. The spent material frequently fetches little or nothing in respect of the ferrocyanide it contains. A good sample, however, sells for £3 to £3 10s. per ton; and therefore the purification of gas should now form a considerable source of revenue.

These considerations indicate also that a complete analysis of the purifying material can enable us to draw conclusions as to the efficiency of the scrubbing and washing process. The author has, in all such cases referred to him, found his inferences confirmed by later experiments on the works. The processes taking place from the retorts to the purifiers have been traced step by step, after the introduction of chemical work in the industry. It is thus even possible, from the analysis of a bye-product, to decide whether, and to what extent, the whole apparatus is acting as it should. We can now follow the course of each molecule of nitrogen in the coal clearly and certainly; and on the basis of experiments, we can surely work for a quantitative yield of cyanogen compounds, while extraneous advantages also accrue to the general working.

Reviewing what has already been said, and confining ourselves, for the sake of simplicity, to the case of Westphalian coal used in gas-works, we find that the nitrogen of the coal is distributed as follows:—

1.—About 50 per cent. remains in the coke, and is only of interest because an increase in its amount means a corresponding decrease in the free nitrogen in the gas.

2.—About 30 per cent. is found in the gas as such, and must be considered injurious, as diminishing the illuminating power.

3.—From 12 to 14 per cent. is converted into ammonia; corresponding to 10·4 parts of sulphate per 1000 parts of coal (with English coal, it is much greater).

4.—Not quite 2 per cent. (0·027 per cent. of the coal) combines with carbon and hydrogen to form hydrocyanic acid; corresponding to a yield of 1·4 parts of potassium ferrocyanide per 1000 parts of coal. Of this quantity, at least two-thirds should, with proper working, be recovered in the oxide.

5.—Finally in the tar, as nitrogen bases, there is about 1⅓ per cent. (0·02 per cent. of the coal).

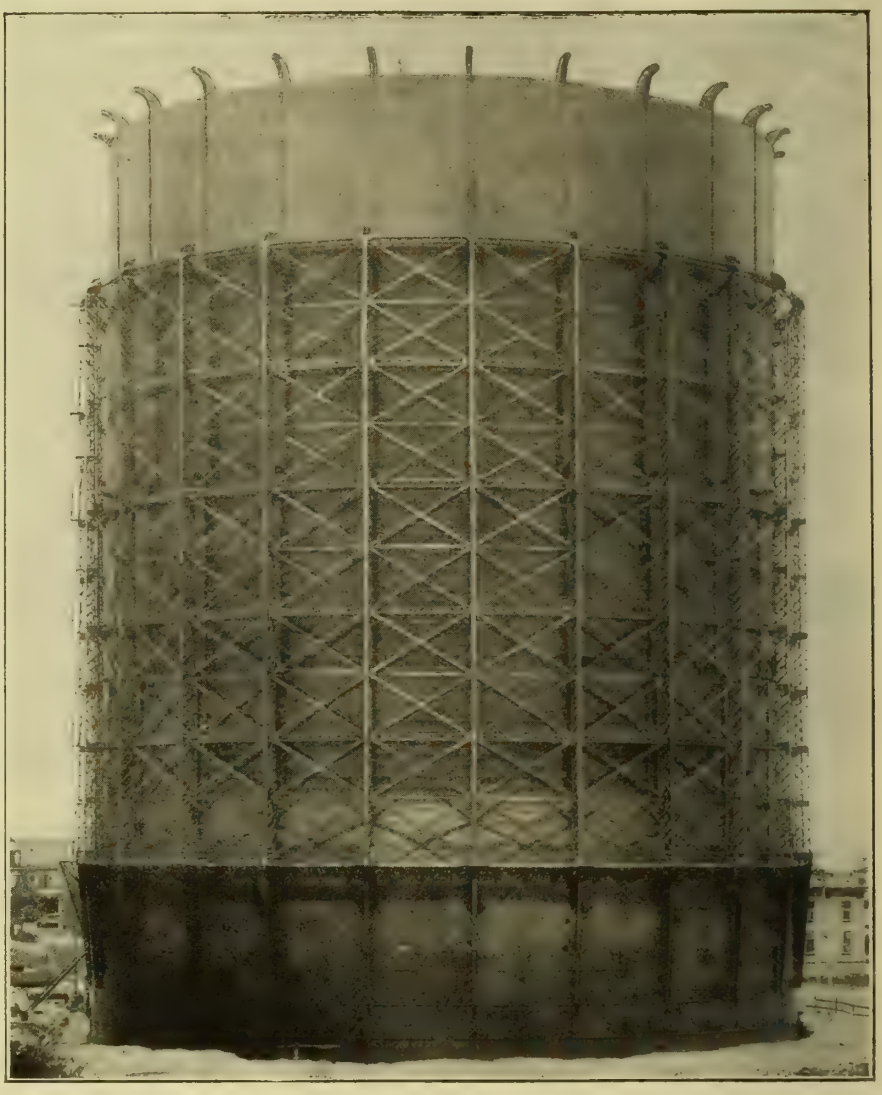
6.—Only 0·2 to 0·25 per cent. of the nitrogen of the coal forms products of marketable value; but the quantities of coal dealt with are large, and a revenue of about £14 per million cubic feet of gas results. This revenue may be easily reduced by a third or more, if the conditions for complete recovery are not constantly fulfilled. It is quite easy to so regulate the working that, even with apparently insufficient washing, the yield indicated may be obtained.

These remarks may perhaps help to elucidate the question of how far the nitrogen of the coal is available, and to attract proper attention to the points indicated.

A Gas-Well in Ontario.—Citizens of the town of Windsor, in Ontario, Canada, have sunk a gas-well about 1000 feet deep, from which a strong flow of gas was secured; the pressure being 400 lbs. to the square inch. The well was then passed over to the town, which now owns it entirely; the stockholders being paid back the money they risked in the first place to put down a test well. In due course, the town purchased the pipes laid in the streets, and all the other plant owned previously by the Ontario Natural Gas Company, laid down also extra piping where needed, and made preparations to connect with the town well and supply the citizens direct.

The City Finances of Dublin.—The *Sunday World*, a paper lately started in Dublin, presented to its readers last Sunday a few comments on the finances of the city, accompanied by some timely criticisms as to municipal doings. The leader-writer characterizes the prospect for the citizens as "gloomy," and he "wonders how many additional pennies in the pound must be squeezed out of the pockets of the Dublin ratepayers, before they realize the gravity of what is taking place in the Corporation." Dealing with the work of the Public Gas Lighting Committee, the writer points out that they "acknowledge a disbursement for legal expenses, arising out of litigation with the Alliance Gas Company, of £1777 10s. 3d., which the City Accountant declares to be £400 less than the actual figure." What was the result of these proceedings? A condemnation by the Master of the Rolls of the meters attached to the public lamps, and an order that they should be replaced by proper ones. Now the Committee want £300 out of the rates, and a loan of £1000, to correct their blunder. "The history of this Committee for the past five or six years," the writer goes on to say, "appears to be a curious one. The number of gas-lamps actually in existence has been reduced to the extent of some hundreds by the lighting of the principal thoroughfares with electricity; yet the annual cost of the department shows an increase of £2000 or £3000 a year during the last five years, while quite £25,000 has been absolutely thrown away. A sum of £14,000 was raised on loan to purchase from the Gas Company lamps and lamp-posts twenty or thirty years old, of which the Corporation had previously the use without any charge whatever. The sums spent in the purchase of the condemned meters and the endless and unsuccessful litigation with the Gas Company amount to several thousands. This department is responsible for heavy additions to taxes for several years past, and continues the same course unchecked." The writer thinks that possibly two or three years of the present methods of running up the city debt, and the yearly rates and taxes will arouse even the ratepayers of the City of Dublin; and when this has been done, possibly an Association will be formed to look after their interests. The *Freeman's Journal*, referring to the litigation between the Company and the Corporation, says: "The city ratepayer has to pay the tight little bill of £1670 to the Gas Company as taxed costs for the recent litigation. The Corporation's own costs cannot be much less; and over £3000 has been thrown away in a legal tussle which could have been easily avoided. This is the way the money goes under existing municipal dispensations. No wonder there is a 6s. rate to be paid next year."

THE LARGE HOLDER OF THE NEW YORK AND EAST RIVER GAS COMPANY.



In the JOURNAL for April 24, 1894, we reproduced from *Progressive Age* some particulars in regard to the works constructed by the East River Gas Company—an undertaking supplying Long Island—for sending gas to New York City by means of pipes laid in a tunnel under the river. The description of the works was furnished to our contemporary by Mr. D. L. Hough, who was the Company's Engineer. One of the principal features of the scheme was a large gasholder, of 5 million cubic feet capacity, the inner lift of which was to be unsupported by guide-framing. Its design and erection were entrusted to Messrs. R. D. Wood and Co., of Philadelphia, who duly carried out their contract. As the holder is the first of any magnitude built in America on the principle introduced by Mr. G. Livesey in England, we give an illustration of it when fully inflated, with a few supplementary particulars taken from a recent issue of our American contemporary.

The general dimensions of the holder are as follows: Inner lift, 179 ft. diameter and 48 ft. 6 in. deep; second lift, 182 ft. diameter and 49 ft. deep; third lift, 184 ft. 6 in. diameter and 48 ft. 6 in. deep; outer lift, 187 ft. diameter and 49 ft. 2 in. deep. The tank, which is of steel, is 190 ft. diameter and 49 ft. 6 in. deep. It is one of the largest of its kind in the world. The guide-framing is composed of twenty-four standards, 148 feet high, and five tiers of latticed girders. Four 36-inch connections have been provided for the inlets and outlets. The top of each standard carries a guide for centring the rollers of the inner-lift goosenecks, both on leaving as the crown rises above the frame, and on re-entering as the holder descends. Each lift is guided at forty-eight points on the bottom curb, and at twenty-four points on the top curb. The inner-lift goosenecks carry radial rollers only, while those of the other three lifts carry both radial and tangential ones. The inner lift is provided with twenty-four friction plates, opposite the goosenecks of the second lift, each consisting of a bar of channel-iron secured to the leg by bolts passing through the shell. Twenty-four flat friction-plates are bolted to the legs and shell of the second lift. The cups and grips are 21 inches deep and 10 inches wide, excepting the inner lift cup, which is 12 inches wide. Each cup is provided with four of Matton's patent interior overflows (a device which has been already described in the JOURNAL) to prevent water overflowing the grip, and forming ice on the shell. The crown is spherical, having a rise at the top of 10 feet above the curb; and it rests upon a wooden support when the inner lift lands on the tank bottom. The latter is $\frac{3}{8}$ inch thick, and the shell $1\frac{23}{32}$ inches thick in the lower course, tapering to $\frac{7}{16}$ inch in the top one. The largest rivets are $1\frac{1}{8}$ inches in diameter. The plates in the same course are joined to each other by double-butt straps, and to adjoining courses by single-riveted lap-joints.

The tank rests upon a concrete foundation; the space under the bottom plates being filled with a cement grouting run through holes in the plates after the bottom was lowered upon the foundation. The top of the tank-shell is stiffened by a horizontal plate-girder 48 inches wide, which serves as a walk round the tank; extension plates being placed at the back of each standard to permit passage. The outer flange of this walk is braced to the shell of the tank. Upon filling with water, the tank was found to be perfectly tight; and it has not been necessary to touch either joints or rivets with a caulking-tool at any time since filling. The top curb of the tank is reached from the ground-level by a stairway, which continues to the top of the guide-framing.

When the holder is fully inflated, the crown is more than 40 feet above the top girder, and is reached by means of a chain-ladder kept taut by a weight on its lower end, working in guides. When the holder is filled with gas, the crown is 240 feet above the level of the ground.

THE NEW WORKS OF THE DANISH GAS COMPANY.

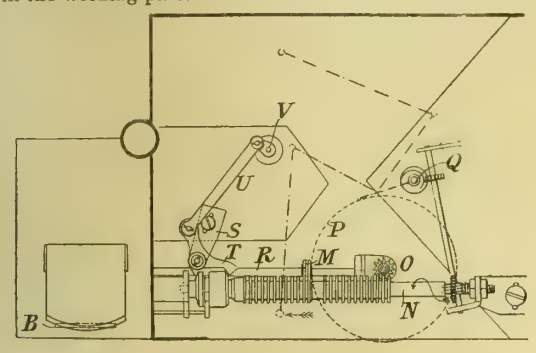
We learn from Mr. F. D. Marshall, the Engineer of the Danish Gas Company, that their new works at Copenhagen, referred to in his paper read at the meeting of the Incorporated Institution of Gas Engineers in May last,* have lately been started. They present a striking example of expeditious construction. The foundations and levelling were commenced only in March this year; and gas was sent out on the 14th inst. We are informed that the works have been excellently built; the brickwork being simply perfection. Native labour was employed upon the buildings. The work carried out in the short space of time above named includes levelling, draining, road making, and paving; two miles of 24-inch main connecting the old works with the new ones; automatic coal-store, briefly described in Mr. Marshall's paper; retort-house fully equipped with inclined retorts to produce $1\frac{1}{2}$ million cubic feet of gas per diem, elevators, coal-hoppers, &c.; automatic coke elevator and railway (the coke being received in trolleys, elevated, and tipped without being touched by hand); the largest Monier tar and ammonia tank yet constructed; the most modern types of engines and exhausters, patent battery condensers on the Marshall-Reutter system, "Standard" washers, and Marshall tar extractors (all under cover); a 170-feet artesian well, water-tanks, and Steinmüller water-tube boilers; purifiers fitted with automatic filling elevators; automatic oxide-revivifying apparatus; station meters, automatic station governor adjusting the town pressure in direct ratio to the consumption without the aid of clockwork; Bunte's benzol apparatus for carburetting in bulk; spirit vaporizer for adding spirit vapour to the gas in bulk to prevent frozen pipes in winter; overground steel gasholder tanks; stores, offices, Manager's house (all centrally warmed by Perret's slow-combustion dust-fuel furnaces); testing works; caustic and sulphate of ammonia works (Grüneberg and Blum's system); baths for workmen, &c. The contracts were distributed among various nations; the Company going to the very poles for machinery and ideas. England has contributed gasholders, purifiers, and pipes, &c.; Germany, retort-ovens, elevators, roofs, and flooring; Italy, paving for the engine-room, flooring, &c.; France, gauges and clockwork apparatus; Denmark, bricks, cement, and labour; Norway, all the timber; and Sweden, all the paving tiles, &c. It is gratifying to find that the Directors allowed Mr. Marshall free scope and unlimited means for carrying out his ideas; and the result has been the production of works of which all concerned may be justly proud.

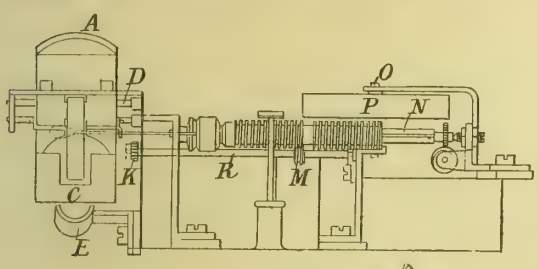
* See JOURNAL, Vol. LXV., p. 1245; also Vol. LXVI., p. 176.

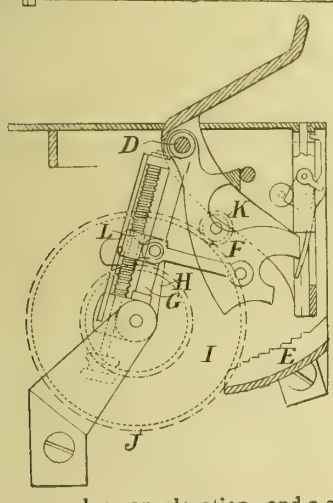
REGISTER OF PATENTS.

Prepayment Gas-Meters.—Sutherland, A. G., of Kennington, and Stidder, J. G., and Everett, J. F., of Stamford Street, London, S.E. No. 22,457; Nov. 20, 1894.

This invention relates to further improvements in the prepayment gas-meters described in patent No. 8981, of 1894; the object being "to improve that part of the mechanism by which the amount of gas to be obtained for the coin is determined, and to effect other improvements in the working parts."







The illustrations are a plan, an elevation, and a sectional side view (on an enlarged scale) of parts of a dry gas-meter made in accordance with the patentees' proposal.

A is the handle or lid, shown raised for the receipt of a coin; but when depressed, the coin-slot B is covered. The coin when inserted falls into the cradle C. The cradle is pivoted at D; and it retains the coin, resting upon the highest step of the fixed plate E, until the handle is moved, so as to cause the coin to push backwards the lever F, also pivoted at D, until the coin falls behind the plate E. The lever is coupled by a link with the lever G, carrying a guide block and nut threaded on a regulating screw-spindle; the position of the travelling nut regulating the throw of the lever. The lever is integral with a lever H, carrying a pawl in gear with the ratchet-wheel I; the latter being integral with the toothed wheel J. This wheel is fitted with a spring impinging against both the wheel and the case, and acting as a friction brake to absorb the momentum of the wheel, and prevent its rotation beyond the regulated angle of advance. The wheel gears with a pinion K. By means of a milled head and the regulating-screw, the radial distance of the block L can be reduced or increased, and the angular movement of the wheels I J correspondingly increased or diminished. This movement of the latter wheel causes the pinion K to rotate a certain number of times. The pinion K is fast on a spindle, which also carries a worm M fast thereon. N is another parallel spindle, carrying a sleeve having a worm and an annular toothed rack formed thereon. The rack is in gear with a pinion mounted on the shaft O carrying the drum P. The sleeve is capable of sliding longitudinally upon the spindle N, and is carried round therewith by means of a pin or feather fitted to the sleeve, and running in a groove formed in the spindle.

The motive power for returning the drum and apparatus to zero is obtained by a worm attached to the crank-spindle Q, which drives a pinion and spindle. By means of a worm fast on this spindle, the pinion fast on the spindle N is driven in the direction of the bent arrow; and the rotation causes the sleeve to rotate. While the spindle is rotating, the spindle R is held stationary by a pawl, ratchet-wheel, toothed wheel, and pinion. The worm M then acts as a nut to the rotating worm, which is driven with the sleeve in the direction of the arrow. S is a fixed adjustable bracket; and T is a forked lever pivoted to S, and linked to the rod U. The forked lever is operated by its contact with the conical surfaces forming part of the sleeve. By this arrangement, the gas is cut off at V, when the sleeve has arrived at the end of its travel in the direction of the arrow; and the gas is turned on by the contrary movement, obtained by the primary movement of the handle A.

The operation of this arrangement is as follows: The handle A is raised preparatory to the insertion of a coin. This movement uncovers the slot, and pulls back the lever F, by means of the bar attached to it. The coin is then inserted in the slot B, and, falling into the cradle C, is then in position to operate the lever F, which is effected by moving the handle downwards. The lever is provided with a projection for contact with pennies; and another projection for contact with half-pennies. The movement of the lever operates the lever G, and with it the pawl-lever H, whereby the ratchet-wheel I and toothed wheel J are caused to partially revolve, thereby rotating the pinion K and worm M. The rotation of the worm causes the sleeve to move towards the right, whereby the drum P is partially rotated, so as to indicate the amount of gas to be obtained on prepayment. The apparatus is then free to supply gas until the sleeve is returned to its normal position, as previously described.

In order to limit the number of coins inserted, and the revolution of the drum P to less than a complete revolution, a rod, fitted with a fork working in a groove formed in the sleeve, is carried by the fork to and fro with the sleeve. The rod is fitted with a cone, which remains idle until the greatest amount of gas available by the rotation of the drum has been paid for and unconsumed. The cone is then carried into contact with an arm attached to a trigger, pivoted so as to cause the bar to stop the slot B, and prevent the further entrance of coins until gas has been consumed. The trigger also performs the function of blocking the slot while a coin is in the cradle.

Conveyors and Elevators.—Hunt, Charles, of Birmingham. No. 46; Jan. 1, 1895.

This arrangement of conveyors and elevators and their parts has been designed "for the purpose of simplifying their construction, so as to reduce wear and tear and minimize the weight of the parts, and further to provide for the rapid and cheap exchange of those parts which are the most liable to rapid wear, as also for such wear." This is especially necessary, says the patentee, for conveyors and elevators used for the transmission of coke or its refuse, as the constant grinding and friction are excessive.

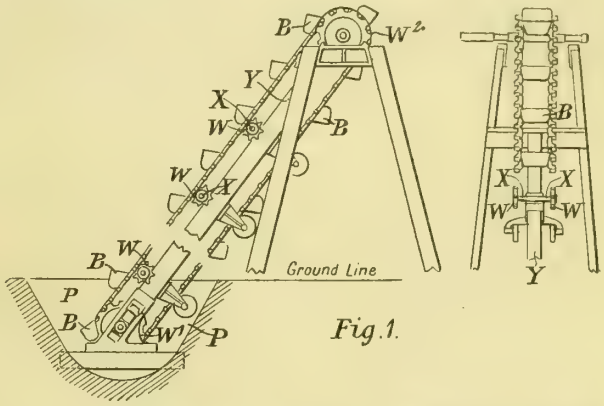


Fig. 1.

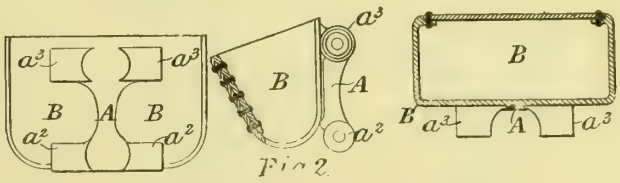


Fig. 2.

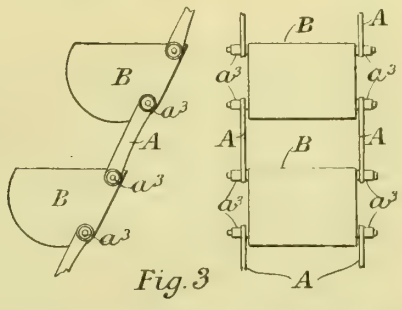


Fig. 3

Fig. 1 shows a side elevation and a front elevation of the invention applied for elevating coke or other matter from the recesses or pit P; also showing the sprocket-wheel W supported by the axle X on the centre-beam Y. To the elevator, buckets B are fastened; each having two links attached to it by rivets or bolts. The connecting-links A are formed with a journal a^2 at one end, and a socket a^3 at the other. The pin portion a^2 enters a^3, and forms the joint; so that all the wear and strain are taken up by the links themselves. The links may be cast upon the buckets B either at the end, or a double or single one at or near the centre, as shown in fig. 2. On the other hand, a very simple elevator may be constructed by forming projections on each side of the buckets B, as in fig. 3, when it is only necessary to pass over the links A with (in this case) their double sockets—that is, a socket a^3 at each end—when the whole are seamed together by a pin passing right through the buckets and studs, and links or short bolts or pins may be used. But even in this case, the wear and strain are not upon the pin or bolts. Even in the case of fig. 3, there may be any number of intermediate links A used, so as to make the buckets any pitch. The sprocket-wheels W and W^1 have hollows, into which the sockets a^3 of the links take, thus avoiding unduly sharp teeth, which are liable sometimes to foul.

In fig. 1, either the wheel W^1 or W^2 may be driven; but the

patentee makes no claim to the mode of driving. It is evident that the webs and other parts of the links A may be formed to any sections and configuration, to serve any particular purpose for which they may be required. In the case of conveyors, the receptacles may be made from flat or dished plates with side flanges only, or both side and end flanges; and these may be secured to the links (such as A^1), or links may be formed on their ends or underneath.

Producing Carbide of Calcium.—Gearing, E., of Harrogate. No. 1807; Jan. 25, 1895.

The claims for this invention—which is for a modification of the arrangement illustrated in the JOURNAL for Jan. 15 last, p. 120—are: (1) An electric furnace for producing carbide of calcium, constructed with a moveable electrode, and means for causing it to travel within the melting chamber in such a path as to change the position of the arc in relation to the vertical axis or centre of the melting chamber, in order that the material in the chamber may be the more effectually and completely acted upon. (2) An electric furnace for producing carbide of calcium, in which an electrode and a feeding-hopper for supplying the material to be treated are arranged to travel, one in advance of the other, around within the melting chamber.

Incandescent Lighting Burners.—Oehlmann, E. H. C., of Berlin. No. 13,467; July 12, 1895.

The claims for this invention are: (1) A burner for incandescent lighting, having a rod which hangs from the top of the burner into the mixing chamber, designed to heat the mixture of gas and air passing through the chamber before it reaches the point of combustion, for the purpose of increasing the efficiency of the light. (2) In a lamp for burning volatile liquids—such as spirit, benzene, and the like—the combination of the burner described in claim 1, with one or more vaporizers heated from the exterior, and provided with wicks, which (for the purpose of facilitating the passage of the vapour formed in the same to the mixing chamber) are pierced with passages or tubes longitudinally.

Incandescent Gas-Lamps.—Farcas, A., of Paris. No. 14,404; July 29, 1895.

As shown in fig. 1, this incandescent gas-burner is formed by the combination (1) of an annular chamber A, connected by two conduits or passages B B^1 to the tube or nozzle C for the supply of gas or other combustible fluid; (2) of a casing surrounding the chamber, and rising some distance above it; and (3) of a central passage or conduit E, which

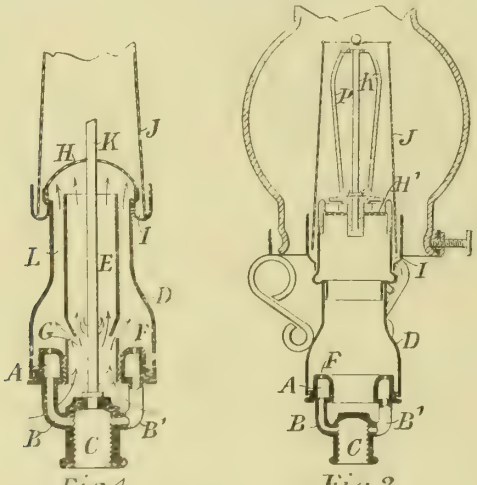


Fig. 1. Fig. 2.

serves for the distribution and control of the air circulating through the burner. The upper edge of the chamber A has in it perforations F, the number of which must be sufficient to ensure an ample supply of gas to the burner. The upper edge of the casing D is adapted for the reception of a perforated diaphragm or sieve H, affording a passage for the mixture of gas and air. It is fitted with a groove or channel I, wherein the lower edge of a sleeve J is retained—the stationary central rod K serving as a support for the sleeve. An annular space L is provided between the casing D and central passage E.

The gas conducted into the chamber A is distributed in quantities, determined by the perforations F; while the gas in the annular space L mixes with the air admitted through the orifice G. The mixing of the air and gas is completed at the top of the burner, underneath the perforated plate H, under the action of the air arriving through the central passage E; and its escape takes place without any risk of the mixture becoming ignited within the casing.

The arrangement may be modified as shown in fig. 2. The central passage E is here omitted; so that the air and gas mix in the casing D direct—the mixture being more thorough than in the other arrangement. The circulation of air is also more active; and the flame, "though obtained at less expense, is productive of more heat than those of other burners." The burner H^1, which surmounts the casing D, is in its turn surmounted by a cone P, of porcelain or other fire-proof material; the object being to increase the heat yielded by the burner. The cone, on being heated to incandescence, both by contact and radiation, heats the mixture of air and gas which comes in contact with it, "thereby producing a light far more intense than it would otherwise be, all the more so because the cone P acts as a reflector of light."

Decomposing Carbide of Calcium.—Gabe, H., of Copenhagen. No. 17,746; Sept. 23, 1895.

This apparatus for decomposing calcium carbide for the production of acetylene, is shown in two forms: fig. 1, a small apparatus; and fig. 2, an apparatus for generating larger quantities.

In fig. 1, A is a water-container, having a gas-outlet tube rising centrally through its bottom, and controlled by a stopcock. D is a gas-bell immersed in the water, and provided with a central guide-tube having gas-exit orifices at the upper part, and sliding easily upon the gas-outlet tube B, whereby the bell is guided. The crown of the bell is surmounted by (say) two cylindrical charge chambers G opening into the bell, and closed at the top by screw-caps. Within each chamber, a cylindrical holder is suspended to the hooked end of a slide-rod, passing through a stuffing-box and gland on the screw-cap H. The charge holders are perforated to admit the water to the calcium carbide packed in the perforated charge holder in layers alternated with discs of waterproof material, so that only the immersed portions of the charge will be saturated.

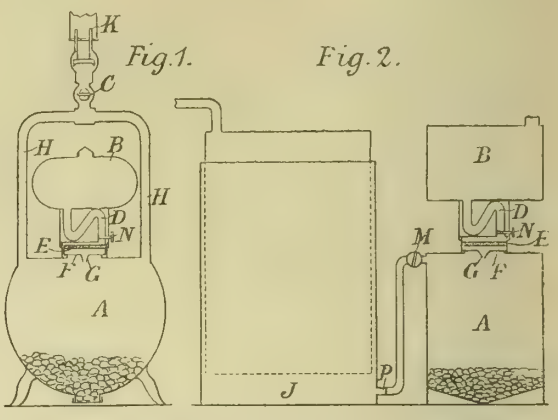


Fig. 1. Fig. 2.

The apparatus is used as follows: The holders containing the carbide having been suspended within the chamber G by the rods retained in the raised position by screwing on the caps and tightening the glands, and the container A having been filled with water and the bell placed in position with the guide-tube upon the gas-tube B, one of the charge holders is lowered slowly by slacking the gland, and pressing down the suspension rod, so that the charge comes in contact with the water. Thereupon acetylene is generated; and the bell is raised by the internal gaseous pressure—the charge being meanwhile continually lowered until it will go no farther. The gland is then screwed up tight. The generation of the gas will thereupon continue at a rate corresponding exactly to the consumption, until the charge is exhausted, and the bell descends; whereupon the other charge must be brought into action in the same way, and so on. Should it be desired to arrest the generation of the gas, the charge is drawn up into the charge-holder chamber out of reach of the water; the gas remaining in the bell being consumed and the stopcock closed.

In fig. 2, the water-tank allows the immersion of one or more bells, having suspended within them a large holder charged with calcium carbide as described. Each bell has two gas-delivery pipes R S—the former leading from the upper part of the bell, and the latter from near its mouth. The pipes have stopcocks kept closed while the bell is being immersed; and they are coupled by screw unions to branches of a common delivery-pipe, provided with a stopcock V between the branches, and leading through a condenser and filter to a gasholder.

Both the lower cocks being opened, and the cock V connected with the holder (so as to be opened whenever it assumes a certain position), the operation is as follows: The air being forced out of the bell, the water rises within it; and on reaching the charge, the decomposition of the lowest layer of calcium carbide takes place. The holder having risen to a certain height, the cock V will be closed automatically; but the calcium carbide saturated by water will continue to be decomposed and generate acetylene gas, forcing the water out of the bell, so that any surplus of gas will pass out to the holder through the pipe S.

Incandescent Gas-Lamps.—Voelker, W. L., of Elizabeth (N.J.), U.S.A. No. 17,795; Sept. 24, 1895.

The patentee proposes to construct the frame or carrier of incandescent gas-mantles of porcelain or a porcellanous compound, which, when baked, has considerable strength, and to add to the frame "in any suitable manner—as by impregnation or incorporation therewith—an incandescing substance, bringing the hood to a hard and refractory condition by baking."

One method of producing the hoods is as follows: 60 parts of kaolin, 20 parts of quartz, and 20 parts of feldspar by weight, are ground to an impalpable powder and mixed; and an equal weight of saturated solution of sugar syrup is then thoroughly mixed with the mass. From the mass threads or filaments "of great tensile strength" can be made in any suitable manner—as by drawing in a die. The filaments can be formed into hoods by weaving, knitting, or other such mechanical operations, to produce the desired shape of the structure, which is then thoroughly dried and baked at a high temperature in an oven. After this, it is dipped in a saturated solution of salts of the metals which are to be used for the incandescing properties. The hoods are then oxidized by the proper chemical agents, heat, or electricity. A modification of the foregoing process consists in incorporating the oxides with a porcellanous material while the latter is still in the powdered state; and the saccharine matter is added at the same time. In this case, 20 per cent of the porcellanous material, reduced to an impalpable powder, is combined with 45 parts of light oxide of magnesia, 10 parts of zirconia oxide, 5 parts of chromium oxide, and 20 parts of dense sugar syrup by weight. These materials are thoroughly mixed and reduced to a mass of the consistency of putty. Threads or filaments can be formed of this mass as before stated; and the threads or filaments may be woven or otherwise combined into suitable hoods or mantles, which are then thoroughly dried and baked, when they are ready for use.

The basis of the invention consists in the forming of a frame or carrier of porcellanous material, to sustain the metallic oxide which constitutes the incandescing agent. The porcellanous carrier gives

tensile strength to the hood, and is the vehicle for holding the incandescing particles—in other words, "the porcelain biscuit (which is to say the porcellanous carrier) being a porous body, is rendered more porous or cellulous by the oxidizing of the saccharine matter." In the first process described, "the porous framework has its coral-like structure sufficiently covered with myriads of small crystals of the oxides or salts of the metals, which are held there first by chemical means, then again when baked by mechanical means. In the second process, the porcellanous structure is still the framework; the chemical combination, under the influence of heat, taking place just the same. But in the latter process, it is modified by the incorporation of the oxides of magnesia in such a manner that the shrinkage is not so great at a given temperature." But after numerous experiments, the patentee claims to have demonstrated that the final result is approximately the same in both processes in respect to light-giving qualities.

APPLICATIONS FOR LETTERS PATENT.

23,577.—Armstrong, F. W., "Incandescent gas-burners." Dec. 9.

23,610.—Fox, J. R., "Taps or valves for water and other fluids." Dec. 10.

23,639.—Birnbaum, T., "Burning illuminating gas." Dec. 10.

23,646.—Glover, R. T. & J. G., "Gear for coin-freed apparatus for the sale of gas." Dec. 10.

23,652.—Asquith, J., "Gas-burners." Dec. 10.

23,661.—Stevens, G., "Appliance to indicate and localize stoppages in water-pipes and cisterns, and to prevent freezing and bursting of pipes, and explosions in kitchen boilers." Dec. 10.

23,712.—Beale, A., "Gasholders." Dec. 10.

23,735.—Milne, J., and O'Connor, H., "Gas-governors." Dec. 11.

23,736.—Milne, J., "Dry gas-meters." Dec. 11.

23,737.—Milne, J., "Gas-governors." Dec. 11.

23,738.—Milne, J., "Valves for gas, steam, water, or other fluids." Dec. 11.

23,752.—Hughes, E. T., "Safety gas-burner." A communication from B. Smith. Dec. 11.

23,763.—Loewenberg, G., "Incandescent gas-burners." Dec. 11.

23,768.—Brouwer, J. de, "Burner and appliances for supporting incandescent gas mantles." Dec. 11.

23,770.—Brouwer, J. de, "Conveying incandescent coke from retorts in gas-works, extinguishing same during its passage along the apparatus, and screening the coke and piling up, storing it, or discharging it into waggons or other receptacles." Dec. 11.

23,856.—Denayrouze, D., "Production of poor combustible gases with or without enrichment, and the application thereof for combustion in Bunsen and incandescence gas-burners." Dec. 12.

23,909.—Witte, W. R., "Glass chimneys for gas-burners with movable flat glass blades or movable glass rods." A communication from H. D. Grange. Dec. 13.

23,955.—Lee, J. W., "Gas-carburettor." Dec. 13.

23,957.—Tomlinson, H., "Gas lighting appliances." Dec. 13.

23,989.—Herring, W. R., and Graham, M., "Charging inclined retorts." Dec. 14.

24,008.—Barrière, P., "Preparation and production of bodies for use in incandescent gas lighting." Dec. 14.

24,012.—Schoonjans, G., "Gas heating apparatus." Dec. 14.

Dissatisfaction with the Proposed Water Board for West Kent.—At the meeting of the Bexley District Council last Tuesday, the Clerk produced for signature the petition for the Kent Water Bill. Thereupon Mr. Cottell objected to the way in which the matter had been brought forward, and contended that the Council would not gain anything by joining in the movement for the establishment of a Water Board, but would be saddled with a share of the expenses. He said they already had the purest supply of water in the Metropolitan area; and he saw no necessity for the Bill. Mr. Lucas moved that the petition be signed; but Mr. Cottell proposed an amendment to the contrary, and it was carried.

Gas-Stoves in Bedrooms.—The Rev. W. E. Hurndall, M.A., and Mrs. Hurndall, residing at St. Ermin's Mansions, Westminster, had a narrow escape from being suffocated by gas on the night of Saturday, the 14th inst. It appears that they were in the habit of using a small gas-stove in their bedroom, for the purpose of heating water; and it is presumed that, on retiring to rest on the night in question, the stove was extinguished, but that the gas was not effectually turned off, and was escaping all night. Nothing being seen of Mr. and Mrs. Hurndall during Sunday, inquiries were instituted, with the result that in the evening they were found lying in an unconscious condition; their room being strongly impregnated with gas. Mrs. Hurndall speedily recovered under restoratives. But all efforts to resuscitate her husband were long unavailing; and he remained insensible till about midday on Tuesday. His medical advisers expressed the opinion that his prolonged unconsciousness was owing to a weak heart. Mr. Hurndall is a minister attached to the Westminster Congregational Chapel.

The Lighting of Falmouth Streets.—Some months ago, the Falmouth Gas Company placed incandescent burners in some of the lamps in Market Street, the principal thoroughfare, to show the advantages of street lighting on that system. At a meeting of the Town Council on the 14th inst., it was proposed that incandescent burners should be also applied to the lamps in Church Street. This led to a general demand for the system in all parts of the town. Mr. T. Webber said he was convinced that, if the Lighting Committee considered the merits of incandescent lighting, they would recommend its adoption throughout the borough. Penzance had saved rather more than one-third of its gas bill by the use of incandescent burners; and Falmouth might also save money and have a better light. Mr. Grose suggested that the Gas Company should be asked to provide the burners free of cost, as had been done at Truro. Mr. S. Collins said the cost would be £450. Mr. W. W. Phillips remarked that, though the saving would be great, the initial cost had to be considered; and before going into this the Council should settle whether they would buy the gas-works. It was decided to refer the matter to the Lighting Committee, together with a suggestion that the street-lamps should be lighted every night, whether there is a moon or not.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Prices of Ammoniacal Liquor and Sulphate of Ammonia.

Sir,—Having ventured to criticize your late reports of the chemical market, I deem it a duty to add how fully I agree with your statement in the foot-note to my recent letter—that the only market reports possessing any value have been those appearing in the Journal. You will also I hope allow me to add that I readily admit that, since their first appearance in 1884, they have been markedly reliable. It is solely against the ratios appearing during the last few months that I ventured to make my appeal. So representative of market movements have these reports been, that I have quite recently suggested the ratios of the last three years as a basis for future business; the last three years being selected on the simple ground that the processes of manufacture have remained fixed during those years.

The scale suggested was based on the following references to your chemical notes: During May, September, and October, 1894, you quoted the price of sulphate as being about £13 per ton, and liquor at 9s. to 11s. per ton. During the months of March, April, and May, 1893, you quoted sulphate at £12, and liquor at 8s. 6d. to 9s. 6d. per ton. In February, 1893, in December, 1894, and during January and February, 1895, you quoted sulphate at about £11, and liquor at 6s. to 8s., or 6s. 6d. to 8s. 6d. During the whole year 1892, you gave the value of sulphate as about £10, and of liquor at 6s. 7d. On May 31 and June 21, 1892, you quoted sulphate at £9 12s. 6d., and liquor at 5s. to 6s. The point of my criticism "lies just here"—that to-day sulphate having fallen still lower than this former "lowest on record," or to £8 11s. 3d., the price you quote for liquor is, not 4s. per ton, as the scale of all former years would suggest, but the value is given at 7s. to 8s. per ton. This I venture to characterize as an impossible ratio.

I should be sorry to conclude without acknowledging that I heartily admit the benefit these reports have conferred on all connected with the purchase and sale of gas residuals, by replacing long-dated contracts by reasonable commercial valuations. By your reports, you have relieved the chemical manufacturer of one of his most anxious duties, Long contracts, made at times of high prices, were simply gambling speculations, which often resulted in serious losses. While recording my gratitude for this valuable assistance, I ask to be permitted to hope you will continue to render the same service to both gas proprietors and the purchasers of residuals.

H. C. Brown, Ph.D., F.I.C.

King's Lynn, Dec. 19, 1895.

The South-West of England District Association of Gas Managers.

Sir,—Having acted as Secretary of this Association for the last ten years, and attended every Committee meeting, and (with one exception) all the other meetings, I can claim a fairly intimate knowledge of its affairs, its present position, and the reasons which have guided the decisions of the Committee. But many things have been published concerning it, as a consequence of the so-called discussion of a certain proposition at the recent meeting of a neighbouring Association, that are quite new to me, and had it been possible to read them with titles and local references cut out, I should never have recognized the "South-West."

The unfortunate suggestion which has been so curtly received by you and by some of the leading lights of the other Association, emanated from members of both. It was discussed by my Committee as a question of mutual advantage. Such a subject as the possibility of a total breakdown in the progress of the South-West, or of disbandment has never suggested itself. There is no reason why it should. The membership is as good as ever it was; there is plenty of money in hand; papers have been promised; and invitations for meetings received. It was thrown out by a gentleman in the course of the proceedings just mentioned, who has no connection whatever with the South-West, and seems to have been largely concerned in furnishing the text for your remarks, which, like the "discussion" in question, tend to stray from the original point to matters concerning this Association only.

It has been a matter of common knowledge for years that the good attendance at the Holborn Restaurant is largely due to convenience of access. If the company was confined to members within driving distance, the muster would scarcely be small. You suggest Bristol as a good centre for the South-West. It is probably the best which the district affords. But how many of the members could get there in an hour? This is the point that tells against our attendances, and not apathy on the part of the members.

My Committee were informed, on reliable authority, that the proposition would not be unfavourably received; and had they been aware of the change of front exhibited at the recent meeting, I do not believe they would have made it. Certainly they did not anticipate that one result of their action, which was entirely innocent and in good faith, would be the holding up of their Association as an "awful example" for the good of the others, all of whom are acquainted, to a greater or less degree, with the difficulties which we have candidly admitted.

N. H. Humphrys.

Salisbury, Dec. 20, 1895.

The Extensions at the Plymouth Gas-Works.

Sir,—In your last issue, I find that Mr. Townsend is endeavouring to show that you have made some mistakes in your remarks on the affairs of the Plymouth Gas Company; and he appears to be very desirous that everything in connection with the Company should be accurately stated. For my part, I also am especially anxious that the whole truth should be known.

It is quite true that the shell of the retort-house and coal-store, &c. were designed and contracted for before I was requested by the Chairman of the Company to prepare plans for the internal work of the retort-house; and I did prepare these drawings, and eventually carried out the work. I also arranged that the roof of the coal-store should be designed so that it would carry the conveying plant, and prepared designs for other parts of the apparatus.

In your remarks upon the statements made by the Secretary of the

Company on the evening of Dec. 5, it was pointed out that the Plymouth Gas Company, like most other gas companies, had been in trouble in connection with the high prices of coal and labour; and that from 1890 to 1893 inclusive they were fortunate in having an undivided balance to fall back upon, from which upwards of £8000 had been taken, and which enabled them to pull through without increasing the price of gas. But Mr. Townsend appears to object to this statement; and he endeavours to correct it. He is very desirous to make out that he has done more than it was possible for any other engineer to do, and meet all these difficulties without taking anything from the reserves. (He must have inspired some remarks upon this subject which appeared in your issue of the 22nd of January of this year, p. 163, which are untrue, but which were allowed to pass at the time.) The facts will show that he has not done any more than, and perhaps not so much as, other engineers might have done similarly placed; and why he should make such misleading statements, when the facts were ascertainable and ought to have been within his knowledge, is beyond my comprehension.

The Secretary prepared for me a detailed statement of the working for the four years referred to, when I had to deal with the re-assessment of the Company's works. Some of the figures I will lay before you. On March 31, 1890—

The reserve fund stood at	£14,736 15 7
The increase upon this amount for the last five years arises entirely from the increment of interest, and has nothing whatever to do with the working or reserve account, amounting to. . .	2,425 16 6
Mr. Townsend is therefore certainly not entitled to take credit for this amount in the ordinary working of the concern	£17,162 12 1

The figures in the yearly accounts from 1890 to 1893 are as follows:—

	Revenue Account. Profit.	Dividend. Amount Required.	Deficiency, taken from Undivided Balance.
March 31, 1890 .	£8169 0 10 ..	£9,887 10 0 ..	£1718 10 2
March 31, 1891 .	6439 12 6 ..	9,887 10 0 ..	3447 17 6
March 31, 1892 .	8777 18 4 ..	10,118 15 0 ..	1430 16 8
March 31, 1893 .	8450 7 3 ..	10,696 17 6 ..	2246 10 3
Total taken from the undivided balance during the four years to make up maximum dividends .			£8843 14 7

During the last two years, the Chairman and Secretary, who always purchase the coals and attend to the commercial part of the undertaking, have, as in the case of most other companies, obtained a considerable reduction in the price, which has helped to meet the dividends and increase the undivided balance, which, after paying the half year's dividend, stood on March 31, 1895, at £17,577 0s. 6d., and not at £23,908 15s. 8d., as stated by Mr. Townsend.

Again, Mr. Townsend is not entitled to take all the credit for the working of the year ending March 31, 1895, as my stoking machinery and the regenerator furnaces and other labour-saving appliances were at work for fully six months out of that year. These brought about the savings which enabled the Company to pay full dividends upon a capital which had recently been doubled owing to the extensions that had been carried out; and these profits would have been more but for the recent unfortunate reduction in the price of sulphate, amounting to £12,000.

Manchester, Dec. 21, 1895. JOHN WEST.

SIR,—Without wishing to criticize the report of the proceedings in the JOURNAL for the 10th inst. of the inauguration of a new gasholder at Plymouth, and its inaccuracies, and knowing as I do the inner working of all matters concerning the undertaking, both of the past and present, I do not care to use your JOURNAL for anything that may possibly appear personal. But as there are persons who are trying to take all the credit for the supplying of the "cheapest gas in the world," I think it only fair that the name of Browning should have a "look-in." Will you allow me therefore briefly to state that my late father occupied the position of Engineer and Manager to the Plymouth and Stonehouse Gas Company for about 34 years, and during that time the whole of the works were remodelled. All the drawings and specifications were made by him (with the help of his sons, who held the appointment of Assistant-Engineer from time to time), and tenders were invited in the usual way.

His policy was (and he was always supported by the Directors) to keep down the capital expenditure and reduce the price of gas at the first opportunity, as any excess in either case only brought worry and trouble for the poor Engineer and Manager, who is, and rightly so, held responsible to his Directors. Consulting Engineers were only employed on parliamentary work when new capital was raised.

Neath, Dec. 20, 1895. R. ALEX. BROWNING, Assoc.M.Inst.C.E.

Explosions of Domestic Boilers.

SIR,—The letter referred to in the JOURNAL for the 10th inst., as having been received by the Secretary of a Water Company from the Board of Trade, in reply to his inquiry as to what "safeguards" or precautions the Board suggested should be adopted to prevent such accidents as those alluded to in their recent circular, appears to me most unsatisfactory. I think it would be advisable for companies and local authorities supplying water to hesitate before suggesting safeguards to consumers, as, in the event of such suggestions failing to prevent subsequent explosions, litigation would not be improbable.

The reason the Board give for abandoning their idea of issuing a short circular is not easy to understand, as it seems to me that "the varying requirements and circumstances of different districts" consist of two—first, where there is a constant supply; and, secondly, where there is not. Surely the Board of Trade could, without much difficulty, frame a circular to meet each case

It is obviously undesirable that a number of different suggestions should be made throughout the country, as would undoubtedly be the case if every water company and local authority framed their own

R. L. S. BADHAM, Secretary,
Provincial Water Companies' Association.

18, *Abingdon Street, S.W., Dec.* 21, 1895.

LEGAL INTELLIGENCE.

HOUSE OF LORDS.—Tuesday, Dec. 17.

(*Before the* LORD CHANCELLOR, *Lord* WATSON, *Lord* SHAND, *and Lord* DAVEY.)

The San Paulo (Brazilian) Railway Company, Limited, v. S. G. Carter (Surveyor of Taxes).

This was an appeal from a decision of the Court of Appeal reversing a judgment of the Queen's Bench Division, and confirming the determination of the Commissioners for the special purposes of the Income-Tax Acts. The appellants are an English Company formed and registered under the Joint-Stock Companies' Acts; and they have their registered office at No. 111, Gresham House, Old Broad Street, in the City of London. The actual work of the Company is carried on in Brazil, where the profits are earned. But the control of the Company is in London; and the business is carried on under the Directors here. The Directors enter into contracts for, and purchase in England and send to Brazil, the materials for the addition, extension, and improvement of their property, for repairs thereto, and for new plant. The accounts are kept in London, where the balance-sheets, reports, &c., are made out, all meetings are held, and dividends declared and paid. The Directors have appointed a Superintendent, who resides in Brazil, is a salaried servant of the Directors removable at their pleasure, and must obey and execute the orders sent out to him by the Directors from London. In these circumstances, the Income-Tax Commissioners made an assessment of £370,122—the full amount of their profits and gains—upon the Company, against which the latter appealed. In the case stated by the Commissioners for the opinion of the Queen's Bench Division, it was found as a fact that, with an exception of transfer fees, amounting to about £128 per annum, and annual interest upon money, amounting on an average to £1423 yearly, upon both of which particulars income-tax has been paid by the appellants, the whole revenue of the Company arises from moneys earned and paid to them in Brazil for the carriage of passengers, goods, &c., on the San Paulo Railway. The contention on behalf of the Company was that they were not chargeable under the first case (Schedule D, sec. 100, of 5 & 6 Vict., cap. 35) to income-tax on £370,122, the full amount of the balance of the profits and gains of the Company, but are chargeable under the fifth case (Schedule D, in the same section) only upon £295,070, the full amount of the actual sums received in the United Kingdom upon an average of three years. The Queen's Bench Division, consisting of Mr. Justice Vaughan Williams and Mr. Justice Wright, held that the case was governed by the decisions in *The Bartholomay Brewing Company v. Wyatt* (1893, 2 Q.B.D., 499) and *The London Bank of Mexico v. Apthorpe* (1891, 2 Q.B.D., 378); and accordingly the Company's appeal was allowed with costs. The Crown having appealed, the Court of Appeal, consisting of the Master of the Rolls, Lord Justice Lopes, and Lord Justice Rigby, reversed the decision of the Queen's Bench Division, and found that the assessment ought to be made upon the full profits of the Company. The Company now sought to set aside the decision of the Court of Appeal, and to restore that of the Queen's Bench Division. The case is of interest to our readers, as the question raised affects English gas companies carrying on their operations in foreign countries.

Sir E. CLARKE, Q.C., Mr. BIGHAM, Q.C., and Mr. BREMNER appeared for the appellants; the ATTORNEY-GENERAL (Sir R. E. Webster, Q.C., M.P.), Sir R. T. REID, Q.C., and Mr. DANCKWERTS represented the Crown.

Their Lordships delivered judgment as follows:—

The LORD CHANCELLOR: I think one proposition has been conclusively established by the various cases that have come under your Lordships' consideration, and that is that, where the trade is wholly or partially carried on in this country, the trader is liable to pay income-tax on the profits of his trade. Now, in this case the appellant Company is an English Company, residing—so far as that abstraction a corporation can reside at all—in England. It has an office in London; and I am disposed to think (though it is unnecessary for the purposes of this case to say so) that its trade, if the word "trade" is strictly construed, is wholly carried on in England. It seems to me that, as was said by Chief Justice Cockburn and Mr. Justice Crompton in the case of *Sulley v. The Attorney-General* (5 Hurlstone and Norman, 711), "it is probably a question of fact where the trade is carried on," and it is probably true to say that this phrase may be understood in two different senses. It may mean where the goods in respect of which trading is carried on are conveyed, made, bought, or sold; or, speaking of land, where it is cultivated or used for any other purpose of profit. That makes the locality of the goods or the land which are the subjects of the trade to be in a certain sense the place where the trade is carried on, because it is the place where the things corporeally exist or are dealt with. But there is another sense in which the conduct and management—the head and brain—of the trading adventure are situated in a place different from that in which the corporeal subjects of trading are to be found. It becomes, therefore, a question of fact; and according to the answer to be given to the question, "Where is the trade in a strict sense carried on?" will the answer be, under the Income-Tax Acts, "There it is liable to assessment." It is therefore necessary to determine upon these principles where the appellant Company carries on its business. It deals, undoubtedly, with land in the Brazils. In Brazil the payments are received; and in Brazil the passengers and goods are carried. But the form of trading can make no difference. If it were a mine or a jute-mill equally with a railway, the person who governs the whole commercial adventure, the person who decides what shall be done in respect of the adventure, what capital shall be invested in the adventure, on what terms the adventure shall be carried on—in short, the person who, in the strictest sense, makes the profits by his skill or industry, however distant may be the field of his adventure—is the person who is trading That person appears to me, in this case, to be the appellant Company. Every one of the tests I have applied are applicable to its proceedings. A shipowner, or indeed a shipbroker,

may not have any one of the ships or the charter-parties which he negotiates in England; but, by correspondence or by agency, he may have both charter-parties and ships, not necessarily British ships, all over the globe. But if he lives in London, and by his direction governs the whole of this commercial adventure, could it properly be said that he is not carrying on his trade in London? So it appears to me that the appellant Company is carrying on trade in London, from which it issues its orders, and so governs and directs the whole commercial adventure that is under its superintendence. I am, therefore, of opinion that the appeal must be dismissed with costs; and I move your Lordships accordingly.

Lord WATSON: The decision of this appeal does not involve any new controversy upon the construction of the Income-Tax Acts. It depends, in my opinion, upon the answer which ought to be given to a single issue of fact. The law which must govern the present case appears to me to be settled by the judgment of this House in *Colquhoun v. Brooks* (14 Appeal Cases, 493). It was held in that case that the interest of a partner, resident in England, in the profits of a trade which was exclusively carried on in Australia by the other members of the firm, was chargeable with income-tax, not under the first, but under the fifth, case of Schedule D. The noble and learned Lords who took part in the decision were of opinion that the interest of the English partner was included in the sweeping language of the first case; but they held that it also constituted, within the meaning of the fifth case, a possession in one of Her Majesty's dominions out of the United Kingdom. The ground upon which the interest was held to be taxable in terms of the fifth case was that the Income-Tax Acts contain no machinery for assessing, under the first case, profits accruing from any trade which is not wholly or in part carried on within the United Kingdom, whereas they do provide machinery for assessing, under the fifth case, all profits arising from trade exclusively carried on outside of the United Kingdom. In my opinion, the decision in *Colquhoun v. Brooks* directly affirms the rule that every interest in the profits of trade belonging to a person who is, within the meaning of the Acts, resident in the United Kingdom, must be charged under the first case of Schedule D, if the trade is carried on, either wholly or partly, within Great Britain or Ireland, and is chargeable under the fifth case if the trade is exclusively carried on in any of Her Majesty's dominions out of the United Kingdom. The considerations which are applicable to trades wholly carried on in these dominions apply with equal force to trades exclusively carried on in foreign possessions which are not subject to the British Crown; and it appears to me to be matter of necessary implication that the interest of a resident here, in profits derived from a trade of the latter description, must also be assessed for income-tax under the fifth case of Schedule D. When it has been ascertained that a person interested in the profits of a trade has his residence in the United Kingdom, in such sense as to bring him within the incidence of the Income-Tax Acts, the only question remaining for determination is whether the measure of his liability is to be found in the first or in the fifth case of Schedule D. In the one case, he is liable to pay duty in respect of the net profits accruing to him from such trade; in the other, in respect only of such part of these profits as shall have been actually received by him in this country. But he cannot, according to the rule established in *Colquhoun v. Brooks*, escape from liability under the first case unless he is able to show that no part of the trade is carried on within the United Kingdom, or what comes to precisely the same thing, that it is exclusively carried on in a country or countries outside the United Kingdom, whether subject to Her Majesty or not. If he succeeds in proving that fact, his liability will be under the fifth case. The appellant is an English Company incorporated with limited liability under British statutes, and having its registered office in London. It is not disputed that the Company has its domicile in England, and is liable to pay income-tax in respect of any profits earned in the course of its trade. The only complaint made is that the amount of such profits has been assessed for duty under the first case; whereas the appellants maintain that it ought to have been assessed under the fifth case, because the trade of the Company is wholly carried on beyond the limits of the United Kingdom. I have no difficulty in rejecting that contention. It is not necessary to consider whether the whole trade of the Company ought to be regarded as carried on in England. To my mind, it is perfectly clear that, in point of fact, part of its trade is carried on there, and that is sufficient to bring its profits within the first case of Schedule D. It is no doubt true that the undertaking, in order to carry on which the Company was incorporated, consists, as its Memorandum bears, in "the making, maintaining, managing, and working" of a railway in Brazil, and in "the making, maintaining, managing, and working" of branch lines, roads, canals, and other means of communication in connection with the main line. It is also true that the Directors, as authorized by the Articles of Association, manage and work the railway and its connections through a Superintendent in Brazil, appointed by them, and a staff of servants in Brazil who are under his immediate supervision; and that the receipts of the Company, from which profits made by it are derived, are earned and paid in Brazil. But the substantial fact remains that the Directors, subject to any resolutions which may be passed for their guidance by the members of the Company, are vested with the sole right to manage and control every department of its affairs. Apart from the authority, express or implied, which they have from the Directors, neither the Superintendent nor any other servant of the Company has any power to act in the carrying on of its trade. They are in no sense traders—they are merely servants; and in that capacity they are remunerated for the services they are employed to perform. The profits of the undertaking, though they are received by these servants, do not belong to them, and are not in their disposal. Their only duty, unless otherwise directed by the Company, is to transmit them to London; and the Company here is the sole judge whether they ought or ought not to be distributed among its members. The only persons who can with propriety be described as carrying on the trade of the Company are its Directors, who, for all purposes of administration and management, are the Company itself. I do not think that in such circumstances the particular localities in which debts are incurred to the Company, or are paid to its agents, are of any consequence in ascertaining by whom its trade is carried on. I therefore concur in the judgment which has been moved.

Lord DAVEY: I may content myself in this case with saying that the business of the appellant Company is not, on the facts stated in the case, entirely or exclusively carried on abroad; and therefore that the case of *Colquhoun v. Brooks*, on which the appellants' Counsel relied, is no sufficient authority for the proposition which they maintained. No doubt the profits of the Company are derived from the profitable use of land in Brazil, and from the business of carriers carried on in that country, and in that sense it is a Brazilian business. But it is not sufficient to say that the Company are carrying on a Brazilian business, as Mr. Justice Wright thought, if the Company is carrying on that business wholly or partially in this country. It is clear to my mind that the direction and supreme control of the appellant Company's business is vested in the Board of Directors in London, who appoint the agents and officials abroad, and, either by general orders or by particular directions, control or may control their duties, remuneration, and conduct, and to whom any question of policy or any contract or other matter may, and if deemed of sufficient importance I suppose would, be referred for their decision. The business is, therefore, in very truth, carried on in and from the United Kingdom, although the actual operations of the Company are in Brazil, and in that sense the business is also carried on in that country. I do not attach any importance to the fact of the railway and business belonging to a corporation and not to an individual, except that, in the case of an English joint-stock company, formed for the purpose of carrying on a particular business, it is, perhaps, easier to say where is the seat of administration and direction. In my opinion, therefore, the case is outside both the decision and the reasoning of the noble learned Lords who gave judgment in the case of *Colquhoun v. Brooks*, because I find that every one of those noble and learned Lords confined his observations to a case in which the business was entirely carried on abroad. Whether it would be possible in any case for a sole owner of a foreign business having exclusive power of control over it, but resident in this country, successfully to maintain that he did not carry on a business here, it is unnecessary to say. That question, which is probably one of fact, will be dealt with when it arises according to the circumstances of the case. I am, therefore, of opinion that the business of the San Paulo Railway Company is not a "foreign possession" within the meaning of the fifth case of sec. 100, Schedule D, as interpreted in *Colquhoun v. Brooks*. That being so, the case undoubtedly falls within the language of the first case; and it follows that the Company have been rightly charged upon the whole of their profits or gains.

The appeal was accordingly dismissed, with costs.

The Rateability of Coal Mines for Water.

The Judicial Committee of the Privy Council, consisting of Lords Hobhouse, Macnaghten, and Morris, and Sir R. Couch, recently had before them an appeal from a judgment of the Supreme Court of New South Wales (one learned Judge dissenting), given on Sept. 17, 1894, by which a verdict in favour of the Hunter District Water Supply and Sewerage Board was set aside, and judgment entered for the Newcastle Wallsend Coal Company, Limited, in an action brought by the Board against the Company to recover money due for water-rates. The action was commenced by the Board, who are constituted under an Act of Parliament of 1893, against the Company, who are the proprietors of a large coal-mining area of 8772 acres, situated in various boroughs, with a connecting railway. The Board contended that the property was in their water district, and was rateable for water under the provisions of the statute. The Company, on the other hand, pleaded that their land and tenements were not liable to be rated; and that the Board did not, by bye-laws, duly make and establish the water-rates in conformity with the Act. The question whether or not the property of the Company was rateable depended on the construction of the statute and bye-laws, and was said to be of considerable importance to the colony. At the trial, a verdict was entered by consent for the Board for the amount claimed—£796, with leave to the Company to move to enter the verdict for them or to reduce the amount. The rule *nisi* was argued before the Supreme Court, who ordered the verdict for the Board to be set aside and judgment entered for the respondents, with costs. Mr. Justice Foster differed from his learned colleagues in that order. The case was argued before the Judicial Committee by Mr. Cozens-Hardy, Q.C., Mr. Vaughan Hawkins, and Mr. W. H. Cozens-Hardy for the appellants; Mr. Joseph Walton, Q.C., Mr. Wood Hill, and Mr. H. G. Davies representing the respondents. At the close of the arguments, their Lordships reserved judgment. This was given on the 7th inst. by Lord Macnaghten, who said their Lordships would advise Her Majesty that the appeal ought to be dismissed, with costs against the appellants.

Financing a Contractor.

In the Queen's Bench Division of the High Court of Justice last Wednesday, Mr. Justice Hawkins and a common jury had before them an action brought by Mrs. Isabella Dixwell upon a covenant made by one Dierden to repay £385 advanced to him by her, with interest thereon. Mr. Carrington stated that in 1892 plaintiff agreed to lend to the defendant, a contractor, who was negotiating for a concession to light Liége, in Belgium, two sums of £250 each. She was to be paid 10 per cent. interest, and she was to have a share amounting to £2000 in the concession, should it be obtained. She advanced the first £250 and £135 on account of the second £250; but she did not advance the remaining £115. In the course of discussion, it was admitted that the case for the plaintiff was made out; but the defendant's counter-claim was insisted on, and he was examined in support of it. It was said that, had the remaining £115 been advanced, he should probably have obtained the concession he sought, and have realized from the work a profit of £3000. It was upon this state of things that he counter-claimed. The evidence having concluded, his Lordship asked Mr. Macorm, who appeared for the defendant, if that was his case. Mr. Macorm said it was. Mr. Justice Hawkins: Then you have no case. Mr. Macorm submitted that that was rather a question for the jury. The jury found for the plaintiff upon the claim for £385—interest not being insisted on; and there was also a verdict for the plaintiff upon the counter-claim.

Stealing from a Prepayment Meter.

At the Lambeth Police Court on Monday last week, Harold Scarse, 16, a labourer, and Reuben Porter, 14, a schoolboy, were charged on remand with being concerned together in breaking open an automatic prepayment gas-meter, and stealing therefrom money belonging to the South Metropolitan Gas Company. It appeared from the evidence that Scarse's parents occupy a house at Camberwell, which is supplied with gas by means of a prepayment gas-meter. On three occasions, the money-box attached to the meter had been broken open, and the contents abstracted. Scarse admitted the thefts, and made a statement implicating Porter. Beyond Scarse's allegations, there was no evidence against Porter. Police-constable Carter stated that Scarse had held several situations, but had been discharged from each. Mr. Hopkins sentenced Scarse to 21 days' hard labour; but he ordered Porter to be discharged.

Reductions in the Price of Gas.—The Burslem Town Council have adopted a recommendation of their Gas Committee that the price of gas be reduced, from Jan. 1 next, to 2s. 9d. per 1000 cubic feet, with an allowance of 3d. per 1000 feet if payment is made within one month after demand, and that an equivalent allowance of 1d. in the shilling be made in favour of consumers using prepayment meters. The Directors of the Durham Gas Company have given notice that the price of gas will be reduced from 3s. 5d. to 3s. 2d. per 1000 cubic feet from the 1st prox.

The Gas Question at Settle.—It is reported in regard to this matter that the shareholders of the Settle Gas Company have agreed to the terms upon which they are disposed to part with their property to the District Council. The Local Government Board, however, have refused to grant the Council the power to purchase; and the negotiations will therefore fall through, unless the Board see fit to reconsider their decision. The streets are at present lighted by oil-lamps; the Council considering the Company's charges too high, although a reduction on former prices was offered.

Dispute between the Queenstown Town Commissioners and the Gas Company.—The Queenstown correspondent of the *Freeman's Journal*, writing on the 16th inst., says: "As the result of a dispute existing between the Queenstown Town Commissioners and the Queenstown Gas Company, the latter body have refused to light the public lamps; the consequence being that on Saturday night and again last night the entire town was in a state of darkness." This condition of things continued until last Wednesday, when, through the intervention of the Bishop of Cloyne, the matter in dispute was satisfactorily settled, and the town was again lighted.

Adoption of Automatic Retorts at the Leeds Gas-Works.—Our readers are aware that the Gas Committee of the Leeds Corporation have been visiting various gas-works with the object of obtaining information in regard to the working of automatic gas-retorts, in view of their adoption in connection with the extensions at the Meadow Lane station. The section of the Committee having charge of this establishment recommended the full Committee to adopt the automatic system; and at a meeting of that body held last Thursday, this was agreed to. If it should subsequently be determined to give the fullest possible scope to the system, the equipment of the new premises in Meadow Lane will include 192 retorts operated on this plan, which the Committee estimate will result in a saving of 50 per cent. in the wages paid.

Explosion at the Worthing Gas-Works.—A leakage of gas, resulting from a defective valve, caused an explosion in the governor-house at the Worthing Gas-Works shortly before eight o'clock on Monday night last week, and the ignited gas set fire to the roof of the building, and burnt it off. In order to avoid feeding the flame, the gas was turned off at the main; and the town was consequently suddenly deprived of its light. Owing to the promptitude and energy displayed by the Fire Brigade, under the superintendence of Captain Crouch, the fire was soon extinguished, and all cause for alarm removed. As a matter of fact, the supply of gas could have been restored by ten o'clock; but the Company's Manager (Mr. W. A. Walker) thought it prudent not to turn any gas into the mains until the consumers had been notified on the following morning, so as to avoid the risk of explosion from taps inadvertently left turned on. The Company's Secretary (Mr. W. F. Verrall) sent a letter to the Town Clerk, expressing the regret of the Directors that the town should have suffered inconvenience through the fire, the cause of which they had made the subject of very careful inquiry, with the result that it had been traced to the valve, the defect in which was a slight one, which could not have been foreseen. On the following day, the necessary repairs were effected; and no further interruption of the supply took place.

Bilston Gas Company.—The annual report of the Directors of this Company states that the profit and loss account, after paying the usual interim dividend, shows a balance of £3768. From this amount the Directors propose to pay dividends of 5s. and 3s. 6d. per share on the "A" and "B" shares; making, with the interim dividends, 10s. and 7s. respectively, for the year, and leaving a balance of £1353 to be carried forward. The total receipts amounted to £20,026; the expenditure, to £15,167—a difference of £4859. The Directors express regret that, through the depression in trade in the earlier portion of the year, the amount realized by the sales of residuals has been £650 less than in the previous year, and that there has also been a slight falling off in the sales of gas. These disadvantages have been greatly aggravated by the large increase in the rates and taxes, consequent upon the altered assessments of the works and mains. The amount paid on this account has been almost doubled since the year 1893, and now equals nearly 4d. per 1000 cubic feet of gas sold. So that for each 20s. paid in dividends to the shareholders, over 6s. has to be contributed in rates and taxes. In the opinion of the Directors, this amount is unreasonably excessive; and were ordinary commercial undertakings taxed in the same proportion, the burden would be deemed intolerable. The Directors will endeavour at the first opportunity to get this heavy assessment reduced.

MISCELLANEOUS NEWS.

CHRISTMAS TIME AT THE YORK GAS-WORKS.

Last Saturday, Mr. Charles Sellers, the Engineer and Secretary of the York United Gas Company, delivered his usual Christmas address to the workmen. In the course of it he said:—

Once more "A Merry Christmas and a Happy New Year" to you all. A threadbare wish it may be; but it is ever fresh to youth, to manhood, and to old age. For convenience, I will divide the wish into two parts. First, I will deal with the time-honoured wish for "A Merry Christmas"—a wish which has resounded through the corridors of a long, long past, and which to-day brings up the memories of merry England in her merriest moods, brings up the memories of the "Fine Old English Gentleman," who—

> "When winter cold brought Christmas old, he opened house to all,
> For while he feasted all the great, he ne'er forgot the small."

And this is the text which should inspire all men who wish to make for themselves a merry Christmas; for on the lines of the fine old English gentleman, no man can be merry who sees others sad, as no man can really enjoy a feast who knows that a Lazarus is picking up the crumbs which fall from his table. Christmas, too, is peculiarly a time for opening the heart as well as the purse. It is not a time to remember those who have "trespassed against us," but rather a time to prompt us—

> "To tak' a cup o' kindness yet
> For auld lang syne."

Not, however, with the tardiness of the man who, when on his death-bed he was urged to forgive a neighbour, replied: "If I don't get well I'll forgive him; but if I do, then he must look out." There are many ways of making a merry Christmas. Then there is the foolish habit of making it at a cost beyond one's means, and afterwards paying for the feast by pinching and running into debt. A happy Christmas is not measured by the money spent upon it. A wise authority has said: "Better is a dinner of herbs where love is, than a stalled ox and hatred therewith." Therefore, let your Christmas be simple, and not costly; and let me urge you to spend your happiest hours at your own firesides.

Coming to the wish for "A Happy New Year," let us start fair and be sensible. Let us acknowledge that it is no more use wishing for a Happy New Year upon unhappy conditions, than it is to wish for figs to grow upon thistles. In our Christmas reunions, we have reviewed many conditions of home and social life; but there is one which we have not reviewed. I mean the influence upon home life of the cardinal virtue contained in the old command, "Honour thy father and thy mother," for on loyalty to this command happy homes and happy new years so much depend. "Spare the rod and spoil the child," was formerly a code in family discipline; but now the tables are turning, and old codes are going out of fashion. The modern youth too often tramples upon the lessons of the past, and instead of helping, by his conduct, to bring to his parents—

> "That which should accompany old age;
> As honour, love, obedience, troops of friends"—

he too frequently speaks of his father as "the old boy," the "old buffer," and the "old governor;" while in polite society the terms "*mater*" and "*pater*" are being substituted for the home-sounding and love-inspiring "father" and "mother." But all such terms are either akin to slang or affectation, and tend to weaken the command, "Honour thy father and thy mother," and tend also to weaken the conditions for a Happy New Year. Unlike mercy, which "blesseth him that gives and him that takes," dishonour to parents curses both parents and child alike.

Lastly, be thrifty, and always save something, even pence, for pounds will take care of themselves, and you will find pounds a capital help to a Happy New Year. Be sober; for a Happy New Year never did go hand in hand with insobriety. Be loyal to your employment; for nothing pays better as an investment than faithful discharge of duty. And to those of you who have not had a honeymoon, I would say, "Do not rely too implicitly on honeymoons; for, like happy new years, honeymoons largely depend upon obedience to the command, 'Honour thy father and thy mother.'"

Upon our own business, we need say little. In the lighting world, we still hold the field; and in other fields, we are extending our borders. There was a time when every long-haired orator, in his wild imaginings, upon the electric light, strewed the field with our bones; while every day theorists did not hesitate to predict to a fortnight how long gas men had to live. But now, with Bray's improved burners, and the incandescent principle for gas lighting firmly established and fast becoming wholesale, gas men can defy all comers; and instead of losing a wink of sleep in fear of competitors, they may, with the greatest confidence, eat, drink, and be merry. And if on the "light of the future" men say, as I have no doubt they will, that my opinions are prejudiced, let them look at the opinions of capitalists—men who have no prejudices, and who never need to be told on which side bread is buttered; and they will find that, while capitalists now give a higher value for gas property than they have ever given before, they are beginning to think twice and thrice before putting their *own* money into the electric light.

Mr. Sellers then said he had pleasure in distributing the usual Christmas gifts (towards which the Directors of the Company had contributed) of books, toys, and articles of dress to all the men who had children. He also distributed twelve Christmas cakes to a similar number of men with the largest families—a custom practised by his mother in her lifetime.

A hearty vote of thanks was accorded to the Directors; and cheers were given to Mr. Sellers for his address.

HUDDERSFIELD CORPORATION GAS SUPPLY.

Ratepayers' Opposition to the Proposed New Powers.

In moving the adoption of the minutes of the Gas Committee at last Wednesday's meeting of the Huddersfield Town Council, Alderman Stocks dealt at some length with the opposition which the proposals of the Committee encountered at the recent statutory meeting of ratepayers (p. 1205). He said that, as Chairman of the Gas Committee, his mouth was sealed as to the immediate future, as the Committee would have to consider what they would do. Whether the ratepayers were wise or not in their opposition to the loan of £100,000 which the Committee had asked for, it was not for him to say. He did not say that the Property Owners' Association was not a good institution. Properly conducted, it might be very helpful to the Corporation; but as it was to be in antagonism, the public interests would suffer. He was not aware of any of the alleged extravagance at the gas-works; but the work done had been carried out efficiently and well, and with the full sanction of the whole Council. The Committee had not on their own authority spent a single shilling. He went on to show that the reconstruction of the works had been absolutely necessary. During four days in 1894, they were within a few hours of having the whole town in darkness. At the commencement of that period, during which a dense fog prevailed, they had in store 3,500,000 cubic feet of gas; the works were running at the fullest pressure, and yet, when the need for the abnormal supply ceased, they had only about a quarter of a million feet of gas in store. Had the fog continued longer, the town would have been without its service of gas. Steps had been taken to avoid such a serious contingency in the future; and a second contract, covering important reconstructions, was on the point of completion. It had been said that the Corporation obtained the works at a fair price. That was true, if giving 30s. for a sovereign could be so described. The works stood them at a capital cost of about £6 per ton of coal carbonized; whereas engineers told them that the cost per ton should not exceed £4 5s. He believed that at Leeds, Bradford, and Halifax that was something like the cost of the works. As a consequence, it was impossible to produce the gas as cheaply as it was made in those towns. There would at the end of the financial year be a suspended debt of about £60,000; and unless it was met gradually by profits from the sale of gas, it would have to be met by a rate in aid. Several members of the Council adhered to their allegations as to the defects in public and private lighting; and the minutes of the Gas Committee were then approved.

ELECTRIC LIGHTING NOTES.

About two years ago, the old Board of Works for the Hackney District obtained an Electric Lighting Provisional Order; but, until recently, no steps were taken in the direction of acting upon the powers thus conferred. Some months ago, however, a Committee was appointed to inquire into the whole matter; and having first secured the services of Mr. F. Hastings Medhurst, M.Inst.E.E., they have visited several towns where the electric light is under municipal control, and where, in certain cases, a combined system of dust destruction and electric lighting is in operation. The Vestry recently had before them the reports of the Committee and Mr. Medhurst. As a result of their visits, the Committee expressed themselves strongly in favour of the practicability of the combined scheme of electric lighting and refuse destruction proposed by Mr. Medhurst. The Committee also assured the Vestry of the safety of Mr. Medhurst's estimate, both as regards the cost of burning the refuse, and as to the capital and general expenditure on the electrical works, and the revenue to be obtained therefrom. The Committee recommended the Vestry to adopt Mr. Medhurst's scheme, and asked permission to engage him to prepare the necessary plans and specifications. Mr. Medhurst recommends the provision of an initial installation capable of supplying 16,000 8-candle private lights and the 140 arc lamps of 1000-candle power each, which will be required to efficiently illuminate the main thoroughfares the Vestry will have to immediately take in hand. He thinks it is extremely improbable that of the 16,000 lights more than 11,500 will ever be simultaneously alight; so that the estimates of cost and plant are on this basis. He recommends the adoption of the high-tension alternating current system of distribution. The streets included in the compulsory area have a total length of about four miles; and lamps of 1000-candle power at 100 yards apart, on each side of the street, would number 140 to efficiently light this area. The annual cost of electrically lighting these streets will be £1800—three times the cost of the existing 188 gas-lamps. But the light from dusk to midnight will be sixteen times greater, and from midnight till dawn eight times greater, than it is at present. At the exceptionally low charge of 5d. per unit (which Mr. Medhurst says is about equal to a charge of 2s. 6d. per 1000 cubic feet of gas), the supply for private lighting would, he estimates, yield at least £6666. To this must be added the saving on the disposal of refuse £3500; and the present cost of street lighting (£519) must also be set against the total expenditure. Thus the estimated total profit amounts to £10,685; and the total working expenses of the entire system could not, he says, exceed £5357—leaving the prospect of a revenue from this investment of no less than £5328. The interest and sinking fund would absorb about £4000 of the income; leaving a clear net profit of about £1328 a year, which Mr. Medhurst thinks would increase to £2000 or more, especially if there were a fair demand for electrical energy during the daytime. The capital outlay is, of course, the principal item; and this Mr. Medhurst confidently limits to £80,000.

The dangers attending electric lighting were once more exemplified on Monday last week, when John Pugh, aged 27, a cable joiner in the service of the Electric Lighting Department of the Cheltenham Corporation, met with his death under circumstances which were investigated by Mr. J. Waghorne and a jury on Wednesday. It was shown that the deceased was at work in a sub-station, putting up a low-tension switchboard near a high-pressure board on his left, and was boring a hole in a batten against the wall. In the act of "changing hands" in his work, he brought his left arm against one of the terminals on the high-pressure board; receiving a shock which caused him to fall forward against the switch. The foreman, who was standing on his right, also received a shock, which he described as being like an enormous blow. All efforts to restore animation failed, though a doctor was on the spot immediately. The evidence showed that the deceased had been cautioned against danger, even up to within a few minutes of death; and india-rubber gloves and a mat were provided for work on high tension. But in the case of the work deceased was employed upon, they were not necessary; and he had declined to use the mat, though had he done so he would probably not have lost his life. Mr. M. H. Kilgour, the Electrician to the Corporation, said the current was conveyed to the station at 2000 volts pressure, and there transformed to 100 volts for general supply. He believed the sub-station was one of the safest in England, and larger than those generally in use. After a most exhaustive inquiry, the jury returned a verdict of "Accidental death;" no blame being attached to anyone.

Shrewsbury has now a supply of electrical energy from works which are the property of the Shropshire Electric Light and Power Company. The station contains three engines and dynamos, each of which is large enough to keep 1000 8-candle power lamps alight at one time. The total capacity of the generating plant at present installed, allowing one engine and dynamo as a reserve, is sufficient for lighting about 4000 8-candle power lamps fixed on consumers' premises; and Mr. A. H. Preece, the Consulting Engineer, is convinced that, as soon as the Company are able to obtain this number of lamps, a good profit will be made on the capital expenditure. The present charge is 8d. per unit; but a reduction to 7d. is to be made with the New Year. The station was formally opened on the 10th inst.; and in conjunction with the inaugural ceremony there was an exhibition of electric lighting and cooking appliances. Of course, a good deal was made of the event in the local paper. The "function" was described as "one of the most interesting and important ever witnessed in the county town;" and it was "a conspicuous success." No doubt seems to be entertained that the Company have "a brilliant future"—possibly distant—before them. They started work on Aug. 1 last; and they have only about a score of customers, none of whom are very large.

A Local Government Board inquiry was held at Harrogate last Tuesday, by Mr. W. F. B. Clarke, regarding an application to the department by the Town Council for sanction to borrow £27,000 under their Electric Lighting Act of 1892. Of this sum, £6500 is required for buildings, and £20,500 for plant, &c. It was stated by the Town Clerk (Mr. W. H. Wyles) that the Corporation had reason to think they had the most modern and perfect system of electric lighting for the borough.

The recommendation of the Electric Lighting Committee of the Eccles Corporation, that a scheme of electric lighting should now be carried out (*ante*, p. 1249), was under consideration at a meeting of the Council yesterday week. It was determined that, in order to afford time to place the fullest information possible before the ratepayers, the consideration of the question should be deferred until April 1 next, and be then discussed at a special meeting of the Council.

We learn that a Sub-Committee of the Bradford Gas and Electricity Committee have been supplied with copies of the report of an expert on the condition of the Corporation electricity works. It is generally recognized that the works are too small to serve the purposes of so large a town as Bradford, and are not capable of sufficient extension on the present site; while, on the other hand, the pressure of applications for the supply of the light is so great that some extension is unavoidable. It is probable that the Committee will immediately lay a proposal before the Council.

RECENT SALES OF SHARES.

On Monday last week, Mr. Alfred Richards sold several parcels of stock and shares in gas undertakings. "A" stock of the *Tottenham and Edmonton Gas Company*, entitled to 10 per cent., but actually carrying 11½ per cent., fetched £273 per £100 of stock. New ordinary 6 per cent. stock of the *Wolverhampton Gas Company*, entitled to 6¾ per cent. in June next, sold for £158 to £160 per cent. Consolidated stock of the *Reigate Gas Company*, the last dividend on which was at the rate of 10 per cent. per annum, with 2 per cent. bonus in addition, fetched £267 10s. per £100. Some fully-paid £5 "B" (7 per cent.) shares in the *Romford Gas Company* were sold for £8 each. On the same occasion, Mr. Richards offered 150 £10 shares (£8 paid) in the *Gas-Meter Company, Limited*, for public competition. This was unquestionably the feature of the sale. These shares are very seldom in the market; for, seeing that the last dividend was at the rate of 10 per cent. per annum, with a bonus of 7½ per cent., holders naturally cling to them. However, here was a parcel of 150; and Mr. Richards knocked them down at no less than £25 each—a surprisingly high figure.——A few days ago, 399 £10 shares in the *Bromley Gas Company*, bearing 7 per cent. interest, were sold by auction at prices varying from £19 to £19 5s. each; and 90 similar shares (with the half-year's dividend) realized an average of £20.——A sale of 3½ per cent. debenture stock in the *Newcastle and Gateshead Gas Company* last Wednesday produced an average of £116 16s. 5d.——On the same day, Messrs. Hollis and Webb sold at Leeds £2500 of additional £10 shares in the *Rothwell Gas Company, Limited*; the prices obtained ranging from £14 5s. 6d. to £14 11s.——At Preston last Wednesday, £100 of "A" stock of the *Preston Gas Company* realized £200; and £283 of "B" stock in the same concern sold for £167 per £100.——At the Mart, last Thursday, Messrs. J. and W. Tharp sold £675 of new stock of the *Commercial Gas Company* for £1701; and 97 £5 shares in the *West Ham Gas Company*, for £1165.

Abandonment of the East Warwickshire Water Bill.—The Chairman of the East Warwickshire Water Company (Captain H. Townshend) has informed the Nuneaton District Council that the Company's Bill, of which notice has been given, will not be proceeded with until next session, on account of there not being sufficient time to fully consider all the clauses.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Offices, Commercial Road, Pimlico, last Thursday—Sir W. H. Wyatt (the Governor) in the chair.

The Secretary (Mr. G. H. Gill) read the notice convening the meeting, and subsequently the minutes of the last general meeting and the reports of the Government Auditor (Mr. A. Stoneham) and of the Company's Auditors. The latter (Messrs. J. A. Hallett and H. P. Bodkin) stated that they had again great pleasure in expressing their entire satisfaction with the clear and precise way in which the accounts had been kept. The report of the Directors was taken as read.

The Governor, in moving its adoption, said he thought the proprietors must all have been well satisfied with it, and with the statement of accounts. Instead of being obliged, like some of the other Water Companies, to be satisfied with a lower dividend, they were able to maintain theirs, and to make a small additional payment in respect of former dividends which had fallen short of the maximum statutory rate of 10 per cent. He could assure them that this had not been done without placing everything to revenue account that it had been possible to debit thereto. They had charged to revenue every shilling of the cost of lowering the mains; but, at the request of the Government Auditor, who particularly wished it, as he had to deal with other Companies who did not like this plan of proceeding, they had charged £200 of the cost to capital account. They had, however, done this with some regret, though it was open to consideration whether a proportion of the outlay might not be debited to capital account. The amount charged to that account, however, ought certainly not to be very large, because the chief expense was in opening and closing the ground; the extra foot or so by which the mains were lowered not being a very costly proceeding. They, however, thought it well to comply with Mr. Stoneham's request. Some of the other Companies had not wished to charge anything to revenue, but would have liked to put all the expense to capital; and they had at present placed the amount to a suspense account. The Chelsea Company's Directors, however, had, as he had said, charged everything they possibly could to revenue, for the contingency fund meant revenue, being nothing but accumulated profits made in former years. They believed they had now finished all the pipes in their district, though he did not say they had paid for everything, because they had not been able to get in all the accounts between June 30 and Sept. 30. He thought the proprietors would regard it as satisfactory that the Directors had been able to recommend a small increase in the dividend, in the shape of a payment on account of back dividends. They could have paid quite easily another 2s. 6d. per cent., and still have had a good balance over on the half-year's trading; but they had considered it to be more in the interests of the proprietors, and of the concern as a whole—the September half being always better than the March half of the year—to carry forward £1400 odd to the next half. He thought there was a very reasonable hope—though, of course, he could not say more than this—that they might be able to continue the payment of the 2s. 6d. per cent. If they were able to do this, it would be advantageous in all ways. It would keep their stock steady. Its nominal price was now very high; and they certainly did not seek to do anything to encourage its further rise, because this might lead to disappointment hereafter. The great thing they had to contend with, and it was a cruel shame, was the amount of law expenses which the London County Council put them to. Last year they expended on parliamentary matters £2400, all of which was charged to the contingency fund, which, however, as he had said, was practically revenue. The County Council did not mind what they did in introducing Bills. But the Companies had to defend themselves; and parliamentary and law expenses represented a most expensive luxury. He hoped, however, that an end might sooner or later come to this state of things. Probably the proprietors had seen what occurred on the previous Tuesday at the meeting of the County Council. He did not think there was much in it, one way or the other; and he could not say whether or not it would at all stop these outlays. If it had not been for the parliamentary expenses which the Company had been compelled to incur—amounting, as he had said, to £2400 (and most of the other Companies had had to pay more)—they might have paid a nice little extra dividend. The Directors had impressed this very strongly on their Solicitor—that beyond actual defence they did not wish to go; they did not desire to encourage any unnecessary outlay. But he did not know how expense was to be prevented if they were to defend their interests when they were attacked. The County Council did not mind what they spent. For instance, in the recent inquiry before Colonel Ducat, they had a grant of £250 from the Council. But they afterwards asked for another £650; and probably a further supplementary estimate would come forward before long. Another matter which rather concerned them was the new assessment of the Company's property. They had resisted it as far as possible, and had been able to settle in every case except Kensington, where such an enormous increase was wanted from them that they intended to resist the demand; and he hoped they would succeed. The assessments already fixed would, however, make a considerable difference to the Company and to all the other Water Companies; in their case, they reckoned the additional charge at £2000 a year. But against this they were able to make a favourable contract for coal, which would help them to pay some of the increase in the assessment. He therefore hoped that, on the whole, they might continue to do well.

The Deputy-Governor (Mr. F. S. Clayton) seconded the motion.

Mr. E. T. E. Besley thought that the report was the most satisfactory one that had been produced by any of the Water Companies; and he ventured to say that it really understated the prosperity of the Company, inasmuch as their investments were very much below their present market price. It was quite correct to put them at their cost price; but it should not be lost sight of that the difference between cost and present market value represented another good asset. In connection with the expense caused by the phenomenal frost, the Chelsea Company had suffered insignificantly in having to pay about £1800. He saw no precise statement as to the actual cost caused by the frost; but he presumed it was very much less than the £28,800 which it would cost the Lambeth Company.

The Governor stated that the £1800 was the expenditure incurred simply in lowering the mains. The outlay in connection with the frost, for repairing broken pipes, and so on, would perhaps be from £1500 to £2000.

Mr. Besley said that in that case he had certainly not wrongly described as insignificant the cost to which the Company had been puts in comparison with the Lambeth Company. The principle upon which the Government Auditor had acted in allocating to capital account a portion of the expense of lowering the mains was, as he understood it, that this proceeding would be for the benefit of the public in future years. Mr. Stoneham, however, had only allowed a very small proportion of this expense to be debited to capital. So far from the present price of the Company's stock being too high, he did not think the market figure represented its real value; and his own opinion was that it must continue to advance. Altogether, the report reflected the utmost credit on the Directors, and upon all who were connected with the management of the Company.

The motion was then carried unanimously; and resolutions were afterwards passed declaring the dividend on the preference stocks, and the distribution recommended on the ordinary capital.

Mr. Besley proposed a cordial vote of thanks to the Governor and Directors for their management of the Company's affairs, as well as to the officers for their assistance. He said he might perhaps be allowed to take this opportunity of expressing a hope that the Company would not withdraw their Bill, even though the London County Council might object to the proposed outlay, which was entirely for the benefit of the consumers, and would not bring a penny of profit to the shareholders. He thought it was very desirable that the public should know, if the County Council opposed such a Bill, how that body were influenced by prejudice against the Water Companies.

Mr. H. P. Bodkin seconded the motion, and it was carried.

The Governor, in acknowledging the vote, said he had been extremely glad that Mr. Besley had thought fit to make the remarks he had addressed to the meeting. He never liked to say anything which might appear to be in praise of themselves, but which might imply unfair comparison with other Companies. He could assure the proprietors that the Directors had worked hard, and that they were still working hard to keep down expenses fairly, and to promote the prosperity of the Company.

The proceedings then terminated.

THE LONDON COUNTY COUNCIL AND THE WATER QUESTION.

Rejection of the Proposal for a Water Authority—The Cost of the Flushing-Cistern Inquiry.

At the Meeting of the London County Council last Tuesday—Sir A. Arnold in the chair—the report of the Parliamentary Committee with regard to the lines on which the Government were to be asked to legislate on the question of the water supply of the Metropolis came up for consideration. The report was published in the Journal last week; the Committee's recommendations being as follows:—

(1) That Her Majesty's Government be invited: (*a*) To constitute by Act of Parliament a Public Authority for the water area defined above. (*b*) To vest in such authority, when constituted, the powers now exercised by the Metropolitan Authorities under the Metropolis Water Acts in reference to the Water Companies, and certain of the powers now possessed by the Local Government Board, with a view to improved administration and efficient control. (*c*) To confer upon such authority power to negotiate for the purchase of the respective undertakings of the Water Companies, and to give effect to such purchase in such manner as may be found expedient, and, if thought fit, to seek parliamentary powers for the acquisition of the undertakings otherwise than by agreement, and for dealing with the whole question, including that of future supply.

(2) That, pending the constitution of such authority, the Council do authorize negotiations to be initiated by the Parliamentary Committee with the Water Companies for the purchase of their undertakings.

(3) That, with a view to the Council coming to a decision on the pressing question of new sources of supply as compared with a scheme of storage reservoirs, the Water Committee be instructed to report their final conclusions without delay.

Mr. H. P. Harris, the Chairman of the Committee, explained that the report was the outcome of the Council's resolution of the 22nd of October. That resolution was passed against the wishes of those who were responsible for the present report. The Committee at the time proposed that the Government be asked to deal with the London Water Question, with a view to an agreement being arrived at between all parties concerned. The majority of the Council, however, declined to accept that recommendation, and insisted on the Parliamentary Committee preparing a scheme themselves, without delay. If the present report accentuated the difficulties of the question, it was not the fault of the Parliamentary Committee. The first thing about the report was that it did not favour proceeding with the present Purchase Bills. The Committee, firstly, were unwilling to commit the ratepayers of London to a headlong purchase on open arbitration; and, secondly, they had a doubt as to the expediency of severing the outside authorities from the general scheme. On the question of purchase, he might say that the arbitration clause was framed with a view to safeguard the ratepayers from loss; but the clause in its entirety was not accepted by the Committee of the House of Commons, because they believed that it would hamper the Arbitrator. So everything was left open to his discretion. He had been asked by a Progressive member: "If you criticize our arbitration clause, what substitute have you to bring forward?" He was prepared to say that the effect upon the rates of compulsory purchase had never been properly understood, and that the result of purchase by agreement had never been tried. Arbitration involved long and expensive conflicts, which purchase by agreement would avoid. The main question to consider was, What is the best system for controlling the Metropolitan Water Supply? There appeared to be three systems. The first he might call the provincial system, under which the corporation acquired the waterworks and managed them, agreeing with the small outside areas to

furnish them with supplies. Then there was the system which he might call the separatist system, whereby the London County Council, as the central authority, might acquire all the Metropolitan water undertakings, not for the purpose of placing themselves in the position of the provincial corporation, but of dividing up the water areas, giving certain portions to the outside authorities, with exclusive power to control those portions. A third policy consisted in the formation of a Water Trust, under which all parties in the water area secured representation and got equal rights. This latter system was now submitted by the Parliamentary Committee as being the best for London. With regard to the provincial system, he would say nothing beyond this, that it did not seem acceptable to the Greater London authorities; but as to the separatist system, which was favoured by the Progressive party, he could only say that it was not in accord with the principles laid down by Parliament, nor with the past policy of the Council. The Trust system proposed by the Committee had many advantages, and got over the difficulties of the other system. First of all, it was a sort of half-way house between the subordination of the outside authorities which was involved by the provincial system, and the total severance of the outside areas comprised in the separatist system. In the next place, this policy was in accordance with the principle laid down by Parliament—and by Sir William Harcourt—in favour of a single authority. Then, again, it did not involve the Council or the outside authorities in any future difference as to carrying out the agreement. Besides this, it was a policy of unification; and unification had been one of the main arguments brought forward in favour of the acquisition of the water supply Adopt this system, and the Council would create at once an authority representing the consumers of the whole of the Metropolitan water area, and would be able for the first time to meet the Water Companies on united ground.

Mr. T. M'Kinnon Wood moved the following amendment to the first recommendation: "That Her Majesty's Government be asked whether they will promote or assist legislation dealing with the Metropolitan Water Supply on the following lines: That the entire control of the water supply within the area of the County of London shall be in the hands of the London consumers, directly represented by the County Council in conjunction with the City Corporation; that the consumers in the Metropolitan water area outside the county shall not be denied, or deprived of, similar rights in their respective areas; and that the purchase price of the existing water undertakings shall not be assessed under the provisions of the Lands Clauses Consolidation Act, but shall be based upon the fair and reasonable value of those undertakings, due regard being had to the rights, special circumstances, and obligations of the Companies; also that the Parliamentary Committee be instructed to report as to the reply of Her Majesty's Government immediately after the recess." He said it was a mistake on Mr. Harris's part to say that the Progressive party had never considered the financial result of the policy of severance. That matter had been fully discussed by the Water Committee, and by those who were responsible for the action of the Council at the time the agreement was made with Surrey. Nor was it correct to say that this was the sole water policy of the Progressive party. The position was, perhaps, best defined in the fifth section of the report of Sir Matthew White Ridley's Committee, which laid down that, in the event of purchase by the new authority, power should be given to that authority to negotiate with the outside authorities for the purchase of certain portions of the works, and possibly some of the sources of supply, such as it might be practical and advantageous to sever from the general rule. The Progressive party went as far as that, and no farther. He must also object to the attempt made in the report to give the scheme the appearance of being conceived in the spirit of Sir William Harcourt's Committee. That Committee only provided for a Water Trust in the absence of a central municipal authority to which the functions could be committed. The Committee carefully left out this reference to the central authority, which now existed in the County Council. The first thing that struck him in looking at the policy propounded by the Committee was that it was a broken-backed policy. The second recommendation was not consistent with the first. The Committee first asked Parliament to create a Water Authority, and then they suggested that the Council should reopen negotiations for the purchase of the water undertakings. This would place the Council in a ridiculous position. When this vague and indefinite authority was constituted, it was to be given the power to purchase by agreement; and if they failed to come to an agreement, then they were to go to Parliament for compulsory powers. Such a proposal could never be considered as a serious or adequate treatment of the question. On reading the report, one would think the Committee held a brief for the outside authorities. Every point in the report went towards swelling the outside authorities, and belittling not only the County Council but the whole of London. He would rather leave the Water Companies as they were, with the Local Government Board and the Council looking after them, than see created a great Trust which would never represent the true interests of London. Against this policy of the Parliamentary Committee what did his amendment propose? It was, at least, simpler than Mr. Harris's scheme, and laid down broad general principles. What the Progressive party wanted first of all was direct popular control; and this was not provided for in the constitution of the Trust. Their second principle, as laid down in his amendment, was to acknowledge the rights of the outside authorities. The Council had before them a clear issue. On the one hand, they had a proposal to spend the wealth of London on a hybrid authority that would be absolute in power, but would not represent them; on the other, the Progressives declared that they would stand firm to London, and that, whatever decision the Council might arrive at, they would never consent to what they regarded as a great betrayal.

Mr. E. Spicer seconded the amendment.

Lord Welby found himself in a difficulty, as he liked neither the recommendation nor the amendment. He said it was natural and reasonable that both parties should wish to present their views to the Government; but there was a consideration which was paramount even to the presentation of those views, and that was the interests of the consumers. It was clear that, if the battle was to be fought out on the recommendation and the amendment, a party division was inevitable. This would lay them open to the charge that they had somewhat subordinated the interests of the consumers to party exigencies, and that the result was a decision of the matter by half of the Council. The Government would at once see that they could not rely upon the co-operation of the whole Council, and would found on that fact an easy plea for delay in undertaking a most difficult and thorny task. The present Government had the prospect of power for the next six years. The Progressives would be sorry to see the water question hung up for that period. If both parties asked the Government to legislate, and if the Government leant rather to the Moderate view, he trusted the Progressives would not adopt a *non possumus* attitude. He had hoped the Council would find some means of passing a unanimous resolution, and would be able to assure the Government of their united co-operation in any measure that would secure for the consumers their proper share and interest in the supply. He feared, however, it was too late now to pass any such resolution; but he wished it were possible, even at the cost of some delay. On the principle that "light gives counsel," a little delay might bring light to them. He did not approve entirely of either policy now before the Council; but, on the whole, he had come to the conclusion that he would rather support the amendment, feeling that, if he was to err at all, he would rather err in good company.

The Earl of Onslow said he felt certain that the amendment would be rejected by this or any Government as an extravagant and profligate proposal. He hardly knew why it was considered necessary to draw up such a lengthy conundrum to put to the Government. It seemed to him that it would have been sufficient if the Progressives had asked the Government to promote the defeated and discredited Water Bills, because the amendment really embodied the whole ground of those Bills, adding to it one more dangerous and extravagant proposal—viz., that they should cut off from their area, which was now supplied by the eight Companies, all that part in which the future profit was to be gained. Instead of simplifying and unifying the system of supply, if the proposal made in the amendment were adopted, they would have at least seventy or eighty separate authorities, with all the inevitable and attendant expenses. The policy of the Separatists in this matter was that of "killing the goose that laid the golden eggs." He was entirely at one with Mr. Wood in desiring that the people of London should have their proper and due influence in the control of the water supply. The Progressives had challenged them to produce a policy; and they had not shrunk from the challenge. The object of the Progressives in asking for that statement of policy was that they recognized that the Bills they promoted in the last session of Parliament had no shadow of a chance of passing; and now that their policy had been produced, the Moderates were not met in any spirit of compromise, with a desire to present a united front to the Water Companies, but with the stale arguments and the old proposals contained in the Bills of last session. If they were going to ask the Government to deal with the matter, they must not dictate, but leave it entirely in their hands, after indicating what the general views of the Council were.

Mr. W. H. Dickinson (the Deputy-Chairman) admitted that the Committee had made an honest attempt to settle a difficult question; but he thought they had not appreciated the far-reaching effects of their scheme. There were in London now four different central bodies. Were the Council going to add a fifth? Lord Onslow had said that the Separatists were going to "kill the goose that laid the golden eggs." He (Mr. Dickinson) could not help thinking that the whole question involved now depended on the true appreciation of that question. Lord Onslow was absolutely wrong in thinking that there was any goose that laid the golden eggs. To show this, he would trouble the Council with a few figures. He would first notice that while the profits laid out on water inside London were 76 per cent., they were 153 per cent. outside; which meant that at the present moment London water consumers were paying £122,000 for the benefit of water drinkers outside. He would surmise that the scheme of abandoning the Thames supply and going to Wales for a new supply was to be carried out. The figures he would place before the Council were based on the understanding that 420,000,000 gallons of water were required both outside and inside, and that the population would be 11,250,000—that was to say, 6,000,000 inside and 5,250,000 outside. Now, 6,000,000 people would require 210,000,000 gallons, and 5,250,000 people, 184,000,000 gallons. This quantity of water could be obtained from two different reservoirs in Wales. The cost of providing London with water would be £19,000,000, and outside London £15,000,000—a total of £34,000,000. If the County Council did the work alone for their own area, it would require a charge of £168,000 on water consumed; but if it was done by a Water Trust, getting the whole of the water at a cost of £34,000,000, it would require £1,041,000. London would have to pay £373,000 a year because it would have a Water Trust. The answer to that would probably be that the rateable value would be growing outside. This question must be examined. What was the condition of affairs in London? The growth of the rateable value of those parts of London which were supplied by the Water Companies was increasing three times as fast as the increase in the number of houses; whereas the rise in the rateable value outside London was growing to be little more than equal that of the number of houses. Therefore the position never would be reached in which the rateable value of the property outside London could have its fair share. In order to show that the march of events he foreshadowed was right, he would look into the profits of the Water Companies. Since 1871, these had increased by 22 per cent., whereas outside they had increased by 12 per cent. It was clear to his mind that the proposal of a Water Trust was simply setting up a water company for a larger area than had existed up to the present. If they, as Progressives, were convinced that the financial results of a Water Trust would be disastrous, they had a right to say they would not participate in such a scheme, which was the worst of the three schemes that had been put forward. It was a betrayal of London; and if the Council voted for the Water Trust, they would vote against the financial interests of London, and would not be carrying out the purposes for which they had been elected.

Mr. H. Clarke opposed the amendment.

Mr. Idris, who continued the debate, was frequently interrupted with cries of "Vote, vote."

After the speaker had proceeded for a short time, the closure was

moved and carried, and the amendment was put, when there voted for it 56; against it, 49—majority, 7. On the amendment being put as the substantive motion, a division was taken, when there voted for the resolution, 56; against it, 43—majority, 13.

Mr. HARRIS asked that he might withdraw the second recommendation.

Mr. J. STUART, M.P., objecting,

The CHAIRMAN ruled that when one member objected, leave to withdraw could not be given.

The recommendation was then agreed to, with the omission of the words "pending the constitution of such authority," and the substitution of the words "Water Committee" for "Parliamentary Committee." The third recommendation was agreed to without discussion.

The Council have incurred an expenditure of nearly £900 over Colonel Ducat's inquiry as to whether a water-closet flushing-cistern should hold two or three gallons. The original estimate was £250; and the Public Health Committee asked that payment of the balance should be authorized.

LIVERPOOL CORPORATION WATER COMMITTEE.

The Protection of the Officials Against Unreasonable Members.

There was a discussion at the meeting of the Liverpool Corporation Water Committee last Tuesday upon a question which concerns many other similar bodies—viz., the protection of officials against members of the Committee who are given to pestering them and wasting time by making frivolous inquiries. In March, 1877, a resolution was passed by the Committee, "That in future any communication between individual members of the Water Committee and the Water Engineer as to matters within the province of the Committee be made through the Committee or the Chairman." This mode of procedure has not been strictly adhered to; but it has lately been thought fit—and apparently with good reason—to apply it to Mr. Beloe. This gentleman, in consequence, felt aggrieved; and at last week's meeting of the Committee, he moved that the above-quoted resolution be rescinded. He said that he and other members had been in the habit of applying for information without going through the form and ceremony prescribed by the resolution; and until lately information had never been refused. But for his special benefit, this old resolution had been dug up. No other Committee of the Corporation had a similar rule; and there was nothing in the business of the Water Committee which required that secrecy. If such a resolution was necessary to the conduct of the business of the Committee, it ought to be included in the standing orders of the Council. It was an objectionable course to have such a resolution hidden away, and brought out again for the benefit of the Chairman, or any other member who was in authority, while favoured members could get whatever information they wanted. In their case, the resolution was allowed to remain a dead letter. Mr. Kearney seconded the motion; claiming that, as representatives of the ratepayers, one member of the Committee had as much right to any information as another. The Chairman (Alderman Radcliffe) remarked that he was a party to the passing of the resolution in 1877; and the reasons which then made it advisable seemed to him to be still in existence. It was a resolution to protect the officials of the Corporation. There were gentlemen on the Council who were not altogether reasonable, and little knew the labour which they entailed upon the officials. As an instance, he might mention that Mr. Beloe had written to him in reference to certain information which he thought he was entitled to have. The consequence was these [the Chairman held up a bundle of large-sized papers closely written upon]. It was voluminous; and the officials were kept at the office until eleven o'clock on Saturday night preparing it. He, as Chairman, and Mr. Burgess, as Deputy-Chairman, had a certain amount of responsibility in seeing that the routine work of the Water Engineer's office was not interfered with. There was no intention whatever to impose secrecy; the point was to ensure that the ordinary routine business of the department was not interfered with. Mr. Beloe said the Chief Clerk (Mr. Annett) told him that he could provide him with the information he required in about five minutes, as he had already prepared it for another member of the Committee. The Chairman said it was Mr. Annett who prepared the voluminous report which he held. Alderman Hughes thought they ought to strongly protest against a member frittering away the time of the officials in obtaining frivolous information which could do no good, but yet entailed arduous work in overtime, to which they did not wish their servants to submit. He thought it was high time they put their foot down, and not be parties to a system of that sort. In this particular instance, it was labour thrown away, because the information obtained served no public purpose. Other members concurred in these remarks; and, in reply to a question, Mr. Pierce (of the Town Clerk's Department) said the information contained in the papers referred to by the Chairman was all new, and was got out for the purpose of Mr. Beloe. On the motion being put to the vote, it was rejected by 3 votes to 14.

PLYMOUTH WATER SUPPLY.

The Remuneration of the Water Engineer for the New Works.

The question of the remuneration of the Water Engineer (Mr. E. Sandeman) for extra services in connection with the important new works which are being carried out by the Water Committee of the Plymouth Corporation, was under the consideration of the Town Council yesterday week. The Committee recommended that the sum of 500 guineas should be paid to Mr. Sandeman, "in consideration of the services rendered by him in preparing the parliamentary plans and sections, and also in carrying out the works in connection with conduits Nos. 1 and 2 authorized by the Plymouth Corporation Water Act, 1893;" The resolution went on to say that the consideration of any further remuneration for carrying out works at the Burrator reservoir was deferred until the completion of the works. The Mayor (Alderman Bond), in moving the resolution, stated that when Mr. J. Mansergh was appointed Consulting Engineer, he was so satisfied of the ability of Mr. Sandeman, that he agreed to accept a commission of 1 per cent., instead of the usual 5 per cent. By this means, the Committee saved £4000. When Mr. Sandeman was appointed, there was no conception that they would be so soon in a position to carry out so great a work; and the plans which he prepared were of the most perfect and elaborate kind. As to the future, it would be for Mr. Sandeman to show that he was as good a contractor as he was an architect. Mr. S. J. Page opposed the resolution, on the grounds that the latter portion of it foreshadowed a still larger vote on the completion of the works now in hand, and that the system of paying officials for extra work would be attended by serious consequences if it were applied all round. The Mayor, replying to these and other objections, said that Mr. Mansergh did not receive any remuneration for the work of laying the pipe-line; while as to the plans, their preparation, if placed in the hands of a draughtsman, would have cost £1000. The Corporation were bound to be just. Since his appointment as Water Engineer, Mr. Sandeman had secured an additional return in the form of revenue from old customers, which more than paid his salary; so that by his energy he had really made a present of his salary to the town. Within the last twelve months, Mr. Sandeman had had an offer of an appointment at £900 a year; but when it was represented to him how disastrous it would be if he left the Corporation "in the middle of the stream," he readily declined the offer without even "sounding" the Committee as to future prospects. The recommendation was adopted by 31 votes to 5.

Harrogate Water Supply.—At a public inquiry at Harrogate last Tuesday, Mr. W. F. B. Clarke, of the Local Government Board, received evidence as to an application by the Town Council for sanction to borrow various sums of money for several purposes. One of the amounts was £4000, which it is proposed to spend upon the construction of new storage reservoirs of a capacity of 300,000 gallons.

Possible Disturbance in the Coal-Mining Industry.—Lately there have been noises in the air which seem to indicate another serious strike in connection with the coal-mining industry; and the prominent personages allied to the Trade Unions appear anxious that this should be thoroughly understood. For instance, Mr. B. Pickard, M.P., the President of the Miners' Federation, speaking recently at Barnsley, referred to Messrs. John Brown and Co., of Sheffield, having accepted the North-Eastern coal at 7s. per ton of 20 cwt. (6d. below the price per ton paid last year). He said he regarded this action as showing a violent desire to bring down prices; and he wished coalowners to thoroughly understand that ruinous competition and forced reduction of values would not exert pressure on the Miners' Federation of Great Britain to accept reductions of wages. Mr. Ben. Dean, J.P., speaking at a miners' meeting at Brownhills, last Tuesday, reminded the meeting that the arrangement made eighteen months ago was hastening to a close, and those miners who did not belong to the Trade Unions by the end of the present year would find it very difficult to join thereafter, for the Federation was bent on altering the conditions whereby men only thought of Trade Unionism when it suited them individually. Everything possible would be done to avert another dispute; but he might say that they had made up their minds that the 30 per cent. basis of 1888 should be the point below which wages should not go.

The Suggested Inquiry into the Water Supply of Shrewsbury.—At the meeting of the Shrewsbury Town Council yesterday week, the Water Committee submitted the draft of a letter to the Local Government Board in reference to a memorial which was recently sent to the Board by a number of ratepayers, in which, it will be remembered, it was asked that an inquiry should be held in reference to the supply of water for the town, which was said to be very unsatisfactory. The Committee's letter explained that, during the last few years, three schemes had been brought before the Council, and met with more or less approval from the members; but all had been condemned by the ratepayers, and the question was still unsolved. The water pumped from the Severn was liable to cause disease if used for drinking purposes; and the supply of drinking water from the wells had, therefore, been largely increased of late years by the erection of additional stands in the streets. The present water-works needed repair; but the Committee had not spent much upon them in consequence of the new schemes which had been under consideration, and all of which would necessitate entirely new works. The Town Council agreed with the memorialists that a Government inquiry into the whole matter should take place; and, after much discussion, they approved of the letter to the Local Government Board. It was agreed to ask for authority to borrow £2000 to improve the present supply of drinking water.

The Prevention of Lead-Poisoning by Water Supplies.—At a meeting of the Association of Yorkshire Students of the Institution of Civil Engineers yesterday week, Mr. O. J. Kirby, the Water Engineer of Batley, read a paper on "Waste of Water due to Lead Contamination, and Means of Preventing such Contamination." He mentioned that a newspaper correspondence on the subject of lead-poisoning had led to an increase in the consumption of water at Batley by more than 100 per cent., mainly through people allowing taps to run before drawing water. The author dealt with the various means of preventing the presence of peat in water, which was said to be the chief cause of the action upon lead; and he described his method (with that object in view) of preventing the first rush of storm water into the reservoir, by means of self-closing flood-gates. Mr. T. Hewson, the Borough Engineer of Leeds (who presided), said that the Leeds water, though containing a certain quantity of peat, was reported to have no action upon lead; and hence no special measures were considered necessary. Mr. M. Patterson referred to the objections to the use of other materials than lead for service-pipes, and said that English-made lead, containing a small proportion of silver, was far less readily acted upon than foreign leads. He also mentioned cases where, owing to the arrangements of the reservoirs, the author's method was inapplicable. In the case of Loch Katrine water, six months' exposure was found to stop all deleterious action on lead. Several other members took part in the discussion.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

After having buzzed for several years around the subject of the Corporation acquiring the undertaking of the local Gas Company, Bailie Lawson, of Stirling, has at last screwed up courage to table a definite proposal for the opening of negotiations. The situation has been rather forced upon him, for there is a movement with regard to the introduction of electric lighting in the town. Stirling has been selected by a Company as a likely place upon which to make an onslaught; and the subject of making terms is before a Committee, of which Bailie Lawson is Convener. I am not without suspicion that the sudden interest which Bailie Lawson has manifested in the procuring of a gas transfer, may be due to a desire to lower the terms of the electric lighting prospectors. His attitude towards the Stirling Gas Company has completely changed since he last addressed the Council on the subject. Then he was all severity; now he is all fawning and smiles. He moved the appointment of a Committee to consider and report as to the advisability of the Commission acquiring the gas-works for the burgh, and for the purpose of meeting with the Directors of the Gas Company with reference thereto. Having mentioned that in the neighbouring burgh of Alloa, the price of gas had, since the Police Commissioners took the supply into their own hands in 1878, been reduced from 4s. 7d. to 2s. 10d. per 1000 cubic feet, while the output had been more than doubled, he said that these things spoke for themselves; and he went on to counsel that they should approach the Directors in a friendly, straightforward, and honest way, and ascertain what they would sell for. The Directors were townsmen of their own, and had the same interest in the prosperity of the burgh. Provost Kinross, who is Chairman of the Gas Company, was present, and presided at the meeting of the Police Commissioners; and Mr. Macfarlane, another Director, was also there. But, in these altered times, there was no insinuation, such as I have seen in similar circumstances, of the Directors of the Gas Company being the enemies of the community. This would be a cheering state of matters, if there were a guarantee or a likelihood of future proceedings being followed out in the same spirit; but I fear that is wanting. I do not object to Bailie Lawson advising that the Gas Company should be approached in a friendly and straightforward way; but when he adds "honest" to his other conditions of mind, I feel that if I were a Director I should be inclined to regard the Commissioners as being in the position of protesting too much, and therefore to be suspected. However, the matter has not yet gone far. The Directors, while they may meet the Committee which the Commissioners appointed in a courteous and friendly spirit, need not give away their position. Nothing can be done now for nearly a year. My advice to the Directors of the Gas Company would be not to repulse the Corporation, nor do anything to provoke needless acrimony in any negotiations which may follow; but that when they come to be waited upon by the Committee of the Corporation, they should remember the direction given by the poet Burns to "gently scan your brother man," and not be too confiding until they are satisfied of the *bona fides* of the movement.

Objection has been lodged with the Town Clerk of Dunfermline to the adoption of the Burghs Gas Supply Act by the community. There were two sets of objections. One, signed by 23 ratepayers, being merely a request for the taking of a plebiscite on the question of whether they should purchase or not, was ruled to be incompetent; but the other, signed by 20 ratepayers, was in proper form, and objected to the adoption of the Act until a plebiscite should be taken. This is accordingly to be done. I understand that what has led to the production of these objections is chiefly the extraordinary trumpeting which there has been for the past two weeks, of the Edinburgh electric lighting installation. The ratepayers have begun to think that, were they to adopt the Gas Act and proceed to a transfer, they would be hastening the burgh to its ruin. How foolish! Even supposing that the Edinburgh electric lighting installation were the success which is claimed for it, there is no reason to suppose that Dunfermline would have a different experience from that of other smaller towns which have introduced electric lighting. Besides, I could understand occupiers or owners of property looking askance at a gas transfer, in view of the probability of their adopting electricity, and a contingent rate being imposed for the support of the gas undertaking; but that, according to the Lockerbie case, would be an erroneous fear, because the rate cannot be imposed unless in emergencies—what must take place is the raising of the price of the gas. The advent of electricity would therefore not affect those who might give up the use of gas; it would, were the price of gas raised, be only those who kept it on who would suffer. Nearly all of the objectors are working men; belonging to the class whom Provost Walker, of Dunfermline, spoke about recently as burning about a pound's worth of gas in a year. They need have no hankering after electricity. To them, occupying houses of from £10 to £15 rental, a gas contingent rate would only mean from 10d. to perhaps 2s. added to their taxes; whereas, were they to introduce electricity, according to experience elsewhere, the increase to their expenditure would be about £3 a year. These things should be put before the ratepayers before the plebiscite which the Law Commissioners of the Corporation are arranging for is taken.

This is the season when pantomime and burlesque hold the boards at our public places of entertainment—when the good fairies, flying in the face of all the recognized laws of Nature, lavish untold possessions upon a favoured few; and young, or thoughtless, people believe it all to be true, until they enter the real business of life, when the awakening comes. Was it something of the nature of a burlesque which Mr. Mackenzie, the Convener of the Electric Lighting Committee of the Edinburgh Town Council, laid before the Council on Tuesday? Summarizing his remarks, his statement amounted to this, that up to the present they had expended upon the electric lighting installation £138,000, of which the station cost £20,000, exclusive of £9681 spent on the site; and that the original estimate for the scheme, other than the site, was £70,000. On account of extensions, however, that sum had been considerably exceeded, although it was believed that the portion embraced in the original scheme would be completed, when all the accounts were paid, for several hundred pounds less than the estimate. It was proposed to spend £40,000 more on further extensions. They were able this year to pay their full complement of the sinking fund, as well as their interest and all their expenses; and they anticipated a balance of about £3000 besides. They were to be allowed to carry in their low tension mains a pressure of 500 volts, which meant that those mains would now be able to supply a radius of two miles instead of one mile, thereby quadrupling the capacity of the mains. With regard to their policy for the future, he had received a communication from Professor Kennedy, who anticipated that next year there would be a revenue of £28,000, and that the total expenditure, including charges on capital account, would be £18,000; leaving them with a balance in hand of £10,000. If, at the end of next year, they found themselves in as good a position as they anticipated by this report, he hoped the Council would see the wisdom of reducing the price of the current from 6d. to 5d. per Board of Trade unit, of reducing the cost of the street lighting from £20 to £18 per year for each lamp, and of abolishing meter-rents. He was perfectly certain that, in pursuing this policy, they would be doing the best thing for the undertaking. He would be very sorry if this great extension of the electric light were to have such an effect as to make the gas a non-paying concern; and he did not believe it would do so. Bailie Kinloch Anderson (who is Convener of the Works Committee of the Gas Commission) seconded the adoption of the report. He was glad to find that Mr. Mackenzie, even with his scientific knowledge in respect of electricity, admitted that gas would still have a place in the running. It was exceedingly pleasing to him, as it must be to a number of others who stood out so strongly for the Corporation doing this work themselves, to find that the undertaking had turned out so well. The proposals were agreed to. Now, all this may be as it is set forth; but it reads like a dream, when the experiences of other places are remembered. It would seem as if Professor Kennedy, or Mr. Mackenzie, or the Corporation, were the good fairy of Edinburgh, who had resolved to confer favours which, in other places where business methods only prevailed, and there had been nothing but disappointing returns at first, were not known. If that be so, it may account for one or two things, matters of detail, which the fairies never enter into—such as a definition of what is meant by "next year;" a statement of how much has actually been received, and whether the great surplus which is to be realized is actually in course of formation in the till, or is simply a calculation from the reading of the station meters; and the like. These are questions which may affect the balance-sheet considerably whenever it may be presented. I do not doubt Mr. Mackenzie's word; and I have no reason to be otherwise than delighted if he should be found to be right at the end of his year. But I am, from month to month, in a position to know the actual output and the actual drawings of the Gas Commission; and I see no reason why the electric lighting department, if it is the extraordinary success it is said to be, should not periodically report their progress. My mind is still open, because I am waiting for the figures.

How great a descent it is in this matter from Edinburgh to Glasgow, where, in the absence of any supernal power, the authorities are involved in a constant struggle with facts and experiences of a most stubborn nature. No magician's wand waves over them; and if they wish to keep themselves abreast of the times in things electrical—as they do wish—they must needs acquire information as to how to proceed, by the more ordinary and grosser methods of sending out deputations. The Town Council wrestled with two such subjects on Thursday. They were not stupendous questions, yet the human intellect, unaided, found it necessary, as one of the speakers said, "to philosophize on this matter for a moment." I am afraid his philosophy did not help the Council much, for the business was very quickly disposed of, whether well or ill, immediately afterwards. The net result of the business was that the Council—though grumbling that the Convener of the Sub-Committee on Electric Lighting had, without the consent of the Council (as must be done in cases of emergency) appointed himself and the Convener of the Gas and Electric Lighting Committee to attend the conference in London on Wednesday—homologated his action; and that the same Sub-Committee having submitted a minute stating that they had appointed a Special Sub-Committee "to take such action as they might deem expedient, in conjunction with a Special Sub-Committee of the Watching and Lighting Committee, appointed on the 18th inst. to consider the question of the electric lighting of the city, and particularly the kind of lamp to be used," they were instructed to take it back and amend it. Somebody had said something about a deputation going to Blackburn to see the lamps in use there; and this started the notion that the Special Sub-Committee were getting power under the minute to roam anywhere in search of information. That was more than could be tolerated, and although it was explained that no such object was in view, as the Committee proposed to experiment with different lamps in Glasgow, the Council were apparently doubtful on the subject, and sent the minute back to be amended so as to say what they did mean.

It is a curse of small places that so many jealousies exist that public men cannot take an unbiassed view of questions which come before them. An instance of this nature has occurred in Rothesay. There the gas-works are about to be transferred to a new site, which has been secured, and upon which there are mill buildings, some of which require to be taken away and others to be adapted for the purposes of a gas-works. Mr. A. Gillespie, of Glasgow, is the Consulting Engineer. The Committee of the Corporation divided the work at the new site into four sections, and advertised for offers. On the 9th inst. they reported to the Town Council that on Nov. 15 they agreed to let sections 3 and 4 to Mr. W. Hunter, whose offer was to give £150 for the material, and to execute certain work for £200. They also resolved that the materials in sections 1 and 2 should be disposed of in small lots. On Nov. 22, however, they met and rescinded their resolution with regard to sections 1 and 2, and agreed to accept an offer of £200 from Mr. G. Halliday for the whole of the materials. When this was reported to the Council, objection was taken to the Committee's work, on the ground that it had been irregular; and a motion was made against approval of the action of the Committee. The sale, it was maintained, should not have been by private bargain; and it was further stated that the price to be paid was about half what would

have been realized if the lots had been small enough to enable local tradesmen to offer. In the discussion which followed, the main element which moved the objectors was the local tradesman question. It was of little consequence to them that the Convener of the Committee was able to tell them that, the site and buildings having cost £2500, they had, by the sale of materials, reduced the cost to the burgh to £864, for which sum they had nearly two acres of land. This is certainly good management; and if the other parts of the work—the transfer of the plant, and the like—be done in the same reasonable manner, the community of Rothesay, albeit a few tradesmen may be disappointed, will have occasion to be gratified with the services rendered by their Manager (Mr. Ballantyne) and the Committee. The Committee had power to sell the materials, which consisted of stone, slates, wood, &c.; and so the Council could do nothing in the matter, and after having their say the objectors withdrew their motion.

The holders of bonds to the amount of £5000 over the harbour of Arbroath, part of whose security is the gas profits, and who say that the Gas Corporation, by reducing the price of gas, have taken away the gas profits and so deprived them of their security, had a conference with the Town Council on Monday. On behalf of the bondholders, it was submitted that the Town Council and the Gas Corporation being the same body, they had no right to take away the gas profits; and when, as a Gas Corporation, they did so, they must, as a Town Council, have known that they were cutting off the possibility of their fulfilling their obligations. It appears that the security which was given was that the surplus revenues of the town and the surplus gas profits, "so far as could be legally done," to the amount of not more than £250 a year, were pledged. Under their Act, the Gas Corporation are required to apply half their profits in the abatement of price; and the other half they must pay over to the Town Council, to be applied by them to public purposes. The half of the gas profits could thus be given; but the Gas Corporation is so financed that the profits do not, in any year, amount to more than a few pounds, and the half of that is unequal to paying interest upon £5000. It is, no doubt, hard upon the bondholders to be deprived of interest, and of the prospect of repayment of their capital; and there may be some question about the honour of the transaction, as to which it is explained that when the money was borrowed—in 1877—and for some years afterwards, the harbour was easily able to pay its way, and meantime the price of gas was reduced without any notion of defrauding the bondholders. While there was a disposition shown on the part of the Town Council to raise the money in some way, none of the Councillors went so far as to admit that what one of the bondholders proposed—viz., that the Gas Corporation were bound to raise the money—was feasible. Apart from every other consideration, the question, so far as it affects the Gas Corporation, is a simple one. They are obliged to fix the price of gas at a figure which, as near as can be estimated, will meet all cost of production and establishment charges. They cannot raise money avowedly for other purposes; and thus the obligation to the bondholders lies, not upon the Gas Corporation, but upon the Town Council—that is to say, on the rates, and not on the price of gas.

The Forfar Gas Corporation have been spoiled by the late municipal election. They had a stormy scene on Monday night over a proposal by a recently admitted member to curtail the powers of the Gas Manager. The proposal was that the power of dismissing men at the works be taken from the Manager, and vested in the Committee, and that Preston, the workman who was dismissed some time ago, should be reinstated. In the course of the discussion, the author of the proposal—a labour representative—altered his motion to giving the men who might be dismissed by the Manager a right of appeal to the Corporation. This is a right which, it was pointed out, the men had all along had; and the motion, in its altered form, was therefore unnecessary. It was accordingly rejected by the Corporation; only two members voting for it. The re-instatement of the dismissed man was lost sight of. Having finished that business, the Corporation took up the subject of an inquiry into the recent explosion at the works, by which the Manager (Mr. Forbes Waddell) was injured. It was reported that an Insurance Company, though explosions are exempted in their policy, had paid them £65 12s. 6d. to cover the loss sustained. The Corporation resolved to ask the Board of Trade to institute an inquiry into the occurrence; and, failing their taking it up, that an expert should be called in to report upon it to them. I understand that Mr. Waddell, having now recovered from his injuries, has been at work for three weeks; and that he is desirous an inquiry should take place.

Messrs. Donald Clerk and Son and the Barrowfield Iron-Works, Limited, have entered into contracts with the Glasgow Gas Trust for the supply of malleable iron plates and other ironwork required for the new holder at the Tradeston Gas-Works.

On Thursday morning five persons were found to be suffering from symptoms of poisoning by gas, in a house in Airdrie. They have now recovered. So far, although searched for, no damaged gas-pipe has been found.

The employees in Edinburgh of the Edinburgh and Leith Gas Company held their annual festival last night, under the presidency of Mr. R. Mitchell, the Engineer and Manager. Mr. Mitchell, speaking of the advance of the electric light, said that notwithstanding it, they recently sent out from the Edinburgh works, in one day, 5,600,000 cubic feet of gas, which was a record output for them—a figure which was never reached, even before the introduction of the electric light.

The Lord Provost of Glasgow (Sir James Bell, Bart.), in his annual statement on the municipal trusts of Glasgow, to which reference was made in last week's JOURNAL, has the following remarks on the public lighting of the city: "A year ago, I mentioned that an experimental installation of the Welsbach incandescent gas-light, consisting of ten lamps, had been fitted up in St. Vincent Street. This was so successful, and the results so satisfactory, that the experiment there commenced was extended during the year to Gordon Street, George Street, Blythswood Square, Bain Square, and Bridgeton Cross, until, by the middle of April, 82 incandescent burners had been fitted up. With the exception of Bridgeton Cross, where the excessive vibration [owing to the tramway and underground railway traffic] is very injurious to the mantles, the experiment has been sufficiently successful to warrant a further extension, and Bridge Street and Eglinton Street [a continuous line of thoroughfare nearly a mile long] will shortly be lighted with the Welsbach burners throughout their entire length. It has been shown that the illuminating power is much in excess of that produced by ordinary gas-burners, and the cost per candle power per annum greatly less. During the past year, also, a considerable addition has been made to the number of public street-lamps, principally within the recently annexed districts. Twelve months ago the number in use throughout the city was 13,243. There had been added within the year, taking, in addition to the new lamps erected, those which were situated in streets assumed as public, 429, making the present aggregate number 13,672. Additions are being made this year as required, where new streets are opened up or additional buildings erected. The number of common-stair lights has also largely increased, 1086 having been added to the number, for the charge of which the Lighting Department is responsible; making the present total 38,139. There are 112 electric street arc lamps now in use; being an increase of nine since last year—eight in Argyle Street and one in Trongate. These additional lamps were among those originally arranged for; but erection was delayed by the operations of the Central Railway Company. There are still four to be erected when the railway works permit.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 21.

Sulphate of Ammonia.—The slightly better feeling referred to last week has not been maintained. There has been a fair demand. But increasing supplies have been more than sufficient to meet it; and prices have, in consequence, again become rather easier. The closing quotations are £8 10s. to £8 12s. 6d. per ton f.o.b. at the usual shipping ports. In the forward position, buyers expect to purchase at so small a premium on spot values as to offer little inducement to sellers to engage themselves in advance; and business actually done has been comparatively small.

Nitrate of Soda is a shade firmer. There has been more doing on spot, at 7s. 6d. for ordinary quality up to 7s. 9d. for refined. The renewed efforts to effect a combination of producers have also induced a larger business in cargoes afloat, at 7s. 6d. to 7s. 7½d. for ordinary quality, and up to 7s. 11d. for refined—the latter for October sailing.

LONDON, *Dec.* 21.

Tar Products.—Your correspondent, Mr. Simon, will be gratified to see, from quotations below, that crude naphtha has now responded to its parity value with benzols. It has been somewhat tardy in doing so, as is invariably the case with crude materials, when sudden and unexpected variations occur in finished products; and the same may be said if the position were reversed. Mr. Simon treats the question as if crude naphtha were entirely composed of benzol, which, of course, is not the case. A crude naphtha showing 30 per cent. at 120° C., would in all probability give about one-third of its bulk in benzol; the balance consisting of toluol, solvent naphtha, and a large quantity of dead oil or light creosote. It is quite correct that benzol has advanced to the extent mentioned by Mr. Simon. But, on the other hand, solvent naphtha and creosote have remained quite stationary; and as these form the greater bulk of the crude naphtha, it will readily be seen that the advance in value of the latter article is not so great as Mr. Simon would make out. It is, of course, very difficult to obtain accurate values for crude naphtha, as the qualities of the article vary so very much, even when the percentage is the same at 120° C.; so that any average prices given should certainly not be taken as a basis for a contract without further particulars being given.

Benzols are not quite so strong; indeed, buyers for next half-year's delivery will not pay within several pence of prices quoted a week ago. Solvent naphtha is steady; but it has not participated in the improvement of benzols. Heavy naphthas are also in fair request. There is a little better demand for creosote and common tar oils. Anthracene is firm; and it is commonly reported that stocks, which have accumulated for several years, have now been cleared out. Carbolic acid is in good request at an increased price, owing to the Japanese making important purchases—it is said for explosives. Pitch is only moderate; and buyers are waiting to see lower prices. There are, however, no stocks in the country; and there is no reason why a lower price should be expected.

Prices current during the week are: Tar, 18s. 6d. to 24s. Pitch, nominal, 33s. 6d., west coast; 37s., east coast. Benzols, 90's, 2s. 3d.; 50's, 2s. Solvent naphtha, 1s. 4d. for shipment; 1s. 6d. for home consumption. Toluol, 1s. 10d. Crude 30 per cent. naphtha, 10d. Creosote, 1¼d.; Naphthalene, pressed, 45s.; drained, 27s. 6d. Cresylic acid, 1s.; crude, 10d. Carbolic acid, 60's, 1s. 9d.; 75's, 2s. Anthracene, "A," 1s.; "B," 9d. to 10½d. Prices quoted are usually subject to discount.

Sulphate of Ammonia shows no improvement. On the contrary, urgent sellers have accepted lower prices than were obtainable a week ago. It is galling to those who did not sell forward—naturally expecting better prices as the season advanced—to hear of deliveries being made on contracts at 20s. to 30s. above current values. Business has been done at £8 10s. to £8 12s. 6d. less 3½ per cent., f.o.b. at all shipping ports. For forward delivery, 5s. to 7s. 6d. more is offered. Gas liquor is quoted at 6s. to 7s. per ton.

This fact should be a little solatium to Dr. Brown, whose good-natured letter last week must excite sympathy. The fact is that spot value of sulphate does not regulate the price of ammonia liquor. The quotations given are either the record of important actual business done, or represent the prices at which such business is possible. Liquor sales are almost invariably made over a period; and when sulphate is unusually low, sulphate makers, Micawber-like, expecting something better to turn up—will always pay a better relative price for liquor for a forward contract. The price quoted is the value at the point of consumption. In case liquor has to be carried any distance, or when sulphate has to be shipped at considerable expense, and when acid, fuel, &c., are costly, of course quotations cannot possibly apply. One fact alone will convince Dr. Brown of the difficulty of making a price to apply all round. Notwithstanding the low price of sulphate, the Manchester Corporation have just declined to accept a tender for the liquor they

produce, which would have yielded considerably more than any recent quotation in the JOURNAL. Moreover, owing to much cheaper acid, as well as other necessaries to the manufacture of sulphate, manufacturers well situated can pay higher prices than formerly. A more important factor, and one Dr. Brown has probably not taken into his calculations, is the larger and ever-increasing quantities now being absorbed by manufacturers of ammonia for the ammonia-soda process, sal ammoniac, muriate of ammonia, galvanizing salts, white liquor ammonia for detergent purposes, which is a much larger business in Yorkshire and Lancashire than is commonly known, and last (but perhaps not least), beyond the ammonia contents, there are not a few buyers who purchase the liquor for the cyanides it contains—an industry which now is growing "by leaps and bounds." For these purposes, liquor is far more valuable than when sold for sulphate.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Only a very slow sort of business continues to be reported generally throughout the coal trade of this district. The better qualities, suitable for house-fire purposes, do not meet with anything like the average demand for the season of the year; and many collieries have a difficulty in keeping on full time, while stocks remain altogether untouched. The lower descriptions of round coal remain a drug; and the excessively low figures which are quoted in the open market to effect clearances, and which render business of any moment only practicable at altogether unremunerative rates, are compelling colliery proprietors here and there to consider the advisability of closing some of their common coal pits. For house-fire coals, prices are about steady at 10s. to 10s. 6d. per ton for best Wigan Arley; 8s. 6d. to 9s., for Pemberton four-feet and seconds Arley; and 7s. to 7s. 6d., for the lower qualities. Common round coals, for steam and forge purposes, are weak and irregular, with if anything lower prices taken, especially for shipping orders. On inland sales of good ordinary steam and forge coals, it is exceptional where more than 6s. to 6s. 3d. per ton at the pit is being got; while for shipment, there are plenty of sellers at 5s. 3d. to 5s. 6d., which represents about 7s. to 7s. 3d. delivered at the Garston Docks or High Level, Liverpool. Only special qualities fetch above these figures. Engine fuel is moving off readily at many of the collieries; and others are putting into stock. The inferior descriptions are the most plentiful, and are quoted very low. At the pit mouth, common Lancashire slack scarcely averages more than 2s. 6d. to 3s. 6d. per ton; and better sorts, 4s. 6d. to 5s.

Northern Coal Trade.—There has been a little more animation in the steam coal trade; but several of the collieries of this class are still without sufficient orders to enable them to work full time. Best Northumbrian steam coals are still quoted at 8s. per ton f.o.b.; and steam smalls are 3s. 9d., with a fair demand. As the holiday time will lessen the production, and allow stocks to be reduced, it may be hoped that the fuller work of the last few days will continue at the steam-coal collieries. In gas coals, the largest consumption of the year is now being experienced; so that the pits are working very fully. There have been enormous despatches of coal; the quantity sent from Tyne Dock alone having averaged above 20,000 tons daily for a week or so. Prices of best Durham gas coals still range from 6s. 6d. to 7s. per ton f.o.b.; but most of the quantity that is being sent out is on contracts that range from 6s. to 6s. 9d. per ton f.o.b. There is little alteration in the demand for manufacturing coals; and most of the contracts for the supply for next year are renewed at prices that do not materially differ from those that have ruled for the supply of the present year. The coke trade is steady; there being a larger inland consumption, though the export demand is low, as usual at this time of the year. The prices quoted give an average of about 14s. 6d. per ton f.o.b. for best Durham coke. In the gas coke trade, there is no alteration in price; but the large production is still well taken up, and contracts for next year are being arranged for manufacturing purposes on much the same terms as the present ones. Some of the inland gas companies have, however, increased their stock of coke lately.

Scotch Coal Trade.—Trade shows no change; and it is not expected that there will be any further alteration until January is well in—the trade outlook being not particularly bright, on account of the strike in the shipbuilding industry. The prices quoted are: Main, 5s. 10d. per ton f.o.b. Glasgow; ell, 6s. 9d. to 7s.; splint, 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 136,971 tons—a decrease as compared with the preceding week of 7204 tons, but an increase over the same week of last year of 1617 tons. For the year to date, the total shipments have amounted to 7,193,985 tons—an increase on the corresponding period of last year of 2,087,419 tons, but a decrease as compared with 1893 of 384,019 tons.

Additional Borrowing Powers for the Maidstone Water Company.—At a special meeting of the Maidstone Water Company on the 14th inst., the Directors asked for power to raise additional capital. It was also desired to consolidate the Company's stock at some future time. By the draft Provisional Order now before the Board of Trade, authority is sought to raise any further sum not exceeding £20,000 by the issue of new ordinary shares or stock. The Secretary (Mr. C. A. Case) said he did not anticipate any opposition to the Order; and the shareholders unanimously approved of its being proceeded with.

The Proposed Purchase of the Shoreham Water-Works by the Brighton Corporation.—Last Wednesday, the Water-Works Committee of the Brighton Corporation resolved that £150,000 should be substituted for £100,000 in the Bill promoted by them for the transfer of the Shoreham Water-Works, as the amount which the Corporation shall be authorized to borrow for the general purpose of water supply. Meanwhile, rumours of opposition to the scheme begin to be more pronounced; and, besides being privately discussed by the various local authorities concerned, the proposals of the Brighton Corporation are adversely criticized in public by gentlemen who possess undoubted knowledge of the question in all its bearings.

Redruth Water-Works.—The new works for supplying water to Redruth are approaching completion. The laying of the mains has been finished; and the reservoir is so far advanced that in all probability water will be turned into it in the course of a week or two. The reservoir is about 90 yards long and 60 yards wide, and has a depth of 33 feet.

Great Combination in the Alkali Trade.—It is authoritatively announced that negotiations which have been in progress for some six months past for a working arrangement between the three great Lancashire Alkali Companies—Messrs. Brunner, Mond, and Co., the United Alkali Company, and Messrs. Bowman, Thompson, and Co.—were completed last Friday.

Mansfield Gas and Water Works Extensions.—The Mansfield Town Council have accepted a tender (£1210) submitted by Messrs. Jonas Drake and Son, of Halifax, for a new retort-stack at the gas-works. It has been decided to make extensions of the water system to Pleasley and Tibshelf; and Mr. Amos Jenkins has been successful in obtaining the contract. His offer amounted to £5010.

Leeds Corporation Water Supply.—The City Engineer (Mr. T. Hewson) has reported to the Leeds Corporation Water Committee that the new 30-inch main from Swinsty to Arthington has been completed, with the result that there are now three gravitating mains between Swinsty and Eccup; and the total quantity of water which can be sent to Leeds without pumping at Arthington is above 18 million gallons per day—the daily consumption at the present time being 14¼ millions.

The Management of the St. Ives (Cornwall) Gas-Works.—The appointment of Gas Manager at St. Ives (Cornwall), vacant by the death of Mr. R. Johns, has been filled. At a meeting of the Town Council last Wednesday, the Gas Committee reported that three applications had been received for the post; and they recommended the appointment of a qualified gas engineer. The Council negatived the recommendation by eight votes to six, and selected Mr. Eldred Faull, a resident in the town, for the position. In the discussion, attention was called to the fact that the vacancy had not been advertised.

New Contracts for the Whessoe Foundry Company, Limited.—The large sulphate plant designed by Mr. A. Gillespie, of Glasgow, for Messrs. W. Baird and Co., of the Eglinton Iron-Works, Kilwinning, N.B., has been placed with the Whessoe Foundry Company, Limited. The whole of the recovery plant for Messrs. W. Baird and Sons and other large works in Scotland has been designed by Mr. Gillespie, and has, we understand, been most successful. The North-Eastern Railway Company have recently placed with the Whessoe Company an order for the steel tank, 74 ft. by 20 ft. 6 in., and the gasholder, 70 ft. by 20 ft., forming part of the extensions at one of their largest gas-works, the whole being designed and carried out by Mr. Head, their Chief Gas Engineer.

The Scarborough Gas Company's Debenture Stock.—At an extraordinary general meeting held last Wednesday, the Directors of the Scarborough Gas Company were authorized to issue from time to time debenture stock, for the purpose of clearing off the existing mortgages of the Company as these became payable, and of raising the whole of the moneys sanctioned by the Act of the past session. The Chairman (Mr. B. Fowler, J.P.) explained that the Directors thought they could get money on loan at less than 3½ per cent., the rate of interest now being paid on the mortgages. A resolution was also passed giving the Board power to raise £1998 in respect of a sum of £5994 of capital stock lately raised under the same Act. The Company have now about £38,000 of debenture stock.

The General Gas Company of France.—The report of this Company for the twelve months ending June 30 shows that the result of the working was a sum of 3,563,329 frs., the addition to which of the 168,928 frs. brought forward made a total of 3,732,257 frs. at the close of the financial year. Deducting the general expenses and the amount required to pay interest on the bonds, there was left a net balance of 2,630,601 frs. Further deducting the statutory reserve, the Directors' fees, and other charges, there remained a total of 1,333,501 frs., of which 300,000 frs. were distributed among the shareholders at the rate of 7 frs. 50 c. per share, and 850,000 frs. were added to the contingent fund; leaving 183,501 frs. to be carried forward. The dividend paid was 32 frs. 50 c. per share (500 frs.). The Company have ten stations in France, and nine in Belgium, as well as shares in various gas companies.

Tunbridge Wells Water Supply.—When the first borehole, rather more than 300 feet deep, was tested at Pembury, an average of 100,000 gallons a day for ten days was pumped up, and the depth of water was decreased about 25 feet. The Water Committee of the Tunbridge Wells Town Council then considered themselves justified in proceeding with another borehole; and they had one (passing through the same strata of about 70 feet of Wadhurst clay into the Ashdown sands) made; and two permanent pumps were erected, each being made to throw 10,000 gallons per hour, so that 480,000 gallons per day are being obtained, which is 80,000 gallons more than the actual requirements. After pumping 1,000,000 gallons, the water level was within 11 inches of where it was at the commencement of the tests; and the water, which was at first loaded with sand and clay, is now becoming clear and bright.

Extensive Water-Works Improvements at Worcester.—The Water Committee of the Worcester City Council have in contemplation the spending of some £30,000 in improving the supply. The works comprised in the scheme are: (1) A brick building for electric motors, pump wells, pumps, &c., and a bridge from the water-works to the island. Estimated cost, £1703. (2) A new engine-house and pumping plant, including two large steel boilers. Estimated cost, £7000. (3) A storage reservoir for 2 million gallons at Rainbow Hill. Estimated cost, £14,000. (4) Additional water-mains of larger size Estimated cost, £6900. These particulars were presented to the City Council, in a report by the Water Committee, at their meeting on the 20th ult.; and, on a suggestion from the Committee, the report was referred back to them, in order that they might obtain the opinion of an expert as to the best method of having the work done.

Launceston Water Supply.—The completion of the Windmill service reservoir and the bringing of water into it has practically put the finishing touches to the new scheme of water supply for Launceston, of which a description recently appeared in the JOURNAL (*ante*, p. 988). A supply of very fine spring water has since gone into the reservoir from the intake at Bray Down. The quantity has proved to be very little in excess of the demand. But it is believed that considerable leakage is occurring in the town; and measures are to be taken to detect and diminish this. In any case, a larger supply from the same source is available in case of need.

Penzance Water Supply.—The necessity for taking action for the improvement of the water supply was urged at a meeting of the Penzance Town Council last Wednesday week. Mr. J. Trenwith, who brought forward the subject, said they had saved water by adopting Deacon's waste-meters; and they had obtained an additional supply from a well which was sunk. In spite of this, they had to turn off the water from September to October; and Penzance was certainly not in the position, as regards water supply, that a watering place should be in. New houses were being built; and with these additions they had not enough water to give a full supply all the year round. He had in his mind three or four schemes which he was assured could be carried out for very little money; and he moved that the question be referred to the Sanitary Committee, with a view to the construction of a new storage reservoir. Mr. W. H. Julyan, who seconded the motion, said the statement that the water was turned off from September to October should be qualified. It was only from Sept. 20 to Oct. 5. As to the cost, he did not think it could be done for a comparatively small sum. If they improved the supply in a satisfactory and complete way, they could not do it for much less than £10,000. Mr. H. Trembath suggested that the present reservoirs were leaking badly, and that water from the reservoir found its way into the well which had been made. By the expenditure of a few hundred pounds, the reservoirs could be so enlarged as to carry them over a good many years. The motion was agreed to.

The Proposed Covering of Reservoirs at Southampton.—Major-General Crozier has held an inquiry on behalf of the Local Government Board, respecting an application by the Southampton Corporation for sanction to borrow £6000 required for covering the two open reservoirs on the common. In his opening statement, the Town Clerk (Mr. G. B. Nalder) mentioned that the two reservoirs in question had a holding capacity of 6 million gallons. In 1889 the Water Engineer (Mr. W. Matthews) reported to the Council upon the serious contamination of the water in the uncovered reservoirs; and he made similar reports in March, 1892, and January, 1894. Between May of this year and the present time, it had been necessary to clean out the reservoirs five times; and the cost of cleaning was £12, while half a million gallons of water were lost. Another great disadvantage was that, when they cleaned the reservoirs, they were left with but one day's storage. Evidence was given in support of the application by Dr. Percy F. Frankland, who stated that the Otterbourne water, in its natural condition, was of almost unsurpassed organic purity, but somewhat inconveniently hard, which defect was, however, entirely remedied by the process of softening adopted. As underground water, it possessed the great advantage of an almost uniform temperature at all seasons of the year. In order to preserve the special virtues of such water—viz., freedom from organic matter and uniformity of temperature—it was necessary that it should be supplied either directly from the well or after a minimum period of storage, and that, during such storage as it received, it should be carefully protected from all sources of contamination and from the access of light. The proposed covering would be to the benefit and comfort of the inhabitants of Southampton. There had been some opposition in the Press and the Council to the proposed expenditure; but no antagonistic evidence was advanced at the inquiry.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1288.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	22½—23½	..	4 9 5
100,000	10	,,	7½	Do. 7 p. c.	10	16½—17½	..	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¾—7¼	..	4 9 8
40,000	5	,,	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	268—273	+1	4 7 11
180,000	,,	,,	9	Do. New	100	210—215	+3	4 3 9
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	124—128	..	3 18 1
320,000	20	27 Sept.	11½	British	20	54¼—55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4 17 10
51,510	10	,,	8½	Do. 7 p. c.	10	19—20	+½	4 5 0
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	7¾—8¼	..	4 17 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	8¼	Cagliari, Limited	20	30—32	..	5 3 3
550,000	Stck.	16 Oct.	13½	Commercial, Old Stock	100	323—328	+1	4 2 4
165,000	,,	,,	10½	Do. New do.	100	251—255	+1	4 2 4
160,762	,,	16 Dec.	4½	Do. 4½ p. c. Deb. do.	100	147–152*	+6¾	2 19 2
800,000	Stck.	16 Dec.	13	Continental Union, Limited.	100	268–273*	−1	4 15 3
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	210–215*	..	4 13 0
535,000	Stck.	29 Aug.	5¼	Crystal Palace Ord. 5 p. c. Stk	100	127—132	..	3 19 6
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4 3 0
354,060	10	,,	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	295—300	+2	4 5 0
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	287—292	..	3 8 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	287—292	+5	3 8 6
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	169—173	+1	3 9 4
1,061,150	,,	16 Dec.	4	Do. 4 p. c. Deb. Stk.	100	135–140*	..	2 17 2
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	145–150*	+¼	3 0 0
908,000	,,	,,	6	Do. 6 p. c. do.	100	200–205*	+1	2 18 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	233—238	−2	5 0 10
75,000	5	16 Dec.	6	Malta & Mediterranean, Ltd.	5	6—6¼*	+¼	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p.c. Deb.	100	113—116	..	4 6 2
541,920	20	14 Nov.	5	Monte Video, Limited	20	16½—17½	..	5 14 3
150,000	5	28 Nov.	8	Oriental, Limited	5	7¾—8¼	..	4 16 11
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb	2	Para, Limited	10	1¼—1¾	..	11 8 6
420,000	100	2 Nov.	6	People's Gas of Chicago—1st Mtg. Bds.	100	105—110	..	5 9 1
500,000	100	9 Dec.	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	16 Oct.	7	San Paulo, Limited	10	11—12	−½	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	375—380	..	4 1 7
1,350,000	,,	,,	12	Do. B do.	100	308—313	..	3 16 8
308,685	,,	,,	13	Do. C do.	100	325—330	..	3 18 9
800,000	,,	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	250—255	+20	4 10 2
				WATER COMPANIES.				
746,021	Stck.	26 June	10¼†	Chelsea, Ordinary	100	297—302	..	3 7 10
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	215—220	..	3 3 7
654,740	,,	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	16 Dec.	6½	Grand Junction	50	110–114*	..	2 17 0
708,000	Stck.	29 Aug.	12	Kent	100	310—315	..	3 16 2
1,043,800	100	26 June	7½†	Lambeth, 10 p. c. max.	100	247—252	..	2 17 8
406,200	100	,,	7½	Do. 7½ p. c. max.	100	210—215	..	3 7 6
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
500,000	100	14 Aug.	12⅝	New River, New Shares	100	380—390	..	3 3 7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	16 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	150–155*	+1	3 17 5
126,500	100	,,	6	Do. D 7½ p.c. do.	100	139–142*	+1	4 4 6
1,155,066	Stck.	16 Dec.	10	West Middlesex	100	288–293*	..	3 8 3

† Next dividend will be at this rate.

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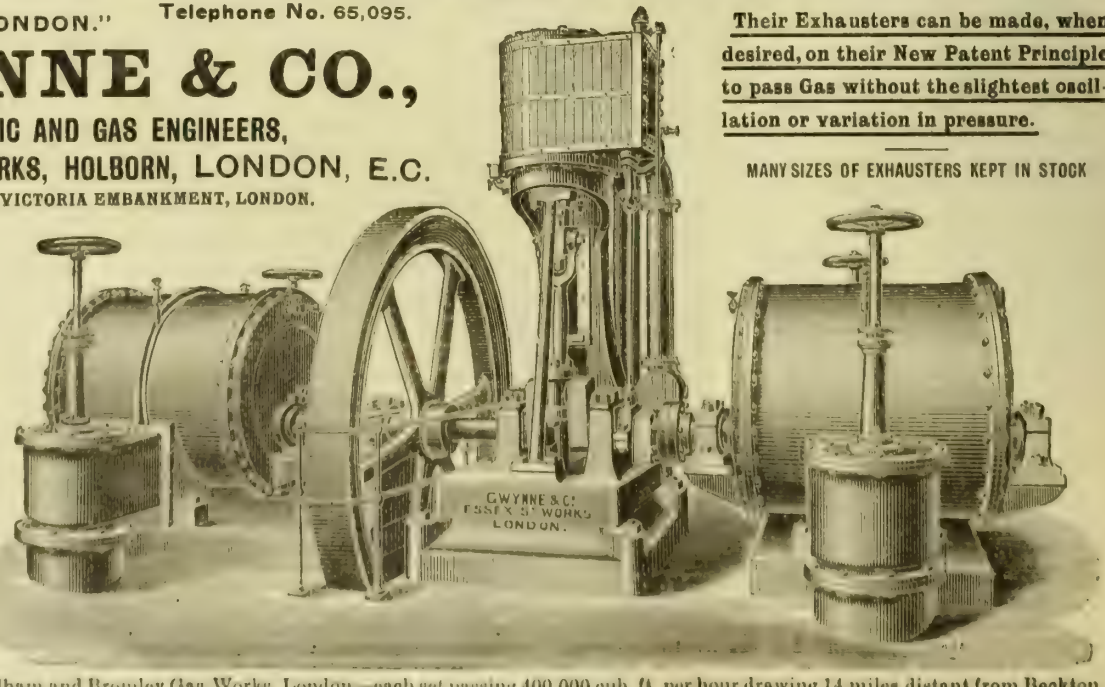

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EDITORIAL NOTES.

A Retrospect of the Year 1895.

ONCE again the course of time brings us to the break of the year, when it is natural to look back over the series of events that will be recorded in history under one date, before contemplating the future and its possibilities with another. The "year that's awa'" might be discussed from the standpoints of an infinite variety of experiences, under as many aspects. It is enough for us here to offer a few reflections upon it from the point of view of the observer of the course of the nation's trade and commerce in general, and of that of the national industry of gas supply in particular. The year has been one of marked improvement of trade everywhere, with the usual concomitants of feverish speculation and interruption by labour troubles. The peace of the world was maintained, with the exception of a little forcible clearing up of the misunderstandings between China and Japan, which had appeared to bar the way of civilization in the Far East; and the extension of commercial enterprise into what were previously waste regions in South Africa and Western Australia, with other more obscure causes, had the effect of considerably swelling the volume of the world's manufacturing output and trade. A very striking feature of the past year was the cheapness of money, leading to the unprecedented appreciation of first-class investments. Money was almost unlendable; while at the same time there was a great deal of gambling in mining and other highly speculative stocks and shares. The state of the investment market was brought under the notice of the authorities of the Royal Courts of Justice by the discovery of the necessity for reconsidering the official rate of interest to be allowed on money under the control of the Courts, which has hitherto been 4 per cent. It had become impossible for trust funds to be put out upon convertible securities yielding much more than 2 per cent. The same story is told by the remarkable rise in the value of gas stocks. At the beginning of the year, Gaslight and Coke "A" stock stood at about 250; it is now worth close upon 300. South Metropolitan "C" stock rose during the year from 300 to 330. Either Company can now borrow money, by selling debenture stock, at very little over 2¾ per cent. It may be, and probably is, true that some of this improvement had its origin in the special advertisement that gas property received during the year, as a result of certain parliamentary proceedings to be discussed farther on; but it must be ascribed mainly to the unprecedentedly high position of all "gilt-edged" investments. Throughout the spring and summer, there was little or nothing doing in financial circles. But after Midsummer, there came a remarkable revival of speculation; and the usual autumn holiday season was consequently abrogated so far as "the City" was concerned.

Several of the new companies launched about this time were in connection with some branch of the gas industry. There were gas-meter and gas-burner companies started with a view to doing business at home and abroad; but not—so changed are the times—a single electrical concern of any sort attempted to compete for the favour of the investing public. Remembering what was done in the palmy days of "Grandfather Brush," this revulsion is indeed noteworthy. Incandescent gas-burners and coin-controlled gas-meters were the favourites of company promoters on the side of gas. Welsbach light finances appeared to reach an unheard-of height of prosperity; and this had the usual result of bringing many rivals into the field. The vicissitudes of some of the joint-stock ventures of the day are worth recording. The past year saw the end of the North British Water Gas and the Wenham Lamp Companies; and a curious speculation, started with a great flourish with the object of turning smoke and factory fumes into gold, likewise came to speedy grief. The arrest of the prime mover in the Liberator frauds, and the proceedings which eventuated in his conviction and punishment, drew attention to the inadequacy of building societies as means for the safe and profitable investment of small savings; and an impetus was thereby imparted to the movement for enabling small capitalists to acquire corporation and gas stocks. On the whole, therefore, the financial history of the year has a considerable degree of interest, even for the observer who

was neither one of the few who made a fortune nor of the larger contingent who lost money.

A discussion was started early in the year by an experienced accountant upon the subject of the indebtedness of local authorities and the policy of debt-reduction which the law imposes upon them. The debate was revived later on in the JOURNAL, with particular application to the comparative circumstances of gas companies, whose capital is irredeemable, and local authorities owning gas undertakings, whose capital has to be wiped out within a stated period. Not very much resulted from this ventilation of the subject, beyond, perhaps, the setting forth of the academic principle that it would be desirable if all gas capital, however held, represented assets. The effect that such a principle would have upon taxation and rating was not considered.

Reductions in the price of gas were recorded during the year in many places. The South Metropolitan Company succeeded, after a troubled interval of six years, in getting back to the lowest price—2s. 3d. per 1000 cubic feet—at which gas has ever been sold in London. The Manchester Corporation distinguished themselves by making a sweeping reduction of 3d. per 1000 cubic feet in the charge for gas over the heads of the majority of their Gas Committee. Meter-rents were abolished by The Gaslight and Coke Company, and also by the Manchester and Leicester Corporation Gas Departments. Almost everywhere the increased price of gas due to dearer coal and labour began to yield to the influence of enlarged consumption and economies in manufacture; so that the selling rates of 1889 were restored, or nearly so. A terribly severe January sent up the demand for gas and coke enormously; and the start thus imparted has been generally maintained so far as gas consumption is concerned. Coke has, however, been saleable only at lower prices. The Metropolitan gas coke market has, indeed, suffered greatly from the depressed condition of the portland cement industry, which used to take upwards of 25 per cent. of the output of the London works, and is reported to be in course of being ruined by the German bounty system.

This topic leads to that of the gas residuals markets. Sulphate of ammonia was never in worse case than at the present time; having fallen in value during the year from £11 to £8 10s. per ton, and consequently being hardly worth making, as a matter of business. Opinions differ as to the cause of the collapse; but, as usually happens, such a downfall is probably due to a combination of circumstances. Certain big producers are suspected of having overreached themselves in the endeavour to force up the price, and being consequently left with stocks that it is equally ruinous to sell or to keep. Then, again, the nitrate "boom" of some years ago has hopelessly given way; and the agricultural interest is too depressed to enable farmers to sink money in chemical manures. From whatever causes arising, the painful fact remains in evidence that the least profitable of gas residuals last year were coke and ammonia. Strangely enough, as the year waxed and waned, a lively demand arose for pitch and benzols, to say nothing of other tar products. Benzols especially, worth at one time about 1s. per gallon, are now nearly touching 2s. 6d.; and dealers continue to make active inquiries after the volatile commodity.

Gas coals dropped in value during the year by about 1s. per ton, which, of course, was one of the sources of weakness in the coke markets, wholesale and retail. Another raw material of gas manufacture which has grown into importance of late—mineral oil—has passed through several somewhat disquieting changes. So far as can be ascertained, it does not appear likely that oil suitable for gas making will advance from the figure at which it is possible for gas manufacturers in the United Kingdom to touch it; but burning oils have shown at least two determined "booms" during the year. The first was based upon the report that the American oil-fields were showing signs of exhaustion; and it lasted until common lamp oil doubled in price, when it came to an end. The second is still with us. These phenomena are ascribable to the remarkable success of the Standard Oil Company of America in getting control over the bulk of the lamp-oil supply of the world, which in some circumstances enables them to make the market price to suit themselves. It is not so much a "ring" as a monopoly, and a stronger one than could be conferred by Royal patent or safeguarded by statute.

With regard to "rings," the year witnessed a notable triumph of Mr. George Livesey over certain tentatives of makers and dealers in gas-works necessaries in this direction. Having reason to suspect these traders of a design to combine with the object of artificially raising the prices of their commodities as against gas undertakings, Mr. Livesey declared in set terms that, unless the idea was abandoned, the South Metropolitan Company would make everything they wanted for themselves. The threat was effectual. While Mr. Livesey's name is before us in this connection, it will be convenient to put upon record another incident of the year which turned upon a manifestation of the same pervasive and powerful personality. It was a scheme of legislation for the South Metropolitan Company, which, though it proved abortive for the occasion, is again to the fore in a slightly modified form.

The South Metropolitan Gas Company promoted a Bill in Parliament last session for the purpose of consolidating and unifying their capital stocks upon a 5 per cent. basis, as had been permitted in other cases. Mr. Livesey wished to include in the Bill a scheme for enabling employees of the Company, interested in it as holders of stock by virtue of the Company's profit-sharing system, to be directly represented upon the Board. The Bill as submitted to Parliament, however, contained no such provision, though the statutory notice of it had been duly published. An irregular disclosure of the nature of the scheme in a London newspaper led to a revelation of Mr. Livesey's wishes at the ordinary general meeting of the Board in February, when the Directors were found to be divided on the subject, with the Chairman in the minority. Later, the unusual course was taken by the then President of the Board of Trade—Mr. Mundella—of moving in the House of Commons an instruction to the Committee on the Company's Bill to consider and insert therein the Livesey provision. But the Bill was withdrawn upon the rejection by the Committee, at the instance of the London County Council, of the capital consolidation clauses. So the workman-director scheme fell through, for all the encouragement it received outside the South Metropolitan Board. But, as already stated, it is going forward again—Mr. Livesey having so far carried his point at the last meeting of the Company; and the Bill is once more upon the stocks, this time with the consolidation of the capital proposed upon a 4 per cent. basis. A sharp controversy upon the subject of the workman-director was carried on through our "Correspondence" columns by the Chairman of the South Metropolitan Company and Colonel Makins, the Governor of The Gaslight and Coke Company, who sought to prove that the idea was impracticable, uncalled for, and pernicious.

The general legislative record of the year is poor, owing to the defeat of the Government in the middle of the session, and the consequent interruption of parliamentary work by a General Election, which changed the Administration. It was impossible for those interested in gas supply and kindred undertakings to regret the change, because the old Government was weak enough to be under the influence of Labour and other agitators, who sought to alter the law of employers' liability for accidents to workmen, the Borough Funds Act, the Valuation of the Metropolis Act, and other statutes for the protection of the interests of Capital from socialistic assaults. The new Administration are pledged by their actions while in opposition to deal with such questions as that of employers' liability with due regard to the preservation of freedom of contract. Among the new statutes that came into effect last year was the Notice of Accidents Act, which originally applied to gas-works in course of construction and in operation. By the Factory and Workshop Act, 1895, however, the former Act was repealed in so far as it applied to gas-works—a striking illustration of the mystifying habit of Parliament that has been denounced under the name of "legislation by reference," by which a clause a few words in length slipped into an Act may change a prior statute bearing a totally different name.

The Private Bill legislation of the year as regards gas supply included several important measures authorizing the transfer of gas undertakings to local authorities. Among these were the Chesterfield Gas and Water Board Act, which directed the undertaking of the Chesterfield Gas and Water Company to be sold to a composite Board, at a price to be ascertained by an open valuation now being arranged for. This Board will be obliged to app all surplus profits to reducing the price of the supp

The Ambleside undertaking was also to be transferred by arbitration. The Hebden Bridge and Mytholmroyd Gas-Works were transferred at an agreed value, based upon 27 years' purchase of the maximum dividends. The Brighouse and Clonmel works were also the subject of Transfer Acts. The Accrington undertaking was taken over by a Board; and several other proposals of the same character were set on foot and discussed with a view to future action. A Bill of the Dublin Corporation containing proposals inimical to the Alliance and Dublin Consumers' Gas Company was abandoned in consequence of an adverse poll of the ratepayers.

The Law Courts were occupied with several important suits affecting or in connection with gas supply, though there was no very heavy gas litigation. The Commercial Gas Company raised a question regarding the action of the Chief Gas Examiner for London. Two gas managers were fined for offences under the Alkali, &c., Works Regulation Act. The Hertford Gas Company had a painful experience in regard to the management of their affairs, which subjected them to prosecution under the law relating to the publication and deposit of accounts. The South Metropolitan Company were cast in damages in a small amount in connection with a street explosion. The working of the prepayment meter system gave rise to several Police Court cases of a novel character. The Croydon Gas Company were successful in an important and instructive assessment appeal. The progress of the incandescent gas-burner gave occasion for the commencement of much patent litigation still in course of development. One such case—that of the *Incandescent Gas-Light Company, Limited, v. Cantelo*—was brought to an issue, and served to define the rights of patentees in respect of the conditions imposed upon the sale of patented articles.

The new discoveries and inventions of the year can, as usual, be distinguished with difficulty from the progress made by improvements and processes still novel yet not absolutely new. In gas-works, the great feature of the year was the extension of carburetted water-gas production, and of mechanical and other labour-saving appliances for coal-handling and carbonizing. Carburetted water-gas plants of two leading patterns occupied much attention in gas engineering circles, both for carburetting coal gas and for production in bulk. Sloping retorts, thanks largely to the skill and devotion of the Brentford Company's engineering staff, held their ground and even made some headway; and mechanical stoking for horizontal retorts, after two leading types, grew greatly in favour. Purifying plant and methods showed some tendency to modification in the direction of the abolition of the water-lute and the use of Weldon Mud for "check" boxes. The construction of columnless gasholders proceeded apace. In gas distribution and utilization, the year was memorable for a great expansion of the coin-controlled meter system, and the extraordinary popularity of incandescent burners for both indoor and outdoor lighting. The introduction of carbide of calcium as a source of acetylene upon the commercial scale created a considerable sensation. Much research into the principles of coal-gas enrichment was carried out; and some remarkable results were published by Professor Vivian B. Lewes, Dr. R. Forbes Carpenter, Dr. Dvorkovitz, and others; and an experiment by the last-named expert at Bradford gave rise to an acute controversy. At the same time, the expediency of enriching gas by any process was made the subject of question by advocates of cheap gas; and a good deal of ill-directed agitation on the subject arose in Liverpool. The question of the photometrical standard of light was much to the front during the year; and the Committee appointed four years previously by the Board of Trade to investigate this matter reported in favour of the substitution, for the parliamentary standard candle, of Dibdin's 10-candle pentane lamp standard. The application of coal gas to the working of tramcars was further developed by experiments at Croydon with the Lührig system of propulsion by this agency.

The state of Labour during the year would occupy a long article to even imperfectly put upon record. The "New Unions" of unskilled workers lost ground very seriously, albeit some of them were still strong enough in places to give trouble. But the arrogance of their professional leaders seemed to increase as they felt the ground crumbling away from under their feet, until the shock of the General Election threw down many, and destroyed the factitious prestige of the rest. One or two disastrous lawsuits, moreover, showed Trade Union officials that "the liberty of the subject" is still something more than a phrase in this country. At the Trade Union Conference, held at Cardiff, professional agitators having no real connection with the cause they exploit received signal discomfiture; though subsequent events go to show that the socialistic taint has struck too deeply into the system of Trade Unionism to be extirpated by the removal of those who carried the infection. Insensate strikes broke out among the Leicester boot operatives, and, towards the end of the year, in the engineering branch of the shipbuilding industry of the Clyde and Belfast. The former failed; the latter is still in progress—the mediation of Lord James of Hereford having been ineffectual in restoring peace. In both instances, the outbreak showed the employers have at length learnt the wisdom of combined action against the common foe.

Several more or less disastrous accidents and casualties happened in connection with the manufacture and distribution of illuminating gas. Early in the year, several cases of poisoning by the inhalation of escaped gas occurred in Glasgow; and the year witnessed the appearance of a novel trouble in the shape of gas explosions in electric street culverts, which formed the subject of Government inquiries that led to remarkable disclosures, duly recorded in our columns at the time. A serious explosion traceable to leakage from a broken gas-main in a court off the Strand in October, led to the death of a Metropolitan fireman, and caused great destruction to some old house property, the ultimate responsibility for which is not yet settled. A purifier explosion at the Dalmarnock gas-works, unattended by loss of life, was the occasion of the holding of a Government inquiry under the new law applying to such matters. A slighter one, due to the carelessness of workmen, happened at the Poplar gas-works.

The technical associations last year maintained their usual activity, usefulness, and popularity. The Incorporated Institution of Gas Engineers held a most successful meeting in May, in the new building of the Royal United Service Institution, under the presidency of Mr. C. C. Carpenter; and the autumn meeting of the same Institution, in Liverpool, was the most satisfactory gathering of the kind in the annals of the organization—thanks mainly to the good offices of Mr. William King. The Incorporated Gas Institute meeting was held in Edinburgh, under the presidency of Mr. Robert Mitchell, and was very largely attended. Mr. Joseph Hepworth resigned the position of Honorary Secretary of the Institute, and was succeeded by Mr. A. Dougall, of Tunbridge Wells. The Secretary (Mr. F. G. Burfield) also resigned; but his successor has not yet been appointed. The North British Association and the various District Associations did fairly during the year, with the exception of the South-West of England, which opened negotiations for amalgamating with its near neighbour, the Southern District Association. Some of the chemical and other scientific societies were also made the recipients of good papers on subjects connected with the gas industry.

The year was remarkable for the number of personal changes in the ranks of the gas engineering profession, which are too numerous to be recited here. Among the most important, however, may be chronicled the retirement of Mr. J. Hepworth from Carlisle, to be succeeded by Mr. C. B. Newton, from Rotherham. Mr. T. Whimster relinquished the management of the Perth gas undertaking, and was succeeded by Mr. A. Wilson. Mr. W. Barratt, late of Grantham, was followed by Mr. R. G. Shadbolt; Mr. H. Ashton Hill left Wallasey, and was succeeded by Mr. J. H. Crowther. Mr. H. Townsend left Plymouth, and received the Wakefield appointment. Mr. F. F. Farrand was promoted to succeed his late chief, Mr. George Garnett, at Ryde. Mr. T. Duxbury resigned his position at Darwen, and Mr. A. E. Loam did the same at Stalybridge. There were some important changes in the administration of the Imperial Continental Gas Association. The Right Hon. Sir Julian Goldsmid, Bart., M.P., retired from the chairmanship—Mr. T. H. G. Newton succeeding him; and Mr. R. S. Gardiner resigned the secretaryship, Mr. G. F. Thompson being appointed in his stead.

Many well-known names are included in the death-roll of the year. Mr. Robert Jones, late of the Commercial Gas Company; Mr. Thomas Hardick, late of Salisbury; Mr. Denny Lane, of Cork; Mr. W. Thorman and Mr. John

Thorman, were all names—and several of them something more—familiar and respected in the gas engineering profession. Mr. A. Willey, of Exeter, did not long survive his father, the founder of the firm. Mr. John Clapham, of Keighley; Mr. R. W. Brownhill, the first patentee of coin-controlled gas-meters; Mr. C. H. Parkes, the first Government Auditor of the London Gas Companies' accounts; Mr. George Flintoff, the most notorious gas agitator of any period—all these in their day filled a space in the striving technical and commercial world, and are now at peace.

Little more remains to be said concerning the past year, which appears, from the cursory history we have been able to glance at here, to have been as full of effort and incident as any that have gone before it. The volumes of the JOURNAL which cover it are fuller of matter than most of their precursors in the series, which shows that a great deal has been going on and talked about in connection with the industry to the chronicling of which its space is devoted. This is a good sign. Turn we now to the year that opens for us with our next number, in the confident hope that, in the future, endeavour and realization will not fall below the standard of any past time.

WATER AND SANITARY AFFAIRS.

The Principal Events of the Year 1895.

THE year now expiring opened with the prospect of a heavier onslaught than at any previous time on the part of the London County Council against the Metropolitan Water Companies. The eight "Transfer" Bills for the acquisition of the Companies' undertakings were ready for introduction into Parliament; and it was evident that if these measures received the sanction of the Legislature, very serious loss would accrue to those parties who had invested money in the undertakings thus marked out for spoliation. But there was a crisis coming on which affected the position of the County Council. In the month of March, the Council would have to undergo the ordeal of a fresh election; and this circumstance had the effect of eliciting a distinct declaration of policy from each of the two parties who sought to have the predominance at Spring Gardens. The Progressives were all in favour of the Transfer Bills, and contended that the water supply belonged solely to the County Council. On the Moderate side, there was a tendency to favour the idea of control rather than acquisition; and there was a recognition of the importance attaching to the outer areas. What may be termed the official manifesto of the Moderate party demanded that, in proceeding to acquire the property of the Water Companies, there should be clear evidence that the ratepayers would not be made to suffer. Failing such evidence, the Moderates proposed that steps should be taken for promoting a Bill to constitute a Statutory Committee, which should represent not only the Administrative County, but the whole of the outside districts concerned; this Committee to exercise "control" over the Companies, so as to secure alike to the consumers and the ratepayers "every possible advantage and convenience."

In the light of more recent events, it is interesting to look back and review the ideas thus expressed at the beginning of 1895. What the ratepayers thought of the matter may be judged by the result of the March elections, by which the large Progressive majority on the Council was made to disappear, and the scale was turned in favour of the Moderate party. It was only by the aldermanic machinery that the Progressives were able to maintain their footing in the Council. The vote of the municipal electorate was clearly against them. London was not led astray by the brilliant promise of what should accrue if the property of the Water Companies was "transferred" to the Council. Still, there was the parliamentary campaign to be passed through; and there was just the chance that Progressive tactics would be successful in a quarter where so many sympathizers were to be found. The Council had even looked beyond the session of 1895, if not to something still more remote; for just before the election of the new body, the old Council—the second in order of time—adopted a series of recommendations from their Water Committee, in contravention of the report of the Royal Commission presided over by Lord Balfour of Burleigh. These recommendations proposed that, instead of agreeing to the construction of large storage reservoirs in the Thames Valley, the Council should authorize the preparation of a scheme for the introduction of an entirely new supply from a different source, with the view of an application to Parliament for the necessary powers to carry it out. This proposal forms part of the work on which the Council have continued to be engaged. It was still in the days of the second Council, and immediately after passing the recommendations of the Water Committee for seeking a fresh source of supply, that two of the Transfer Bills passed their second reading in the House of Commons—one of them having reference to the Lambeth Company, and the other to the Southwark and Vauxhall Company. The fervour with which Mr. J. Stuart and others who acted in the interest of the County Council pressed forward the second reading of these Bills, seemed to suggest some fear lest the elections then close at hand should change alike the constitution and the policy of the Council. By a resolution of the House of Commons passed only two days before the County Council elections, the second reading of the six remaining Transfer Bills was postponed until the 3rd of May.

A phenomenal frost which prevailed during the month of February, and nearly up to the middle of March, was the cause of much embarrassment to the Water Companies, not only in London, but in other parts of the kingdom. Water remained frozen in all the communication pipes for several weeks; and the flow in the mains being thus impeded, the water in some of those which were not at the lowest depth became also congealed. The London Companies did their utmost to mitigate the consequences. After they had done all that lay in their power, and expended many thousands of pounds in the effort, a Government inquiry was instituted, presided over by General Scott, who held several sittings in different localities, and took a large amount of evidence. This unfortunate affair was turned to account by the ever-ready critics of the London Companies; and it was made to appear as if the freezing up of the supply was due in some way to the fact that the undertakings were not possessed by the County Council. But it was pointed out that towns where the water supply was the property of the local authorities fared no better than London, and in some cases even worse.

In the month of April, a debate extending over a period of three hours was brought on in the County Council by Mr. Benn, who moved that it was desirable to press forward the Bills for the purchase of the Lambeth and the Southwark and Vauxhall Water Companies "with all "possible speed." Sir J. Lubbock moved an amendment requesting information as to the financial aspects of the proposed purchase. The amendment was rejected, and the motion was carried by a large majority. On April 29, an unreasonable arrangement was effected in the House of Commons, as moved by Mr. J. Stuart and supported by the (then) Government, whereby the Bill of the Chelsea Company, asking for power to raise £50,000 of additional capital to enable them to lay down a new main, was referred to the same Committee as the Transfer Bills relating to the Lambeth and the Southwark and Vauxhall Companies. A Bill promoted by the Lambeth Company was referred in like manner. A policy of adjournment was applied to the four outstanding Transfer Bills; the order for their second reading being postponed on May 6 to June 13.

On May 14, the Hybrid Committee, presided over by the Right Hon. D. Plunket, commenced their inquiry into the two Transfer Bills which had passed their second reading, and the Bills of the Chelsea and Lambeth Water Companies. The first Bill to be dealt with was that for the transfer of the Lambeth undertaking. At the close of the day's sitting, the Chairman stated, for the guidance of Counsel, that the Committee intended to follow the line laid down in the report of Sir Matthew White Ridley's Committee in 1891—that it was desirable to establish a single public representative Water Authority for the whole of the Metropolis. This announcement was referred to by Mr. Balfour Browne, Q.C., on the opening of the second day, as if it pointed to the London County Council. But Mr. Plunket gave a kind of hint that Mr. Browne was travelling a little too fast. The words in the report of the Committee alluded to were to be taken for what they were worth, and no further construction was to be put

upon them. At a subsequent sitting, Mr. Pember, Q.C., who appeared for four of the Water Companies, proposed to deal with the question as to whether the County Council would be "the best body" to have charge of the Metropolitan Water Supply. But the Chairman considered that this was out of course, seeing that in no one of the many petitions against the Transfer Bills was there any alternative suggested as to the creation of another authority. There was, in fact, no counter-scheme; and the Committee must take the Bill simply as they found it. Another conclusion showed that if there was to be one central authority, the principle of purchase at once ensued. The extraordinary arbitration clause in the Bill was not rendered more pleasant or equitable in appearance when viewed in the light of the evidence given by Mr. Cripps, the Parliamentary Agent of the County Council. Neither was there any improvement in the nature of the conditions by which the undertakings were to be transferred before the price to be paid for them was settled. A critical stage was reached on the thirteenth day of the sittings; the Committee then deciding that the Arbitrator, instead of being restricted to such considerations as detracted from the value of the Company's property, should be at liberty to take evidence on all the points concerning which he thought proper to receive information. Upon this the County Council proceeded to draft an alternative clause, which was submitted to the Committee on June 25. At that sitting, the Chairman said the Committee were disposed to put a clause in the Bill which would debar the Council from purchasing one or more of the undertakings without acquiring the whole. It was also stated to be the intention of the Committee to give the Arbitrator an optional power to award a sum in respect of compulsory sale. But a crisis of an Imperial character was now overshadowing the scene; and at its twenty-first sitting, the Committee declared its own dissolution, just five days before the dissolution of Parliament.

There was thus the appearance of a large sacrifice of time, trouble, and money. Yet it was rightly declared in *The Times* City Article that the labours of the Committee, and of others engaged in the inquiry, had "not been thrown "away." Facts had been brought to light, and principles had been established, which could not fail to influence the future deliberations of Parliament. A fresh test of public opinion was now brought to bear in respect to the question of the Metropolitan Water Supply. Candidates for the suffrages of a London constituency based their claims partly on the course they were prepared to take with regard to this particular subject. But the London electors failed to show their gratitude to the Progressive candidates; the latter being, as a rule, rather unlucky. The *Daily Chronicle* was sorely disappointed, and wondered what had happened to the London working man. The plunder of the Water Companies proved to be less popular than was expected. But the skies gave some help to the adversaries of the Water Companies. Phenomenal frost was followed by equally phenomenal heat, aggravated by a prolonged deficiency in the rainfall. In July, the supply of water to the East London district was greatly reduced. Parliament, in the session of 1893, influenced by the County Council, who were aided by the Government, had refused permission to the East London Company to enlarge their capital so as to provide funds for an extension of their works, then declared to be necessary in order to secure an adequate supply. The urgency of the case and its direful character were at length unmistakeably displayed. The distress among the East-enders was all the greater, owing to the general abolition of house cisterns. Of course, every attempt was made to bring the East London Company into disrepute, although the Company were rendered simply helpless by circumstances over which they had no control. Their Bill had been passed in 1894; and not a day was lost in commencing the execution of the necessary works. But a year had gone by; and the works which could have prevented the calamity that befell the people were just so much too late for that purpose. A striking circumstance occurred in connection with this affair—the new President of the Local Government Board, Mr. Chaplin, paying a personal visit to the East-end, to satisfy himself as to the degree of inconvenience the people were suffering, and as to the character of the works which were then in hand. Mr. Chaplin seems to have been impressed with the *bona fides* of the Company; and he succeeded in getting himself virulently abused by the *Daily Chronicle* for his impartial scrutiny of the facts. A fussy agitation got up by one or two vestrymen at length took the shape of a formal demand for a Government investigation into the failure of the supply. This was granted; and it was carried out by Colonel Ducat, R.E., and Dr. F. W. Barry, Inspectors under the Local Government Board; the County Council taking a prominent part in providing evidence. The Inspectors paid a visit to the works in progress; and they appear to have been gratified with what they saw. The extent of the works, the excellence of the design, and the admirable manner in which the plan is being carried out, found recognition in an able article which proceeded from the pen of a representative of the *Daily News*. In addition to this inquiry and that with reference to the frozen mains, there has been a third, also conducted by the Local Government Board, relative to the capacity of flushing-cisterns used in water-closets. This resulted from an application on the part of the County Council; and it has cost that body close upon £900, in place of the £250 which they estimated.

At the close of July, the County Council issued the report of their Engineer—Mr. A. R. Binnie—giving an outline of their great scheme for bringing a supply of water to London from the head waters of three rivers in Wales. When the scheme was in full operation, the estimated supply would be at the rate of 415 million gallons per day; the capital outlay being £38,800,000. To convey a supply of 200 million gallons per day would cost £18,095,000. But surveys and investigations, in order to bring the scheme into parliamentary shape, are still going on; and it appears they will continue until next Christmas.

The County Council, having their Transfer Bills in a state of suspension, and having to face a greatly altered House of Commons, proceeded to consider, in the middle of October, what they had better do. Their Parliamentary Committee recommended that, as it was desirable for the supply of water in and around the Metropolis to be in the hands of a public authority, the Government should be invited either to deal with the question themselves or to appoint a Royal Commission to do so. To this Mr. Stuart moved an amendment, that the Transfer Bills should be proceeded with next session. On a division, this was negatived by the bare majority of one. The debate stood over for a week, when Dr. Collins succeeded in carrying a resolution requiring the Parliamentary Committee to report the lines on which, in their opinion, the Government should be asked to legislate. Three weeks ago, the Committee presented their report; and after the lapse of a week it underwent discussion. The main proposal was that the Government should be asked to constitute by Act of Parliament a Water Authority for London and the surrounding districts. This recommendation, as might have been expected, was set aside, and preference was given to an amendment, moved by Mr. Kinnon Wood, proposing that the Government should be asked whether they would promote or assist legislation dealing with the Metropolitan Water Supply in such a way as to give the entire control of the supply within the area of the Administrative County into the hands of the County Council in conjunction with the City Corporation, leaving the supply of the outer areas to the control of the Local Authorities in those districts. This amendment was carried. A further resolution authorized the Water Committee to open negotiations with the Water Companies for the purchase of their undertakings. The probability of success in approaching either the Government or the Companies appears abundantly doubtful.

The County Council make very small promise of an appearance in Parliament in 1896. The field is left open to the Water Companies, except that the Council will oppose whatever the Companies may bring forward. The Council have a little Bill of their own, by which they seek to make it compulsory on the East London Company to give their constant supply at a greater pressure than heretofore. The Staines reservoirs scheme, promoted by the Grand Junction, West Middlesex, and New River Companies, is a large and well-conceived project. The works of extension and improvement provided for in the Bill of the New River Company are of great magnitude. The Southwark and Vauxhall Company have a Bill to authorize large additions to their works. The Bill for the formation of a Kent Water Board is an entirely new device; but its progress appears doubtful. At the half-yearly meeting of the Chelsea Water Company a few days back, a hope was expressed that the Directors would not withdraw the

Bill which stood suspended from the date of the recent dissolution of Parliament.

The history of the water supply in the provinces during the past year does not present any features of a remarkable character. Mention has been made of the fact that in several cases considerable inconvenience was caused by the prolonged drought. The Barnsley Corporation Water Bill passed the House of Lords; but it remains suspended—awaiting its second reading in the House of Commons. It was strenuously opposed by parties interested in the watershed of the Little Don, and especially so by the Sheffield Corporation. More or less of the supply to be obtained from the Little Don or Porter River and its tributaries is claimed by several Local Authorities, and is a special bone of contention among them. An account of various Water Bills for the coming session appeared in our columns early in the month; one promoted by the Sheffield Corporation being of considerable importance, especially in its bearing on the Little Don question. The struggle for water areas throughout the country is becoming increasingly earnest; and the authorities of the area affected by the Welsh scheme of the London County Council are anxiously on the alert.

Personal.—A capital portrait of Mr. William Statter, J.P., has just been hung in the Directors' room at the Wakefield Gas Company's offices. Mr. Statter, who is in his 90th year, has been Chairman of the Company for more than fifty years. The portrait has been painted by Mr. T. Mostyn, R.B.A.; and the cost (£200) was voted by the shareholders at their last half-yearly meeting.——A vote of condolence with the family of the late Mr. T. S. Weeks, Assoc.M.Inst.C.E., whose death was recorded in the JOURNAL last week, was passed at a special meeting of the Torquay Town Council last Thursday. The resolution referred to the effective and efficient manner in which Mr. Weeks performed the duties of Water-Works Engineer of the borough for upwards of 31 years. The Mayor (Alderman E. P. Bovey), by whom it was moved, stated that during that time Mr. Weeks enjoyed the confidence and respect of the town and of the Council. When Mr. Weeks was appointed in 1864, the gross receipts for water-rentals amounted to £3000 per annum, and they were now £13,000. Throughout the period of his official connection with the works, the Water Committee were very much indebted to his valuable counsel and the thorough grasp he had of the concern. Mr. Appleton, the Chairman of the Water Committee, in seconding the motion, said that the late Mr. Weeks was a most conscientious, accurate, and painstaking official.

The Town Clerkship of Croydon.—Mr. E. Mawdesley, the Town Clerk of Dewsbury and the Clerk of the Dewsbury and Heckmondwike Water-Works Board, was last week appointed to the town clerkship of Croydon, rendered vacant by the recent death of Mr. C. M. Elborough. During the last eleven years, Mr. Mawdesley has had large experience in municipal work. In 1884, he was elected Town Clerk of Swansea; and in the six years he was there, he had the management of the whole of the legal work of the office. One of the cases which he conducted was an important water-works action—*Lewis and Sons v. Swansea*—which was twice before the Court of Appeal. He also had the experience of promoting and carrying through the Swansea Corporation Water Act, 1884, and also the obtaining of the Electric Lighting Order for the borough. At the latter part of 1889, he was chosen to fill the town clerkship of Dewsbury; and he has since had considerable parliamentary experience in connection with that borough. He was concerned in obtaining the last Act of the Dewsbury and Heckmondwike Water Board and the Dewsbury Electric Lighting Order; and he is now engaged in promoting a Bill for the extension of the water-works.

Presentation to Mr. T. Banbury Ball.—On Saturday, the 21st inst., the employees at the Rochdale Gas-Works celebrated the Jubilee of the gas undertaking and the completion of the extensions, by a dinner and social evening, for which they were indebted to the Gas Committee and the Contractors for the various new erections. The chair was taken by Mr. T. Banbury Ball, the Engineer and Manager, who was supported by Mr. T. Stenhouse, the Borough Analyst. Mr. Ball made some interesting remarks, and compared the present conditions of labour and remuneration in the Gas Department with those of forty or fifty years ago. During the evening Mr. Stenhouse spoke of the esteem in which Mr. Ball was held, and concluded by asking Mr. T. Mills to make a presentation on behalf of the workmen, every one of whom had, he said, subscribed towards it. This consisted of an elegant timepiece with the following inscription: "Presented to T. Banbury Ball, Esq., Gas Engineer, by the employees at the Corporation Gas Works, as a token of respect and esteem, and to commemorate the Jubilee of the acquisition of the gas works by the Corporation." Mr. Ball was quite taken by surprise, not having heard anything about the matter. During the evening, votes of thanks were passed to the Gas Committee and to the Contractors.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1361.)

CHRISTMAS week came in somewhat opportunely this year. As a general rule, it is only an unwelcome interruption to business, especially when business is good. But it was perhaps just as well that an enforced period of inactivity should succeed the exciting and perturbed week which preceded it. A time of quiet was thus afforded for temperate reflection; and the fever-heat engendered by the President's action had a chance of cooling down. Thus matters rapidly began to improve here at home; although progress was at first somewhat hampered by heavy selling in Paris. Gradually, however, the tendency to improve spread in wider circles; and a smart recovery all along the line was effected before the close. Prices in every department had a nice rise, especially in the American and Foreign markets, which, as the largest losers, had the greatest scope for recovery. The general amenity was favoured by the prospect of an easy settlement to wind up the old year satisfactorily, and give it a "happy despatch." The Money Market fairly maintained its improvement; the demands of the season being good. The Gas Market was extremely quiet; business being unusually slack on all four days of the week. Changes in quotation are naturally very few in number; but they serve to indicate the main lines on which the general movements run just now. These are the strong and increasing demand for the stocks of the Metropolitan Companies and other home undertakings, contrasted with the falling tendency exhibited by the Continental Companies. Thus, South Metropolitan advances, while Imperial and Union recede. In Gaslights, business was as quiet as it well could be. About half-a-dozen deals in the "A" were the total; nothing at all being marked in any of the debenture, preference, or limited issues. About as much was done in South Metropolitans; and the "A" stock more than once realized the record price of 381. Nothing at all was done in Commercials in the market; but we heard of a large parcel of stock having changed hands privately at a high figure. Only one or two transactions were recorded in the Suburban and Provincial division; but the prices obtained show that the great favour with which these investments are regarded by the public, is increasing rather than abating. The Continental undertakings show the "reverse of the medal"—Union and Imperial being weaker. None of the rest exhibit any salient feature. Business in Water stocks was very fair on the first two days of the week, but did not revive after the intervention of the holidays. Prices showed a fair disposition to rise wherever transactions were effected; and Grand Junction made an actual advance.

The days of the working week were so few, and the actual operations so inconsiderable, that it will be sufficient to record that on Monday South Metropolitan "A" rose 2, but Continental Union fell 5, and Imperial 1½; and that on Tuesday Grand Junction Water rose 2½.

ELECTRIC LIGHTING IN 1895.

THE history of the electric light industry in the United Kingdom for 1895 is mainly a chronicle of municipal "enterprise." Joint-stock speculation in the same line is dead and buried; the established electric lighting companies in London and the provinces having been left by investors to struggle as best they can with their troublesome "load factor." Nor has there arisen any new industrial development to help them over this difficulty. Very little has been heard of late of electric motors on central station circuits, or the fantasy of electric cooking appliances, both of which developments were at one time ardently recommended to the favour of the public. The latter were a leading specialty of the firm of Messrs. Crompton and Co., Limited; but the factory of the Company at Chelmsford was burnt down in the autumn, and since then nothing has been done towards helping the electric oven to displace the gas cooker. The destruction by fire of one of the principal central stations of the Metropolitan Electric Supply Company did not tend to reassure the public mind with regard to the harmlessness of this "safe" illuminant. Still, the stocks and shares of the principal London and provincial electricity supply companies fairly maintained, if few of them improved, their position in the market. On the other hand, the obligations of electrical engineering and industrial concerns fell heavily, and some of them were compelled to close their doors; while the most fortunate hardly paid dividends of more than microscopic proportions. It was admittedly a very bad year for all over-capitalized ventures of this order. The only electric machinery and plant contracts going were those of local authorities spurred to adventure into central station electric lighting by the desire to be "progressive" at all hazards; and these were keenly competed for at unremunerative estimates.

Some electric lighting stations which are to be regarded as calculated to satisfy a legitimate demand, such as that installed by the Leicester Corporation, were opened during the year;

and several municipal electric lighting undertakings previously started were reported as doing well and requiring extension. The Liverpool Electric Supply Company's undertaking was agreed to be taken over at a handsome premium by the Corporation. A considerable number of local authorities having electric lighting departments discovered, however, that the rosy promises of those professional and other advisers who had persuaded them into spending the ratepayers' money upon this object were illusory, and were driven to have recourse to the unpopular expedient of levying a rate-in-aid. Some local authorities are yet struggling to solve the problem, not of electricity supply, but of whether electric lighting is really wanted in their districts.

A little fillip of interest was imparted to the vexed question of how to make municipal electric lighting experiments certainly remunerative, by the introduction of refuse destructors and thermal storage as elements in this problem. Shoreditch, St. Pancras, and Cardiff were so far won over to this idea as to adopt combination schemes in which the steam required by electric light generating plant is to be a bye-product of house refuse incineration; but no results were obtained for publication. Some consulting electricians appear to be staking their reputation upon the successful working of combinations of this character; while other electrical experts decline to have anything to do with these experiments.

Another matter that attracted attention during the year—also connected with the problem of improving the profit-earning capacity of central station electric lighting installations—was the expediency of increasing the pressure upon incandescent lamp circuits from 100 or 110 volts to 200 volts. Lamps to carry the increased voltage were made, generally with two filaments instead of one. But though a Committee of Experts appointed by the Board of Trade to consider the question of increasing the voltage of low-pressure circuits reported favourably to the idea, doubts were entertained and expressed as to how the interior wiring of houses fitted for electric lighting could bear the additional strain. The movement for doubling the voltage was initiated by Mr. Sydney Baynes, at Bradford; and it is being prosecuted by him in connection with the extension of the St. Pancras Vestry's electricity supply undertaking.

Much uneasiness was caused during the early part of the year by the frequency of explosions in street distributing conduits and junction-boxes; several occurrences of the kind being on a somewhat formidable scale, and being even more distinctly alarming in character. Endeavours were made by the electric lighting interest to throw the blame for these explosions upon the gas companies. But the discovery of impure metallic sodium in some electric conduits, and the occurrence of explosions in others to which it could not be proved that coal gas had access, led the Board of Trade to issue stringent regulations for putting these novelties of the highway into proper order; and, in point of fact, no explosions of any moment have occurred lately in the electric conduits and street-boxes. This goes to show that these things can be kept in order if a due sense of responsibility for this condition is brought home in the proper quarter.

An ingenious device for encouraging the use of electric lamps over long periods, so as to ameliorate the condition of electricity supply undertakings in respect to the "load factor," known as the "Brighton system," was rather widely adopted last year. By this arrangement, the full price of the unit is only charged the first two hours or so of daily use of the lamps of any consumer; current supplied for the remaining hours of the evening being charged at a considerable reduction. The idea of the system—a very good one—is to make those consumers pay most who only come on the station at the busiest period of the twenty-four hours, and to encourage those customers who are willing to use their lamps all day or night long, if this can be done at the price.

Beyond these few points, there is really little to record as distinguishing electric lighting practice for the past year. Electric traction made some headway, notably in the case of a tram line at Bristol. It was understood, moreover, that capital was obtained for the proposed Central London Electric Subway; and the subway from Waterloo to the City was actively pushed on. But as against this must be put the tacit abandonment of all attempts to make accumulator batteries useful for traction purposes, whether on rail or road, after the waste of infinite effort and enormous sums in the endeavour.

Presentation to Mr. W. Ruxton.—Last Friday, Mr. W. Ruxton, the Assistant Gas Manager at the Arbroath Corporation Gas-Works, was presented by the employees with a marble time-piece, as a testimony of their regard for him on the occasion of his leaving the town to take over the managership of the Berwick and Tweedmouth Gas Company. Mr. R. S. Carlow, the Manager, made the presentation. He said he could testify to the fact that during the time that Mr. Ruxton had been in the works, he had performed his duties faithfully and well. He had now been fortunate in securing the appointment of Manager at Berwick. This was his first step in the ladder as a manager; but he (Mr. Carlow) hoped before many years to hear of his promotion to a larger and more important position. He wished Mr. Ruxton every prosperity in his new sphere. Mr. Ruxton suitably acknowledged the presentation.

COAL CARBONIZING IN BULK AT LANCHESTER.

Among the different systems of coal carbonization that have been suggested and carried into practice of late years, with the chief objects of economizing labour and improving results, there is one which has not hitherto been adopted for works devoted to the manufacture of illuminating gas, but has been brought to a considerable degree of perfection in the cognate industry of coke production. This is the system of carbonizing coal in large bulk, with recovery and utilization of all products and with full application of machinery and labour-saving devices to all the manufacturing processes. In the belief that an account, written from the gas engineer's point of view, of a good modern example of a coal carbonizing works would prove interesting, and to some extent instructive, in the estimation of followers of the coal gas industry, we recently availed ourselves of the kindness of Colonel S. A. Sadler, who opened for our inspection the works at the Malton Colliery, near Durham, for obtaining the facts of the working of this establishment which it is now our intention to recount for the benefit of our readers.* It must be premised that, although our visit to Lanchester was made by Colonel Sadler's invitation, and we were received and shown over the works by Mr. C. J. Sadler and Mr. W. Schroller, of the Durham Coke and Bye-Products Company, Limited, we alone are responsible for the matter of this article, from which, for business reasons, all data of purely commercial value have been omitted. The interest of the Lanchester works for gas engineers, is wholly confined to the bearing of the processes there carried on upon the problem of carbonization.

This problem is attacked at Lanchester, first from the side of metallurgical coke production, and, secondly, with regard to the liquid bye-products. The coal gas, after treatment for the recovery of whatever is worth extracting from it for the products market, has no further value except as a fuel to be consumed on the spot. It is unnecessary to go into detail in respect of the modern development of the metallurgical coke industry of which the Lanchester establishment is an example. The waste attending the operation of coking coal in the bee-hive oven has induced many inventors to try their hands at its prevention without prejudice to the chief product. But it must be confessed that success in this laudable effort has been difficult of attainment. The first question to be asked in connection with an industrial problem of this character, is what meaning ought properly to be assigned to the term, waste? The attainment of the highest possible standard of quality in the chief product is the first consideration. If the best possible quality of metallurgical coke is wanted, then any inferior quality of the article is so much waste of the raw material, labour, and capital employed in its production. It would be foreign to the question in such a case to argue that the operation as a whole is successful by reason of its effecting something else besides the production of coke. It is just the same in some gas-works, where the desired quality of illuminating gas is only procurable by employing materials and processes which, from another point of view, than that of the special gas makers, might be regarded as extravagant and wasteful.

The coke-oven has maintained its credit as the producer of the very highest class of metallurgical coke that money can buy. This class of fuel is required for the working of the very best type of blast-furnaces that skill can design and capital erect, for the production of one of the staples of British industry—the highest grades of finished iron. Buyers of metallurgical coke have consequently framed their judgment of the commodity with regard to its possession of certain characters, which they have learnt to associate with supreme quality; and no consideration of price will induce them to depart from these views. On the other hand, it is not to be supposed that coke buyers entertain an insuperable objection to modify their ideas respecting the characteristics which this kind of fuel may exhibit, provided always that the intrinsic value of the article remains unaffected. This is the position which those who have tried to improve upon the bee-hive coke-oven have had to face. If they could not also improve the coke, they had at least to keep it up to the standard of the best in every respect, or rest content with such diminished value as their chief product would command in the market—the depreciation, if any, going to discount the value of any economies they could effect. Thus, at any rate in the North of England, where the best bee-hive coke has ruled the trade, would-be improvers of the coking process have had little prospect of reward for their ingenuity.

It was not so on the Continent of Europe; and accordingly it is in connection with the coking of the inferior Continental coals that inventive effort has met with the greatest encouragement. Hard coke is hard coke, to the Belgian or German ironmaster, who once satisfied on the scores of calorific value and physical character, has not looked for those refinements of colour and form which the Durham coke buyer has learnt to insist upon as the inseparable concomitants of first-class coke. In these circumstances, it is no small triumph for the Simon-Carvès system of coke production that it has established itself in Durham, where batteries of these retorts now exist alongside the old bee-hive ovens, and that the coke made by the new method finds a ready sale on its merits. Of course, as yet it suffers somewhat

* A view of the works in question is given on p. 1348.

from being outside the "fancy." The bee-hive oven is hotter, by reason of its principle of internal self-generated firing than any externally-heated retort. The charge in the oven is very large, and compresses itself by its own weight; and the quenching of the coke inside the oven preserves a silvery lustre which quenching in the open air (which is apt to be excessive) does not confer upon the product. The yield of coke from the Simon-Carvès retort is so much greater, however, from the same coal —76 per cent. and upwards, as compared with 65 per cent. or thereabouts with the bee-hive oven—that on this account alone the new system possesses solid recommendations worthy of being set against the fancy for appearances.

Leaving the delicate subject of comparison with the bee-hive oven, let us ascertain what the Simon-Carvès retorts are like, and how they are worked at Lanchester. The colliery itself is a mere appanage of the coking plant; for no coal whatever is raised for sale as such. Everything goes into the retorts, and only coke and liquid products are sent away by the railway which bounds the site of the works upon two sides—each siding being appropriated for one of these divisions of the output of the establishment. The coal is a friable, clean-looking mineral, only needing to be put through the breaking machine to fit it for coking, to which it is by nature well adapted. And here we may pause to observe that the quality of coking is something of which nobody has yet succeeded in discovering the cause. Some coals will coke, while others of precisely similar approximate composition (as determined by analysis) will not. An experienced hand will generally tell at a glance whether or not a sample of coal will coke satisfactorily; but the quality, in itself, is something which has hitherto eluded analysis. Dirt is, at any rate, inimical to coking. When broken rather small, the coal is elevated to a hopper capable of containing about 400 tons, whence it fills the charging trucks by gravitation.

The carbonizing plant consists of two ranges, or stacks, each of thirty-five retorts built of fire-brick in the form of a long, high, narrow chamber. These are placed side by side; so that the stack of thirty-five forms a substantial-looking block. It exhibits the unusual spectacle of a retort-bench without a retort-house; for the whole structure is in the open, without any attempt at shelter. The retorts are heated by the gas of their own making; and one-third of the quantity actually burnt (to get rid of it) would suffice for all the purposes of the works. All the boilers are, of course, fired by the waste heat of the retort-stacks, which keeps the steam blowing away. The reflection is forced upon a visitor to these works, that here is an example of a kind of waste of energy comparable to that of the waterfalls which electricians are so partial to "harnessing." We have few unappropriated water power privileges in this country; but millions of British thermal units of heat are every day dissipated into the clouded atmosphere of our mining districts.

Upon the flat top of the retort-benches run the charging tram lines, traversed by conical trucks carrying a load of about 18 cwt. of coal. These stand right over the charging-doors, which open into the top of the retorts, one on each side of the middle line. As the waggon-loads of small coal pour into the retort, young men or lads with rakes passed through holes in the side doors help the charge to level itself in the retort. An ascension-pipe to each retort, not rising far above the top of the bench—empties itself into the hydraulic mains. These are open at one side, like a fishing-box, in order that any accumulation of thick tar in the bottom may be easily got at. The dip-pipes have also a disc-valve to close them when the retort is opened. All the retort-fittings would appear, to the gas maker accustomed to work under cover, of the roughest and rudest description. But this is only on the surface; for the plant works regularly and well, notwithstanding the exposure to the weather, clouds of coal dust, and liability to rough handling.

The most striking aspect of this plant is the "draw." Every retort contains a charge of 5½ tons of coal, which burns off in 48 hours. At the proper time—which the workmen are always ready to anticipate, for their own sakes—the retort is thrown out of connection with the gas-mains; and the doors which form its two ends are opened. A travelling ram, driven directly by means of a rack and pinion from a 12-horse power steam-engine, enters at one end of the retort, and slowly but irresistibly pushes the vertical slice of red-hot coke out at the other doorway. On the discharging side, the ground is prepared for the coke by being paved with brick, and laid as a quenching platform with a slight incline towards the railway dock, where the coke waggons await their turn for loading. At intervals along the outer edge of this platform are standpipes to which the hose for quenching the coke can be attached as required. It is an impressive spectacle to witness the huge slice of glowing coke growing, as it were, out of the opened retort, without visible inducement to move. There is usually no smoke (the charge being too thoroughly burnt off for this), and it is all one colour and texture—top, bottom, and sides. Before the coke moves from the retort, it is seen to have shrunk away from the sides; and it is also diminished in height from that attained by the charge of coal. By the time the charge is about one-third of its length outside the retort, it betrays a tendency to split open vertically. It quickly exhibits its dual formation, with a fissure running through the midst from top to bottom; and then the moving pile splits asunder or topples over on one side. The remainder of the charge, under compulsion of the ram, then pushes the heaped lumps forward; while a couple of strong streams of water quickly change the hue of the mass, and envelop the last of the movement in an impenetrable cloud of steam. This, it strikes the observer, is something like carbonizing by machinery. The machine has something worth doing, in driving out the whole residual coke of a 5½-ton charge. It is not like the petty work of the gas retort-house, where machines are perforce cut down to the measure of the power of a single man, who is as competent, weight for weight, to draw a retort as any mechanism that can be adapted to the purpose. The Simon-Carvès ram discharger does not emulate the man; it simply transcends him, for this particular work.

After the gas and liquid products leave the retort-stacks, they undergo treatment not remarkably different from the ordinary gas-works processes; but with the addition that the gas is also washed with creosote oils for the extraction of its benzene, and with dilute sulphuric acid to make sure of getting all the ammonia. The ammoniacal liquor is treated for sulphate-making in a Simon plant, which is now to be duplicated. The simplicity, the directness, the absence of the superfluous of every kind from the whole apparatus, are most instructive. Where machinery is required, as for exhausting and pumping, it is of the best (Donkin's exhausters), and the excellent tar and liquor pumps made by Messrs. Audemar Guyon, of Dôle (Jura), testify to the care with which the Lanchester management equips the plant. But there is nothing spent upon show, and not much for shelter. It would do many a gas engineering student, trained in the monumental school of gas-works design, a world of good to spend a few months at Lanchester, close to realities of things as these are perceived by men of business who have no Act of Parliament to help them make dividends.

To return, by way of epilogue, to the coking. Is there no lesson here for gas engineers? We are unable to give particulars of the gas made at Lanchester, for the simple reason that none is registered there. Neither the yield of gas per ton, nor the illuminating power is known or regarded. There is neither station-meter nor holder upon the works; but all needful carbonization data could doubtless be obtained by a competent examiner who should obtain permission to spend a few days here. It would be useful to know what are the actual comparative results of carbonizing coal in bulk and in small charges. The investigation may be commended to the attention of those whom its lessons may concern.

A New Carburettor.—The Berlin Anhalt Machinery Company have patented in Germany an apparatus for enriching gas. It consists of a chamber containing a number of slightly inclined corrugated sheets, down which the enriching liquid trickles; the partitions being warmed by hot water or steam pipes placed beneath them. The gas enters at the top of the vessel, but at the opposite end to the liquid, and therefore traverses the chamber in a reverse direction to the latter, which is gradually vaporized by the heat from the pipes as it descends the chamber.

The Proposed Association of Water-Works Engineers.—Our readers may remember that, in a letter in the JOURNAL for the 26th ult., a suggestion was put forward by Mr. D. M. F. Gaskin, M.Inst.C.E., the Water Engineer of the Nottingham Corporation, for the formation of an Association of Water-Works Engineers for Great Britain. Mr. Gaskin informs us that the response he has received, from the publicity given to his idea in this and other professional journals, has been so satisfactory that he is encouraged to take further steps to bring the scheme to a successful conclusion. He has therefore called a meeting in the Exchange Hall, Nottingham, for the 11th prox., at one o'clock, when the subject will be fully discussed, and a Provisional President, Secretary, and Committee will be elected. Evidence of the interest taken in this project by members of the profession is afforded by the fact that Mr. C. H. W. Biggs will present a paper on the Cologne Water-Works after the general business has been disposed of.

Explosions of Domestic Boilers.—Although, from the letter which appeared in the JOURNAL last week, and the correspondence to which reference was made in a paragraph on the 10th inst. (p. 1195), officials of water companies experience some difficulty in complying with the suggestion made in the circular lately issued by the Board of Trade on the above subject, the Directors of the Grand Junction Water Company have been able to formulate a series of precautions, which they have communicated to the consumers in their district. They are as follows: "(1) That all cisterns from which boilers are supplied, and particularly the pipes communicating therewith, should be placed in positions where they are not likely to be affected by frost. (2) That a safety-valve should be fixed on every boiler that has not a loose, moveable lid. (3) That, should the water supply be interrupted from any cause, the fire should be at once withdrawn until the boiler is cold and the water supply has been restored. It is very dangerous to put water into an empty boiler while hot." In making these suggestions at the instance of the Board of Trade, the Directors are careful to point out that the Company have no responsibilities in the matter, and that the precautions to be adopted and carried out rest entirely with the householders themselves. It will be seen from our "Correspondence" columns to-day that the Manager of the Deal Water Company has also issued a few useful suggestions to the consumers in the Company's district.

NOTES.

The Recovery of Bye-Products from the Jameson Coke-Oven.

At the meeting of the North of England Institute of Mining and Mechanical Engineers at Newcastle on the 14th inst., Mr. J. Jameson submitted a paper dealing with the recovery of bye-products in the manufacture of hard coke in the Jameson coke-oven. The author said that, though the patents had now lapsed, he believed the method of recovery of bye-products in open ovens, unless displaced by some process more effectual, would in time come into extensive use. He narrated the history of the process, and gave the results of the experiments made at Felling, in the way of obtaining a supply of ammonia by suction during the process of coke making. The quantity of coke produced was found to be in no way diminished, and the percentage of residual sulphur was reduced. Sir Lowthian Bell made experiments on the quality of the coke, to see if any injury had been done to it for metallurgic purposes by the abstraction of the products; and he found that it was in every respect fully equal to coke made in the ordinary way without the recovery of products.

Hints on Engineering Workshop Practice.

At a recent meeting of the London Association of Foremen Engineers and Draughtsmen, a lecture was given by Mr. W. T. Coates, a Past-President, on "How Not to Do Some Things." The practical character of the lecture may be inferred from the observation of Mr. Coates that his remarks were really an expansion of the word "Don't;" and he had adopted it because he found in engineering workshops it is more frequently used than the word "Do." The first caution was in regard to giving instructions to workmen, as is not unusual, to make a certain thing to a stated size "full" or "bare," as the case might be, when it would be as easy and far more accurate to give a definite size. The lecturer does not appear to have mentioned the practice followed by some designers of deliberately avoiding round figures in measurements, wherever possible, and so compelling the workman to keep to an accurate dimension by rendering it difficult for him to trust to memory. Mr. Coates observed that in a drawing office there are ways which things should not be done, as in making drawings inaccurately, and then inscribing an instruction upon the sheet that only figured sizes are to be worked to, although it is so easy to alter or obliterate figures. Speaking of testing materials, Mr. Coates offered a most valuable observation, as contractors and inspectors are likely to esteem it, to the effect that too much importance is commonly attached to the appearance of bars when broken, seeing that an experienced hand can produce either a crystalline or a fibrous fracture at pleasure. He proved his point by exhibiting some samples of iron, broken from the same bars, but showing different fractures. One end of a piece of Low Moor iron, for example, showed a tough, fibrous fracture, while the other looked crystallized and brittle. Mr. Coates also observed that sufficient care is seldom taken to work steel at a right temperature; the appearance of the heated metal on a dull day and in bright sunshine or a good light covering a difference of temperature of from 700° to 1000°, which is quite enough to account for the very different results indeed being obtained at such times.

Professor Clowes on Explosive Gaseous Mixtures.

At the meeting of the Chemical Society on Nov. 21, Professor Clowes, of Nottingham, read a paper on "The Composition of the Limiting Explosive Mixtures of Various Combustible Gases with Air." This is a subject to which, as readers are aware, Professor Clowes has given special attention. A number of experiments were made with mixtures in varying proportions of each combustible gas with air. A flame was brought into contact with each mixture, sometimes above and sometimes below; and it was noted whether the mixture burnt back independently of the external air. For each combustible gas there was thus obtained a lower percentage below which the mixture would not burn independently, and a higher percentage above which the gas burnt independently only when it was supplied with more air. The limiting percentages were as follows: For methane, 5 and 13; for hydrogen, 5 and 72; for carbon monoxide, 13 and 75; for ethylene, 4 and 22; for water gas, 9 and 55; for coal gas, 5 and 28. It was also proved that many mixtures which were outside, but close to, the above limits, and which could not be fired from above, could be fired from below. Hence it was inferred: (1) That the limiting explosive mixtures for different combustible gases vary widely. (2) That methane shows the narrowest limits; hydrogen the widest limits. (3) That the risk of a mixture being fired explosively increases with the different gases in the following order: Methane, ethylene, coal gas, water gas, carbon monoxide, hydrogen. (4) That the risk of explosion is greater when the mixture is kindled from below than when it is kindled from above.

The Determination of Carbon in Iron.

Herr F. Foerster recently dealt with this subject in the *Zeits. für Anorg. Chem.* Among the procedures which give trustworthy values for the determination of carbon in iron, the copper-ammonium chloride can be executed with the simplest appliances at hand in every laboratory; and it does not make such demands on the experience of the analyst as does the chlorine process. Sometimes its general applicability is interfered with by the fact that some sorts of wrought irons, especially tungsten steels, if in contact with a quite neutral solution of copper-ammonium chloride, give a violent escape of gaseous hydrocarbons. In such cases, the author, instead of a solution of copper-ammonium chloride, uses a solution of copper-ammonium oxalate. This is obtained by mixing a 10 per cent. solution of copper sulphate with a solution of ammonium oxalate saturated in heat until the initial precipitate is re-dissolved. Of this solution, 250 c.c. are poured upon 2 to 3 grammes of the tungsten steel to be analyzed, and heated together in a water-bath at 80° for five hours. Copper separates out, and the liquid takes a green colour. It is decanted away from the residue; the copper is dissolved away with a solution of copper-ammonium chloride when the residual carbonaceous substance, after filtration and drying, is burnt in a current of oxygen.

TECHNICAL RECORD.

THE CHEMICAL PURIFICATION OF ILLUMINATING GAS.

In a previous issue of the JOURNAL (*ante*, p. 977), we gave an abstract translation of a portion of the paper on the above subject, by MM. Delseaux and Renard, for which the authors were awarded a prize of 750 frs. by the Société Technique du Gaz en France. We now deal with the rest of the paper, treating upon purification by lime and other materials, and revivification.

The authors begin by remarking that, in all towns where the suppliers of gas are compelled, by their contracts, to remove the sulphur compounds, purification by oxide of iron alone is found insufficient; and therefore it becomes necessary to use lime. Like oxide, lime is more active hot than cold. In the former condition, its action upon carbonic acid is almost twice as great as it is when cold; while its effect upon sulphuretted hydrogen is very considerably augmented. It is the same with the action of sulphide of calcium upon sulphide of carbon; but the former is more easily decomposed by carbonic acid. These considerations led Messrs. Hood and Salamon to conclude that the lime produced from carbonate of lime prepared hot, is more active than, and therefore preferable to, that coming from calcite. Having explained the reactions which take place in lime boxes, the authors remark that the material is no longer used in the condition of milk of lime, but in a mass; and in this form it may be introduced into the purifiers—anhydrous, slaked, or partially hydrated, but generally without the addition of inert matters, and in several layers. They then pass on to show how purification may be carried on by the simultaneous employment of oxide of iron and lime; and they advise the two following arrangements of purifiers: (1) Lime, sulphide of calcium, oxide of iron; (2) lime, oxide of iron, sulphide of calcium. The first disposition is, in their opinion, the most rational one; sulphide of calcium forming naturally in the second purifier in consequence of the decomposition of that contained in the first. Moreover, it presents more security; for if all the carbonic acid is not arrested in the lime purifiers in one or the other of the arrangements, the sulphuretted hydrogen liberated in the sulphide of calcium purifier will be taken out by the first, and not by the second arrangement.

The authors next deal with purification by Laming material, and give three methods of preparing it—one being that in use at the works of the Paris Gas Company. As there prepared, it consists of the following ingredients: Sulphate of iron, 250 kilos.; slaked lime in powder, 4 hectolitres; inert material, 7 hectolitres. A current of gas was passed through a mixture made in this way; and the result showed its great activity, when newly prepared, alike upon hydrosulphuric and hydrocyanic acid. The authors explain the latter fact by the presence in the mass of a certain quantity of protoxide of iron more active than the sesquioxide, and not transformed into that salt—the material having been brought into use several hours after its preparation. A few remarks are next offered on the purification of gas by the residual oxides of iron produced in the manufacture of sulphuric acid or aniline; but the results obtained show that this material has not anything like the activity of the hydrated oxides. Purification by the oxides of iron in the presence of alkalies is then considered; reference being made to the processes of Levbold, Knublauch, and Foulis. The authors consider that the methods adopted by the two last-named gentlemen have the drawback of being wet ones; and therefore an attempt was made to obtain by the dry way the advantages they procure. The material called "Lux masse" may, they think, rank among those attaining this object.

At first, an attempt was made to employ mixtures which when placed in ordinary purifiers were capable of completely arresting the hydrocyanic acid as well as the sulphuretted hydrogen. In one works, the following combination was tried: Natural oxide of iron, 2200 kilos.; soda crystals, 2200 kilos.; iron filings, 880 kilos.; sawdust, 44 hectolitres. This was submitted for 103 days to the action of the gas to be purified. The quantity of gas passed through it was 975,240 cubic metres (about 34½ million cubic feet); the purifying surface being 55½ square metres per 1000 cubic metres of gas per day, and the time of contact 2 min. 46 sec. In the works where this trial was made, continuous revivification by air was employed;

the purifiers being arranged in series of four. Although the sulphuretted hydrogen did not reach the purifier containing the material, this did not completely arrest the hydrocyanic acid. The authors tried a similar combination, but containing free sulphur, in the last boxes at a works where there was no addition of air. Instead of making up fresh material to which sulphur would have been added, they made use of stuff which had been three times in the purifier, and with which they mixed iron filings and carbonate of soda instead of soda crystals, with the object of obtaining a more homogeneous and less humid mixture. As prepared, the mass was put into the purifier with 18·50 per cent. of water. It was thought that, under these conditions, by avoiding too large a formation of sulphocyanates, the hydrocyanic acid would be no longer left in the gas. But, after some hours, traces of it were found; and it was presumed that the quantity would increase. The authors thereupon sent in first unpurified and then purified gas; in other words, they made the outlets inlets for a few hours, and then changed them back again until the presence of cyanides was detected. In this way the hydrocyanic acid was completely arrested; and the conclusion was come to that sulphide of iron in the nascent state, so to speak, is more active than a mixture of sulphur and iron. Subsequent trials justified this conclusion; and, in the authors' opinion, they demonstrated the inutility of working with alkaline mixtures. They consider that the arrangement of the purifiers in series of four, of which three are in use successively and one is off, is preferable to series of two, for retaining the largest possible quantity of hydrocyanic acid. This arises from the fact that, in the series of four, the first one contains sulphide of iron, which is very susceptible of taking up the acid.

Purification by salts of iron and ammoniacal liquor is next briefly touched upon; and the authors conclude the first part of their work by giving the prices of some of the purifying materials they have been considering.

In the second part of their paper, the authors deal with the revivification of spent materials. They begin by pointing out that, for effecting this object, oxygen, either pure or in the form of gaseous mixtures, may be employed. They show, by means of formulæ, the changes which take place in oxide of iron when used for the purification of gas, resulting in the formation of ferrous oxide, in which condition it will rapidly absorb oxygen to reproduce ferric oxide. The secondary reactions relative to the production of prussian blue are noticed; and then the authors describe the three methods of treating spent oxide—in the open air, *in situ*, and in the purifiers by the continuous system. With regard to the first, they do not agree with spreading the material in very thin layers and watering it as soon as removed from the boxes, unless the object is to produce prussian blue. They consider the practice defective where the idea is to effect the decomposition of the sulphide of iron. They think the stuff should be kept in a heap, so as to cause a certain rise of temperature to facilitate the various reactions; then spread out in layers from 8 to 12 inches thick; and turned over from time to time to expose fresh surfaces to the air. Revivification—generally a very slow process—is facilitated by dry and warm weather. The authors demonstrated this by some experiments, the results of which are tabulated. When revivifying in the open air, it is always the upper surface of the oxide which is in contact with the atmosphere. This fact led to open-work flooring being devised, to admit air to the under side of the mass; and this again led to the system of purification *in situ*. In the latter process, the purifier being thrown out of action, air is sent through the vessel. If the air is dry, revivification will be effected in 27 hours; if it is humid, in about twice this period. Dry air should, however, only be employed very cautiously. If ample time can be allowed for the revivifying operation, the authors consider it preferable to employ moist air. Various plans have been introduced to attain this end—such as putting water in the bottom of the purifier, moistening the material itself, or sending in a jet of water with the air. The introduction of air into the unpurified gas affects the removal of the cyanogen compounds by oxide of iron. Two samples of oxide were submitted by the authors to the action of crude gas without the addition of air and with 2 per cent. of air, with the result that without air the percentage of prussian blue was 2·46, whereas with air it was only 1·26; the proportions of total sulphur being 22·42 per cent. without, and 29·58 per cent. with air, and of free sulphur 11·81 and 18·81 per cent. respectively. The third process of revivification—that by oxygen—which the authors say is becoming general, is fully dealt with. The inconvenience attending revivification by the continuous and intermittent systems alike is the caking of the material. This is by some attributed to the fusion of the sulphur in it; but the authors are of opinion that the trouble results simply from getting rid of the humidity.

The use of steam for the purpose of revivification is the next branch of the subject taken up; and Mr. F. G. Dexter's labours in this connection are here mentioned. The authors made a trial of continuous revivification on two lots of material—one with the addition of steam, and the other without. In the latter case, the quantity of gas purified was 344,960 cubic metres (about 12¼ million cubic feet) in 42 days; and the following results were obtained: Humidity, 8·70 per cent.; total sulphur, 8·25 per cent. of dry material; free sulphur, 6·82 do.; sulphuric acid, 0·17 do.; sulphocyanic acid, 0·13 do.; prussian blue, 2·65 do. In the former case, the material had purified 583,910 cubic metres (20½ million cubic feet) in 59 days; and the following results were obtained: Humidity, 13·20 per cent.; total sulphur, 20·66 per cent. of dry material; free sulphur, 16·55 do.; sulphuric acid, 0·26 do.; sulphocyanic acid, 1·08 do.; prussian blue, 3·57 do. An inconvenience attending the use of steam the authors found to be this—that, consequent upon the maintenance of the humidity at a tolerably high temperature, the production of bisulphide of iron was favoured, and thus a portion of the oxide was rendered inactive.

With regard to the revivification of spent lime, the authors remark that pure oxygen is the only agent recommendable in this case. Not only has it a more energetic action than air, but any slight excess left in the purified gas really increases its illuminating power. The oxygen should not, like the air, be introduced at some point as near as possible to the hydraulic main, but at the very inlets to the purifiers; the washer-scrubbers being capable of absorbing 13 to 20 per cent. of the volume used.

MM. Delseaux and Renard conclude this part of their work by remarking that the object sought to be attained in the various methods of revivification dealt with has been to economize labour in the handling of the materials. Continuous revivification in the boxes was a great advance in purification. But whichever of the systems may be employed, one is compelled, at more or less frequent intervals, to remove the material; and consequently a good arrangement of purifier-house and revivifying-floor, requiring as few hands as possible, will, of course, reduce the expenses to a minimum. The authors cite a few figures to show the cost of purification per 1000 cubic metres of gas by various systems.

The third part of the paper consists of a number of analyses of spent materials, and the general conclusions arrived at by the authors. These may be shortly summed up as follows:—

Removal of the Sulphur Compounds.—Where oxide of iron is used, there should be a large purifying surface and prolonged contact with the purifying material, which should be in one or several layers according to the use or non-use of inert materials. Where revivification is effected in the open air, the material should be heaped up on its removal from the purifiers, and, as soon as it becomes heated, spread in layers from 8 to 12 inches thick. Where continuous revivification is employed, the volume of air or oxygen should be injected without interruption, and in exact proportion to the make of gas; the material to be kept warm and moist. In the case of purification by lime, the material should be divided into several layers, and used cold if it is desired to retain more of the sulphide of carbon, otherwise hot. Oxygen to be employed for revivification.

Removal of the Cyanogen Compounds.—To ensure material rich in prussian blue, keep the stuff very moist at a low temperature; have a large purifying surface, and long contact. When revivifying in the open air, spread the material in very thin layers kept quite moist; but if *in situ*, inject cold air, saturated with moisture, at great speed. In the case of continuous revivification, the opposite process must be adopted, owing to the presence of less sulphide of iron in the purifiers.

Removal of Carbonic Acid.—Here lime purification should be adopted; the material to be hot, and divided in several layers. No special system of revivification need be followed.

CARBURETTED WATER GAS WITHOUT OIL.

By Frederic Egner, of St. Louis (Mo.).

[Prepared for the *American Gaslight Journal.*]

When, during the past summer, the price of gas oil was advanced, in our case, 33⅓ per cent., thereby adding 10 c. per 1000 cubic feet to the cost of making, "without any effort on our part," we at first went back to making a mixed (coal and water) gas, as a possible remedy, with decidedly encouraging results. We also tried making water gas enriched with cannel instead of oil gas. Now, this was not a new thing in the writer's experience, and possibly it would not be unknown to many of the readers of the *Journal*. Still, as the matter might be of general interest, the facts are given.

The works are provided with one set of the improved Lowe double-superheater type of water-gas apparatus, a double set of the Granger-Collins kind, and a complete, good (though not modern) coal-gas plant, besides ample purifying and storage capacity—especially so in respect of the latter. The water gas goes from the scrubber and condenser of the generating apparatus to a primary or relief holder, from which it is taken by an exhauster, and pushed through a second condenser, the scrubber, the purifiers and station meter, into the holders. The coal gas goes direct from the hydraulic main to the exhauster, where it meets, at the inlet, the water gas from the relief holder. The speed of the exhauster is regulated by a home-made, but absolutely reliable and effective, governor; and the pipe from the relief holder to the exhauster is provided with a convenient valve. These simple details are given because it is believed they will conduce to a clearer understanding of what follows.

Upon a certain morning, having then on hand more finished gas than could be used in the town for the next 24 hours, we started our trial of making carburetted water gas without oil. We had in action four benches of fives making coal gas, and had our relief holder (previously completely exhausted) filled

with "blue" water gas—that is, water gas made from the decomposition of steam by means of incandescent retort-house coke, without oil, in a Lowe-Collins water-gas apparatus. To produce 1000 cubic feet of the above-described uncarburetted water gas required 60·6 lbs. of gas coke, including the fuel used under the boiler—carburetted water gas requires, in our case, about 18 lbs. less. It was also found that, instead of making an average of about 4580 cubic feet of gas per run in each generator, the quantity was reduced to an average of 3140 cubic feet, or from 15,600 to 13,200 cubic feet per hour for the set. Let it be well understood that no oil whatever was used in making the blue gas.

Our custom in making coal gas is to draw and charge as many retorts in several of our four benches each hour as would be equal to one bench together. This system possesses certain advantages for both workmen and the Company, be the works large or small. We commenced charging the retorts with a reduced weight of cannel, two hours before beginning to mix the gases, and then opened the valve between the relief holder and exhauster until the Lowe jet photometer close by, and used for the purpose, indicated 22·5-candle power. It was found that, with a combination of 43·6 per cent. of cannel and 56·4 per cent. of blue water gas, the above average illuminating power could be easily maintained, while at the same time practising the revivification *in situ* method in our purifiers.

It may be remarked in passing that we have run our purifiers for upwards of seven months without once raising the covers—and that is going pretty close to purifying in closed vessels; and the only cost on account of purification was the first cost of the material. What that was is of little consequence, since the whole thing hinges upon the manner of using what one can buy or make as may be most convenient or cheapest.

The cannel used yielded something like 23 gallons of tar per ton, which is worth 5 c. per gallon, to burn in lieu of coke, whatever it may be worth to sell. We are obliged to gauge the value of our tar by its fuel value. This cannel also produced 1100 lbs. of really first-rate coke per ton, besides considerable breeze. The coke was more than was required for fuel in the benches and under the boiler, which, of course, is not saying much; but it should be remembered that our benches, though good, were not by any means modern. In consequence of this, perhaps we did not obtain the yield of gas per pound which the cannel was said to contain. We have no means of utilizing our ammoniacal liquor; and hence this valuable bye-product goes to waste.

It was stated that we use gas coke in our generators. Therefore the question may naturally be asked, "How much is that worth?" We find it to be worth at least as much as good anthracite would be to us; and though that might be the ready answer given, it might not be entirely correct. Let me put it in this way: "How much does gas coke cost the producer?" Suppose we were to figure, for example, as follows: 1000 cubic feet of [?] candle power carburetted water gas might cost us, for material alone, say, 38 c. Remember, gas oil is away up in some sections of the country. Now, a ton of a certain kind of coal might produce (say) 9000 cubic feet of the same candle-power gas as the above-named sample of water gas; hence the gas from this ton of coal is worth $9 \times 38 - 90$ (the cost of labour to produce it) = \$2·52. The same ton of coal will produce 14 gallons of tar, which, at its value to burn, is worth 5 c. per gallon, or 70 c. We now have \$2·52 + 70 = \$3·22 of value obtained from the ton of coal, which, in this supposable case, cost us to begin with just \$3·05. This same ton of coal may yield 1300 lbs. of coke, of which 35 per cent. may be used in production; and we have left 845 lbs., which has not only cost nothing at all, but actually (?) came with a profit of 17 c. to boot. These figures ought to be gone over by acetylene enthusiasts, or others (with whom the former, however, should not be classed), who periodically appear with "gas for nothing" schemes.

This experiment has demonstrated to our satisfaction that carburetted water gas can be made without oil. There need be no apprehension that the gas will stratify in the holder. The verdict of many of our consumers, after using this gas, may be described by some of their exclamations next morning, such as: "What have you been doing with your gas?" "We never have hitherto had such good gas!"

[We learn that the cannel coal referred to in the above experiments is "Bear Creek" cannel, supplied by the Log Mountain Coal Company, of Pineville, Ky.—Ed. J. G. L.]

A Town Lighted by Water Gas.—The small town of Valkenburg, near Aix-la-Chapelle, but on the Dutch side of the frontier, is lighted, according to the *Journal für Gasbeleuchtung*, with uncarburetted water gas. A concession was granted to Dr. H. Strache, of Vienna, to set up a water-gas installation for lighting according to his system (see Journal, Vol. LXIII., p. 527; and Vol. LXV., p. 218). The street-lamps have an illuminating power of about 105 English candles, and are placed at intervals of 100 to 150 feet. A light of about 90 candles costs private consumers as near as possible 4d. per 15 hours. The water gas is made in special generators from coal or lignite. This is the first instance of a town installation of non-carburetted water gas on Strache's system.

STORAGE BATTERIES v. GAS-ENGINES.

At a recent Meeting of the American Institute of Electrical Engineers, the following paper on the relative economy of storage batteries and gas-engines as auxiliaries to electric lighting plant was read by Mr. Nelson W. Perry:—

Whether or not it is economical to equip a central station with an auxiliary storage battery plant is a question which must be decided separately for each particular installation. Generally speaking, the question will be decided by the character of the load-line—a broad-topped curve being the most unfavourable, and a sharp peak the most favourable to storage battery economy. Again, a station having a very light day load may use the battery to good advantage, even though its night load may present a broad-topped aspect. Apart from purely economic reasons, convenience may be controlling; so that it is impossible to state, unless all the conditions are known, whether or not the storage battery is advisable. The price of the battery is an important element, of course, but less so than is popularly supposed; for the space it occupies and the cost of maintenance may largely overbalance any gain in first outlay over the cost of the extra boiler, engine, and dynamo.

In regard to the cost of maintenance, manufacturers are willing to guarantee that it will not exceed 10 per cent. per annum. But it is well to understand just what this 10 per cent. means. It means, in the first place, that if you put in all the battery power the manufacturer recommends, and take care of the battery exactly as he says, then the guarantee holds good. Under such conditions, the manufacturer is undoubtedly on the safe side; but if we instal a plant under these conditions, we are pretty sure to find that the economy effected in the first cost of the storage battery over the engine and dynamo has entirely disappeared.

Then it is well to understand beforehand what the 10 per cent. means—10 per cent. of what? The public are given to believe that this means 10 per cent. of the cost price of the batteries; and the statement has been freely made that this is what it does mean. Some time ago, I had occasion to inform myself accurately on this subject, and to this end entered into correspondence with the President of the leading storage battery company of America. As regards the guarantee, he said they would undertake to provide renewals, when required, at a specified price, and would give an assurance that they would not exceed an average of 10 per cent. per annum. He added that he had every reason for believing that the actual cost, when the batteries were used at normal rates, would not exceed 5 per cent. The Company's catalogue, however, stated that they were prepared to undertake maintenance contracts according to a scheduled rate of charges, for periods up to ten years or longer, under which they would guarantee that the total amount paid for renewals during the term of the contract should not exceed 10 per cent. per annum on the catalogue price of the cells specified in the contract. But it was specified that in all cases of renewal by contract, the old material becomes the property of the Company, and must be returned to their works free of charge for carriage or packing. Since the regular trade discount at that time was 20 per cent. of the catalogue price, and a further discount was offered which made the cost of the batteries comparable with that of an engine and dynamo, the guarantee assumed a very different aspect from that which it bore on its surface. When to this was added the cost of packing and carriage back to the factory, it ceased to be an attractive guarantee; and my calculations showed that in many cases where the storage battery might be recommended, if the guarantee was what it appeared to be, it would not be economical under the guarantee as it actually was.

As before indicated, there are some situations in which either convenience or extreme steadiness of current may be controlling in deciding the question of the use or not of storage batteries. But where the question is one purely of economy, I would not myself recommend their use under any circumstances, simply because there is a still more economical method at hand. I refer to the gas-engine. Even if it were necessary to use illuminating gas from the street mains, it would be more economical (considering space and other factors coming into the question) to take the peak of the load with a gas-engine than to instal a storage battery for this purpose. There would be no stand-by losses; and the engine would be ready at a moment's notice to be brought into service.

It is a fact that has been amply demonstrated by others as well as myself, that a given number of lights can be produced with half the gas burned in a gas-engine that is required to produce them in ordinary burners. The mechanical efficiency of the gas-engine is not quite so high as that of large compound condensing steam-engines—rarely exceeding 83 to 85 per cent., while the latter may go to 90 per cent. But the total efficiency, from the fuel to the pulley of the gas-engine, is about double that of the steam-engine—reaching 25 per cent. under favourable conditions, whereas with the steam-engine it rarely equals 12 per cent. So that with the gas-engine, operating at anywhere near its full load, there would be a gain in efficiency, instead of a loss of somewhere about 20 per cent. where the storage battery was used.

As indicating the performance of a gas-engine using lighting

gas at various loads, I quote the following figures obtained from a test of a 12-horse power (actual) gas-engine :—

Actual Horse Power Developed.	Gas Consumption per Horse Power.	Actual Horse Power Developed.	Gas Consumption per Horse Power.
12	15·0 cub. ft.	6	18·0 cub. ft.
11	15·3 ,,	5	19·0 ,,
10	15·5 ,,	4	21·0 ,,
9	16·0 ,,	3	26·0 ,,
8	16·5 ,,	2	30·0 ,,
7	17·0 ,,	1	48·0 ,,

These figures are somewhat better than would be obtained in practice; but they go to show that the gas-engine compares favourably at light loads with the steam-engine under similar conditions.

Thus far I have spoken only of illuminating gas; but the power may be much more cheaply generated by using fuel gas. The cost of producers or generators comes to about $11 per horse-power capacity—considerably less than the cheapest boiler. An idea of the space required may be gained from a statement of Mr. J. Emerson Dowson, who, in estimating for a plant of 400-kilowatt capacity, says that, if the gas plant is all on one level, it would occupy a ground space of 27 feet by 54 feet. But, if necessary, all except the gasholder can be placed under or over the engine-room. His estimate for such a plant is, including erection, foundations, and ashpit for the generators, $10·38 (£2 3s.) per horse power. These fuel gas generators can utilize advantageously the poorest grades of fuel, and produce from the better grades of anthracite about 160,000 cubic feet of gas, of a calorific value one-quarter that of 16-candle power illuminating gas, per ton of coal.

As to the stand-by losses of the gas-producers, these have been very carefully determined in a number of cases. As an illustration, I will cite a single case—by no means the best on record. At Openshaw, a generator, which supplied gas for from 250 to 300 indicated horse power, was shut down for 41 hours, and the fuel consumption during this time was but 3·9 lbs. per hour, or about 1 per cent. When we compare this with the stand-by losses of the steam-boiler, which are estimated by Professor Kennedy at 10 per cent. of the total consumption in all the boilers, we see how insignificant it is.

A situation usually considered peculiarly adapted to the storage battery is in subordinate or outlying stations, where they are charged during the daytime from the central station, and act as centres of supply during the night. But gas can much more economically be distributed to these stations than can the electric current; for Mr. Denny Lane has shown that, with ordinary 16-candle power gas, 3000-horse power can be sent a mile for an expenditure of 1-horse power, or 1-30th of 1 per cent. of the power conveyed.

My own calculations show that a 6-inch pipe will deliver 6000 cubic feet of gas per hour, at a distance of 10,500 feet, under 4 inches water pressure. If this is 16-candle power gas, allowing 25 cubic feet per horse-power-hour, this quantity represents 240-horse power.

Cast-iron pipe 6 inches in diameter, having a thickness of inch, weighs 31·9 lbs. per foot. The total weight of this two miles (nearly) of pipe will therefore be 334,950 lbs. This would be equivalent in conductivity to about 41,869 lbs. of copper. But four miles of copper weighing 41,869 lbs. would be equivalent to about four No. 000 B. & S. wires, which would have a resistance for the four miles of 0·325 ohms. If the charging current were transmitted at 220 volts, there would be required a current of 848 ampères. But a wire having a resistance of 0·325 ohms will only deliver, under a pressure of 220 volts, 667 ampères. There would, therefore, be required five No. 000 B. & S. wires to deliver this energy; and the weight of this would be 53,540 lbs. If the distribution took place at 1000 volts, the ampères required would be approximately 180. To deliver this at the same distance with a loss of 10 per cent. would require 6264 lbs. of copper; to deliver it at 1 per cent. loss would require 62,642 lbs., which would cost far more than the pipe, and still give less efficient transmission.

I think it would be very easy to prove that the gas-engine, with fuel gas, would prove a much more economical auxiliary to the central station for taking the peak of the load, and the loads amounting to fractions of a unit, than the storage battery; and when we consider the efficiency of transmission of energy in the form of gas, which will permit of the location of the gas-generators where land is cheap and fuel easily procured, it seems to me that the plan must commend itself to electrical engineers.

Unfortunately, the gas-engine business in America seems to be in the hands of parties totally incompetent to handle it properly, as everyone knows who has ever had occasion to seek information from them. It is probably not too much to say that every attempt thus far made in America to adapt the gas-engine to electric lighting has proved a failure. Our own manufacturers either do not know what their engines are capable of doing, or else they are afraid to make public what they will do. I believe there is not a single manufacturer who has a printed price list; and my own experience (and that of others whom I know) has been that it is impossible to get prices quoted until the manufacturer or his agent has been thoroughly satisfied of the exact purpose for which the quotations are desired. Information of any kind is almost impossible to get; and guarantees of performance, when given, are worthless. To such an extent is this true, that nearly all, if not all, the recent large orders for gas-engines have gone abroad, where the business is conducted on business principles. In England, Germany, and France, the gas-engine has come into extensive use in isolated lighting, and already has been adopted with satisfactory results in several central stations of considerable size. When the business is properly handled in America, we may expect to see the gas-engine make its way rapidly in the lighting industry there also; for it has merits which need only to be known to be appreciated.

A SPECTROSCOPIC STUDY OF OXY-COAL GAS.

Some time ago, M. Jean S. Stas undertook a series of spectroscopic studies of various elements; using, in his fundamental experiments, air, oxygen, hydrogen, and coal gas. A translation of his work in which the results are recorded is now appearing in the *Chemical News;* and we extract therefrom the portion relating to the spectroscopic examination of the oxy-coal gas employed.

When the air is pure, coal gas taken direct from the main burns in a Bunsen burner, or blowpipe, or blowpipe fed with air or oxygen, without showing a trace of the sodium line on spectroscopic examination. During my examination of the coal gas spectrum, I tried whether the presence of compounds of ammonia or cyanogen modified it. With this view, I examined the spectrum of oxy-coal gas, made with gas either taken direct from the main or kept in a gasometer where it was stored, having been previously deprived of compounds of ammonia and cyanogen by its passage through flasks filled with broken pumice-stone, and moistened respectively with a strong solution of caustic potash and sulphuric acid diluted with its volume of water. I have never detected any difference between the spectrum shown by ordinary gas and that by gas purified as above.

With the object of economizing oxy-hydrogen gas as much as possible, on account of the difficulty of preparing hydrogen fulfilling all requirements, I often used oxy-coal gas to eliminate from compounds the sodium which is accidentally contained in them. I also used the oxy-coal gas blowpipe (which is very much easier to manipulate) to check the results given by the oxy-hydrogen burner. These requirements led me to examine the oxy-coal gas jet formed from coal gas under pressures respectively of 4 and 5 centimetres of water. The results having been the same, I shall limit myself to mentioning here those obtained under constant pressure of 4 cm.

When the internal surfaces of the service-pipe and burner were thoroughly moistened, the gas-jet issuing from a platinum burner, with a hole 1 mm. diameter, formed a luminous flame 25 cm. high and 1½ cm. diameter. When the supply of oxygen was regulated so that all luminosity disappeared from the flame, its height was reduced to 17 cm., and its diameter to 7 or 8 mm. In pure air, this flame is deep pure blue, without an inner cone. Spectrum analysis of it shows an absolutely dark spectrum. On gradually increasing the supply of oxygen, the colour intensity of the flame decreases, and the light intensity increases. Instead of deep blue, it becomes sky-blue. It develops at the same time a highly luminous inner cone, pure light blue in the absence of sodium, and pale blue tinged with green whenever it has the least trace of sodium in it.

Spectrum analysis of the sky-blue flame and of the inner cone reveals a hydrocarbon spectrum. I found that the luminous intensity was greatest, and the spectrum most complete, when the inner cone was reduced from its original height of 9 or 10 cm. to about 5 cm. Whatever the height of the inner cone might be, the appearance of its spectrum is the same. It consists of six well-marked bands, shaded from left to right; one reddish-brown band, two bands of different shades of green, and three pure blue bands. The bands are defined by lines, the number of which varies with the luminous intensity of the cone. With maximum intensity, examining the apex or one side of the cone, the bands are made up as follows: (1) The red band—composed of four sharp very bright lines, situated between 43 and 49 on the micrometer of my Steinheil spectroscope. (2) The first green band—composed of four sharp very bright lines, situated between 56 and 66 on the micrometer. (3) The second green band—composed of three very bright lines, situated between 72 and 77. (4) The first blue band—composed of five sharp lines, less bright, situated between 90 and 96. (5) The second blue band—composed of four faint lines, situated between 113 and 115. (6) The third blue band—nebulous and very faint, extending from 117 to 118. When the luminous intensity was not at its maximum, but yet the bands were broken up into quite distinct lines, the second green band consisted of only two lines, and the first blue band of only four lines, instead of three and five lines respectively.

The coal gas spectrum generally recognized appears then to be an incomplete spectrum. The connection between the number of lines in the coal gas spectrum and its luminous intensity is undoubted; and the influence of a rise of temperature on them both seems to me indisputable.

I made a set of experiments to ascertain what influence the lines in the coal gas spectrum had on the spectra I was studying under different conditions; and I found out definitely that the spectrum of sodium, potassium, thallium, lithium, calcium,

strontium, and barium is the same when rendered incandescent either in an *oxy-hydrogen* or *oxy-coal gas* blowpipe.

Having obtained the coal gas spectrum, it suffices to place a compound of sodium, potassium, thallium, lithium, calcium, strontium, or barium in the desired part of the jet, in order to extinguish completely all the lines in the spectrum, and replace its characteristic bands and lines by the lines of each of these metals. Doubt is only possible in the case of the green lines shown at a very high temperature by barium compounds. This metal itself has a band made of very fine green lines, as observed by M. Bunsen, that might be mistaken for the green lines in the coal gas spectrum.

The rays from the metallic compounds I have just mentioned extinguish—that is, render invisible—the rays from coal gas burning in oxygen. The vapours of thallium and sodium, especially thallium, extinguish the lines of coal gas most easily; but one must raise the vapour of barium compounds to the highest possible temperature before it will make a coal gas spectrum completely disappear. Besides this, one finds in some of these bodies this property of extinguishing others.

THE PRODUCTION AND USE OF ACETYLENE.

The November number of the *Journal* of the Society of Chemical Industry contained the following abstract translation, by Professor D. E. Jones, of an article in the *Elektro-chemische Zeitschrift* on the above subject:—

The heat of formation of acetylene is $-47{,}750$ calories. This amount of heat is absorbed when 24 grammes of carbon and 2 grammes of hydrogen unite to form 26 grammes, or 22·33 litres, of acetylene. This negative heat of formation can also be deduced from the fact that in the reaction—

$$C_2H_2 + O_5 = 2CO_2 + H_2O,$$

310,050 calories are evolved. For the heat of formation of $2CO_2$ is equal to 194,000 calories, and of H_2O is equal to 68,300 calories. These together amount to 262,300; and the difference between this and 310,050—viz., 47,750 calories—is absorbed in the synthesis of acetylene. The Neuhausen Aluminium Company offer calcium carbide wholesale at the rate of 40 pf. per kilo. (about 2·2d. per lb.). It is stated that 1 kilo. on an average produces 275 litres of acetylene. Since 1 kilo. of pure calcium carbide should yield 348·9 litres of acetylene, the Neuhausen product really contains about 79 per cent. of calcium carbide.

In the electric furnace, the carbide is a viscous fluid. On cooling, it solidifies to a bronze-brown or grey crystalline mass as hard as granite. In demonstrating the preparation of acetylene, about 50 grammes of the carbide should be placed in an Erlenmeyer's flask provided with a stoppered funnel, from which water is allowed to drop slowly. In the decomposition of the carbide, the volume increases greatly, and much heat is evolved. The residue consists of calcium hydrate mixed with only a few specks of carbon. The carbide needs to be kept in well-stoppered bottles made tight with paraffin, for it is decomposed by the aqueous vapour always present in the air.

If acetylene be required for a series of experiments, it should be collected over a concentrated solution of common salt in a glass gasholder containing about 10 litres. [Water at 18° absorbs about its own volume of acetylene; whereas 100 volumes of the above solution only absorb about 5 volumes of the gas.] Acetylene condenses to a colourless liquid (sp. gr. ·42) under much the same conditions as carbon dioxide. Its critical temperature is 37°, and its critical pressure is 68 atmospheres. A Mannheim firm is already preparing to supply liquid acetylene is steel cylinders. Acetylene is about as poisonous as carbon monoxide, of which 0·4 per cent. is fatal; but it fortunately possesses a most characteristic smell. The presence of acetylene can be detected chemically by the formation of its silver compound ($C_2HAg \cdot AgOH$), which falls as a yellow precipitate when the gas is passed into an ammoniacal solution of silver nitrate.

To demonstrate the high illuminating power of the flame of burning acetylene, we only require very simple apparatus—a glass test-tube standing on a foot, and provided with a stopper through which passes a glass tube. The lower end of the tube should be cut on a slant, and provided with a side opening, so that condensed water may easily drop off. Its upper end should be provided with a platinum tube squeezed at top so as to leave a slit-shaped opening. About 3 grammes of calcium carbide are placed in the test-tube, and a few drops of water added. The stopper is pushed in, and the gas lighted.

An efficient illuminating agent should not only produce a bright light, but should also be cheap; and the products of combustion and the heat evolved should be comparatively small. All these factors are affected by the construction of the lamp or burner. Schülke's "Regina" lamp is well adapted for burning pure acetylene. The cost for a given number of candle-power-hours is about the same as when petroleum is burnt in the same lamp. But acetylene produces only one-third the amount of heat and one-fifth the amount of carbon dioxide. Light for light, acetylene is about 55 per cent. cheaper than electric glow lamps. With the arc light it cannot compete in cheapness, although it has the advantage of being more easily handled, and of sufficing in many cases where the extreme brilliancy of the arc light is not required.

The author gives a detailed comparison of the efficiency of various illuminating agents, accompanied by tables showing the consumption, price, number of calories and of cubic metres of carbon dioxide evolved per 100 candle-power-hours. In the following table, typical sources of light are arranged in order according to the number of candle-power-hours which can be provided at the cost of one mark:—

Wax	33
Stearine	77
Incandescent electric light	440
Coal gas (slit burner)	625
Acetylene and air (slit burner)	716
Oil gas	1660
Water gas and benzene	1666
Electric arc	2232
Schülke's petroleum-gas lamp	2250
Auer burner with coal gas	2300
" " with water gas	4350

In making such a comparison, it is necessary to bear in mind that the introduction of improved burners and mantles has greatly improved the efficiency of ordinary gas as an illuminating agent for both indoor and outdoor work. The Auer incandescent light only requires 112 litres of illuminating gas to produce 57-candle power (normal) per hour. Even if we allow for deterioration of the mantles, this only comes to 4·34 pf. per 100 candle-power-hours. Fed with water gas, the burner will give the same amount of light at a cost of only 2·30 pf. Whether acetylene in combination with water gas can compete with this remains to be seen.

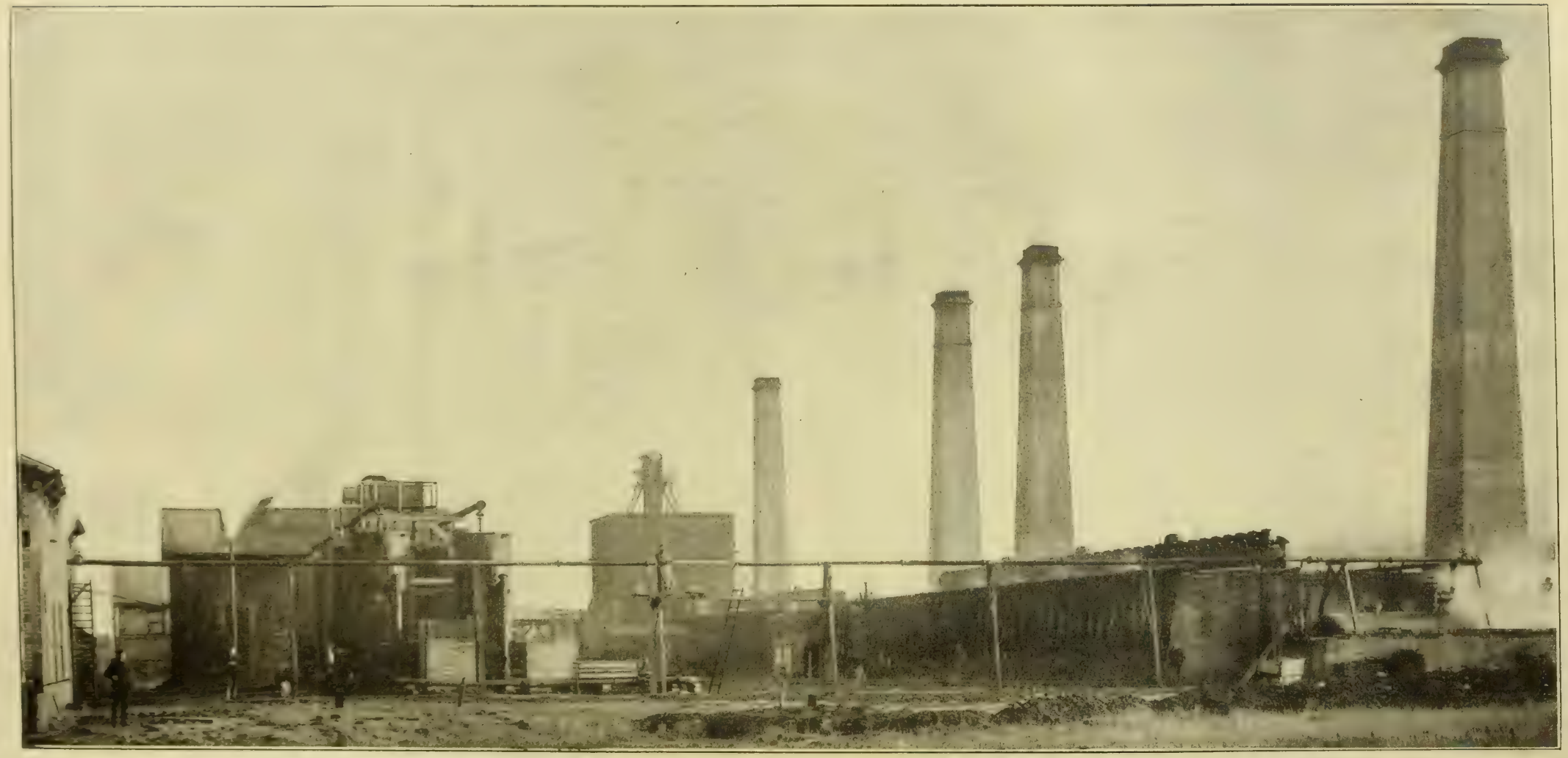
THE PURIFICATION OF TRADE EFFLUENTS.

The stringent conditions which are now being enforced by the Rivers Pollution Commissioners with regard to the purification of trade effluents, have necessarily stimulated attention to all processes by which the pollution from manufacturing operations can be most effectually dealt with. It will therefore be of interest to our readers to describe somewhat in detail a simple, and what has so far proved to be a very effective, process for purifying trade effluents, which has been introduced by Messrs. Mather and Platt, of the Salford Iron-Works, Manchester. The plant and the process are in operation at the bleach and dye works of Mr. J. Jackson, of Smedley, near Manchester, where for the last eighteen months they have been treating the polluted waters from their bleaching and dyeing processes at the rate of 20,000 gallons per hour in so efficient a manner that there has been no complaint whatever from the Rivers Pollution Commissioners as to the effluent discharged from the works. This process is also equally adaptable for softening hard water for use in boilers. The plant was inspected a short time since by a number of gentlemen interested in the matter; and the party were afterwards taken to Adlington, near Chorley, where they had an opportunity of seeing a plant at the works of Messrs. Davies and Eckersley for softening and purifying water at the rate of 8000 gallons per hour; reducing the water from a hardness of 15 or 16 per cent. to 3 per cent. before it is passed into the boilers. All the mechanical appliances of this process, which is practically a reversal of the operation in the ordinary filtering methods that have been found ineffectual in dealing with trade effluents to satisfy the requirements of the Commissioners, are extremely simple; and no great amount of labour is required. So far the operation has not been extended beyond treating trade effluents; but it can be very readily applied for dealing with sewage from moderate-sized towns, without any materially increased labour. Moreover, it would cost no more to deal with 20,000 gallons at one time than with 2000 gallons; and the appliances required for treating the sewage outfall of a town of 20,000 to 30,000 inhabitants would not be much larger than those put down for a fairly extensive dye or bleach works.

The apparatus consists of a cast-iron tank, where from 5000 to 10,000 gallons per hour are to be dealt with; or a brick-built tank, or series of tanks, where larger quantities of polluted water have to be treated. Each tank (the number of which is, of course, regulated according to requirements) is divided into two equal parts; the two tanks thus formed being fitted up in exactly the same way. The process of filling and clarifying—or softening, where the system is required for dealing with hard water for boilers—is carried on in one, while the clarified or softened water is being drawn off from the other. The polluted or hard water is admitted to either tank by means of a supply-pipe, connected up to a pump or main; the water being run in up to a level of a gauge-mark on the side of each tank. While the tank is filling, quicklime and sodium carbonate (58 per cent. ammonia alkali), in proportions depending upon the character of the water, are weighed out, and boiled up with water in a small chemical tank by means of live steam. The lime is first slaked in the hot water, and then the alkali added and stirred up until it dissolves. Some waters require the addition of a little aluminoferric, which is prepared in the form of a standard solution of which a measured volume is added to each tank of water immediately after the chemical-shave been run in. When the tank is full, and the inlet-valve has been closed,

THE DURHAM COKE AND BYE-PRODUCTS COMPANY'S WORKS AT LANCHESTER.

[*For Description, see p.* 1341.]



steam from the boiler is admitted to a blower, causing a current of water to circulate through a rose and a three-way cock, down a vertical pipe, and back into the tank through the perforations in a row of horizontal pipes about 18 inches above the bottom. On turning a small tap, the chemical solution is slowly drawn into the circulating current, and thus diffused throughout the body of the water. A cock is then opened to admit air through the pipe at the top of the blower; and by reversing the three-way cock, this air is forced through perforations on the under side of a row of pipes lying on the bed of the tank, where it stirs up the sediment lying on the bottom. Before being mixed with this mud, the new precipitate, which is very finely divided, will not coagulate, and takes a long time to settle; but when the old precipitate, consisting of coarse particles, is stirred up, the fine particles attach themselves to the coarse ones, which greatly accelerates the subsidence of the precipitate when the water is allowed to rest. After the blower has been in operation for fifteen minutes, the steam is turned off, and in about thirty minutes, or from that to an hour, very nearly all the precipitate will have settled to the bottom of the tank, and the water will not contain more than about one grain per gallon of suspended matter.

In the tests made at the works of Mr. Jackson, the polluted water was from the bleaching process—probably one of the most difficult effluents to deal with. The tests occupied about an hour, from the commencement of the process to the finish, when samples of he water were taken. These, though retaining a rather dark brown colour, were perfectly free from any solid matter in suspension, and of sufficient purity to pass all the conditions required by the Rivers Pollution Commissioners.

The darkness in the colour was due to the quantity of lime introduced being scarcely sufficient; and the process was repeated, with additional lime, when an almost perfectly clear effluent was obtained. This repetition is a special advantage of the process introduced by Messrs. Mather and Platt, as a further purification of the effluent, supposing any mistake to have occurred in the first process, would be absolutely impossible in other systems, as the water would have passed away, and in such an event might possibly result in action on the part of the Commissioners. In this process, the polluted water is not allowed to be discharged from the tank until a sufficiently clear effluent is obtained. The average period for dealing with the water, from the time of receiving it to obtaining a clear effluent, ranges from $1\frac{1}{4}$ to $1\frac{1}{2}$ hours; while meantime the second tank is being filled with polluted water for treatment simultaneously with the discharge from the first tank.

It may be added, in conclusion, that, in the process for softening water, a plant on the above system has been successfully in operation for some time at the locomotive works of the Midland Railway at Derby, dealing with 30,000 gallons per hour; and that at a mill in Nottingham water is being treated which has 35·5° of hardness, and contains both carbonate and sulphate of lime, as well as a large quantity of magnesium salts. The hardness in this water is reduced to an average of 3·2°; and the formation of boiler scale is entirely prevented.

Dinas Fire-Bricks.—Dinas bricks are now manufactured, according to Herren Seger and Cramer, writing in *Stahl und Eisen* (1895, XV., p. 1084), at Freienwalde-on-Oder. A quartz-like mineral, resembling the Dinas quartz of South Wales, and containing a high percentage of silica, is found in Germany; and this furnishes a suitable material for producing these bricks. The qualities required in the bricks are solidity, high melting-point, and freedom from shrinkage in the fire. The methods by which comparative tests of the English and German bricks were made, are fully described by Herren Seger and Cramer. The German bricks examined fused at about the same temperature (3880° to 3930° Fahr.) as the English ones; but they were superior to the latter in respect of constancy of volume.

The New Factory Act.—The Act of last session to amend and extend the law relating to factories and workshops comes into force to-morrow. It repeals the first paragraph of the schedule to the Notice of Accidents Act, 1894, so far as gas-works are concerned (so that these works will not henceforth come under the provisions of that Act), and the second paragraph, relating to accidents occurring during the construction or repair, by means of a scaffolding, of any building exceeding 30 feet in height, entirely. Under section 18 of the new Act (which is to be substituted for section 31 of the Act of 1878), written notice of an accident is to be forthwith sent to the inspector for the district, if it causes loss of life or such bodily injury as to prevent a workman from being employed for five hours on his ordinary work on any one of the three working days after the occurrence. In the case of fatal accidents, the certifying surgeon of the district is to be notified, unless the accident is of such a nature as to bring it under the Explosives Act, 1875, by section 63 of which notice has to be given to a Government inspector. An inspector may obtain a Magistrate's order to prohibit what he regards as dangerous machinery; and where accident is caused by neglect to fence, enlarged provisions are made with respect to compensation to sufferers thereby.

Obituary.—We regret to record the death, on the 20th inst., at his residence, Fairfield Court, Eastbourne, of Mr. George Ambrose Wallis, Resident Engineer of the Eastbourne Water Company. Deceased was the son of Mr. A. S. Wallis, of Walham Green, Middlesex. After undergoing a course of study in water and sanitary engineering, he was elected, just thirty years ago, as an Associate of the Institution of Civil Engineers; becoming a member in 1877. He was first connected with the Eastbourne Water Company in 1860, when the works were being provided by the late Duke of Devonshire. The population of the town was then about 4000, whereas at the present time it is estimated at 40,000; while the rateable value has risen from £20,000 to £300,000. In bringing about this result, Mr. Wallis was an active participator; for, being appointed Agent to the Duke, and Surveyor to the old Local Board, he was able to suggest and carry out many improvements. One of the greatest works he accomplished, however, was in connection with the new water-works, which were opened in 1883 by the Prince and Princess of Wales. Mr. Wallis had by that time resigned his public appointments, and become Chairman of the Local Board, and Resident Engineer of the Water Company. He was the first Mayor of Eastbourne. Mr. Wallis was in his 56th year at the time of his death, which was the result of only a short illness.——We have just learnt with regret of the death of Mr. Augustine Marie Murphy, formerly the Manager of the Cirencester Gas-Works. Deceased succeeded his father, who undertook the management of the works on the establishment of the Company in 1833; and for a period of about thirty years he directed successfully the practical operations of what has become one of the most prosperous local undertakings. A serious illness a few years ago necessitated the relinquishment of his duties, which passed into the hands of the present Manager (Mr. E. M. Beecham); but his interest in the works continued until his death, which occurred on the 14th inst. during sleep.

REGISTER OF PATENTS.

Producing Metallic Carbides and Illuminating Gas Therefrom.—Ellis, C. B.; a communication from T. L. Willson, of New York No. 16,342; Aug. 27, 1894. No. 16,705; Sept. 1, 1894.

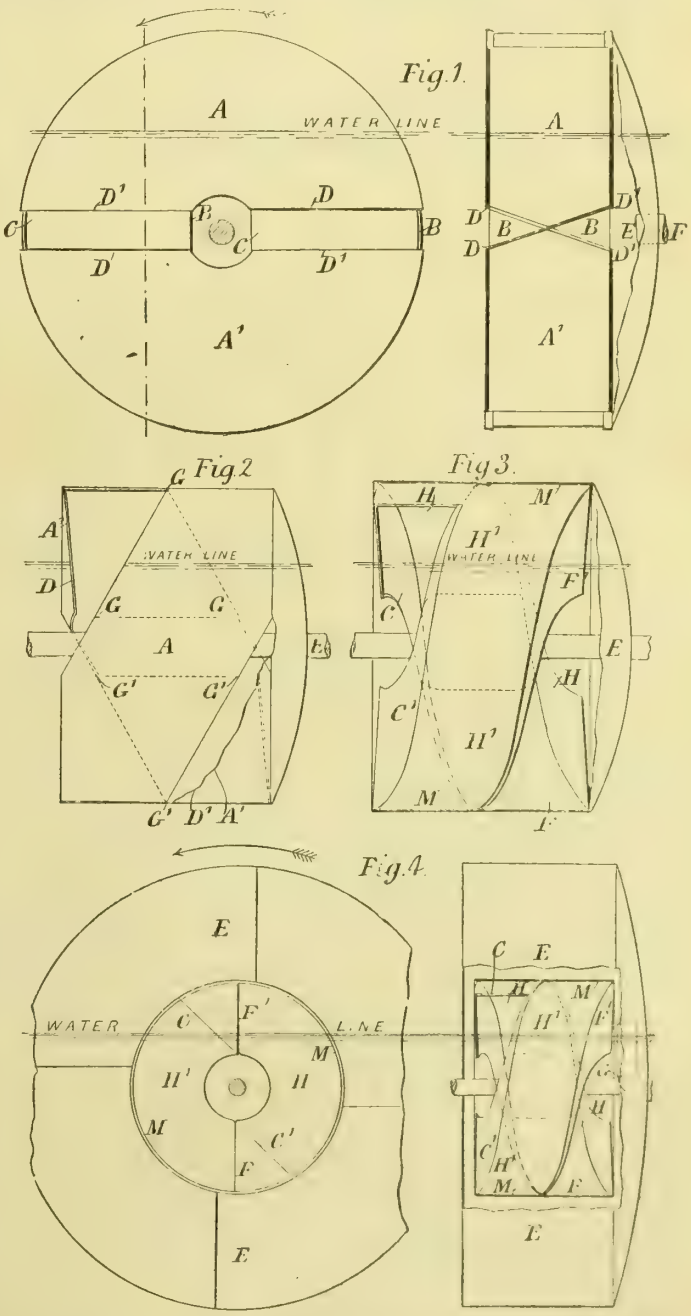
The objects of these inventions have been sufficiently described in the various accounts given in our pages during the past year of the patentee's proposals.

The claims for both inventions are substantially the same—(1) The production of crystalline calcium carbide, by subjecting lime and carbonaceous matter in suitable proportions to the continued heat of an electric arc between a carbon pencil above and a conducting hearth or pool of reduced material beneath. (2) The production of hydrocarbon gas by heating a compound containing calcium with carbonaceous matter in an electric furnace, so as to produce a carbide of the metal or metals contained in such compound, and afterwards, by acting upon the carbide so formed with water, to generate the hydrocarbon gas. (3) The production of acetylene gas by treating calcium oxide with carbonaceous matter in an electric furnace, so as to produce calcium carbide, and afterwards acting upon the calcium carbide with water to produce acetylene.

[The above inventions are those for which application is to be made to Parliament next session for a Private Act to permit the antedating of the patents to Feb. 28, 1894—see *ante*, p. 1151.]

Wet Gas-Meters.—Warner, W. J., of South Shields, and Cowan, W., of Edinburgh. No. 25,257; Dec. 29, 1894.

This invention forms modifications of, or additional improvements in, the form of wet gas-meters described in patents Nos. 1698 and 4504 of 1894; and it has for its object "to still further improve the said class of meters." The claims for the present invention are: (1) In wet gas-meters the construction of an independent abstracting wheel, with abstracting channels or chambers. (2) The employment of an abstract-



ing wheel as an "inner wheel" in communication with alternate chambers of the major wheel. (3) In the "drums," "cylinders," or "wheels" of wet gas-meters, the combination therewith of two segmental chambers or channels, arranged in the form of a wheel, to take the place of an ordinary four-chambered "inner wheel," and placed in

communication with the chambers of the main or "major wheel" and the case (the common outlet), or with the chambers of the "major wheel" and the "hollow cover" (the common inlet) of the wheel.

The most simple combination of the segmental chambers is that of two chambers AA^1, in fig. 1, each rather less than a half cylinder, placed immediately over each other; thus forming a cylinder with spaces B between the two halves. The opposite sides of the cylinder are connected by inclined portions or partitions C, similar to a partition of an ordinary wheel, and the spaces of the rim of the wheel are entirely closed. When driven, as shown by the arrow, the gas will be taken in at the back of the wheel at D, and discharged into the hollow cover E at D^1; and so of the chamber A^1—the gas being taken in at the back of the wheel, delivered into the "hollow cover" E, and thence conveyed back to the inlet-gas by the spout F. The axis of this cylinder is, of course, concentric with the shaft.

As shown in fig. 2, the abstracting wheel may be made by combining the segmental chambers or channels AA^1 across each other, with their axes placed diagonally across the shaft; or rather they would be if each were an entire half cylinder. The form of each chamber may, however, be better described as being a half cylinder, with a portion of each opposite end cut away diagonally, and the sides then being made good so as to form the chambers and the inlets or intakes D and outlets D^1. The chambers AA^1 are separated from each other by the triangular partitions GG^1; the two inlets or intakes D being open to the exterior of this wheel, and the outlets D^1 discharging into the "hollow cover" E, from which the gas is conveyed to the common inlet as described.

As a further modification (fig. 3), the chambers or channels are made in spiral form—that is to say, a cylinder M is employed, within which are firmly soldered two spiral-shaped partitions, in such a manner as to form a wheel with two chambers or channels HH^1, the intake ends CC^1 of which are arranged at the back of the wheel, while the outlet ends FF^1 are open to the "hollow cover" E, as already described.

In this form, the number of abstracting channels or chambers may be more conveniently and neatly varied than in any other. Thus the two chambers are combined so as to form an "inner wheel"—that is to say, the wheel is formed as a cylinder having two spiral-shaped partitions, or it may have four partitions; thus forming (by the two additional partitions, placed intermediately between the other two partitions) an "inner wheel," with four spirally-formed chambers. Further, in the construction of a three-chambered combined wheel, the abstracting channels of the "inner wheel" may be arranged in the same manner—that is to say, as the cylinder with two chambers having the partitions arranged for taking in the gas from alternate chambers, and the variation by alternate forming four chambers, so in like manner a three-chambered wheel may have an abstracting arrangement of three chambers, formed by three partitions arranged at equal distances around the inner side of the cylinder, in like manner to those with two and four chambers.

In thus varying the number of partitions and channels, the arc of each abstracting chamber must be such as to ensure the sealing of each chamber at the "low-water line," and the abstracting and delivering of the compensating volumes, as already described. A "hollow cover" and "spout" are necessary in every case to separate the inlet and outlet gas, though the "hollow cover" may be used either as the inlet or outlet to the ends of the chambers which it covers. If the end of the abstracting wheel opposite to the "hollow cover" be open to the case of the common meter, then the gas will be abstracted through the open end and delivered into the "hollow cover;" the ends of the chambers entering the water as the inlets, and the opposite ends rising from the water as the outlets within the "hollow cover," into which the gas is discharged as the inlet end enters the water. Hence the abstracting wheel may be arranged with its chambers discharging to the left or the right of the shaft looking at the "hollow cover," or with the spirals as a right or left handed screw, as may be most convenient in the arrangement of the ordinary meter and the abstracting wheel. The ends of the chambers entering the water are always the inlets or intakes; the other ends being the outlets or discharge ends. The abstracting wheel may therefore be driven with, or in the opposite direction to, the meter-wheel—abstracting the gas directly from the meter case, and returning the gas so abstracted through the "hollow cover" to the common inlet; or by reversing the motion, the gas may be abstracted through the "hollow cover," and discharged into a case over the abstracting wheel, and thence into the common inlet. The abstraction, however, may be made to take place always through the open end of the wheel or through the "hollow cover," without changing the direction of the motion of the abstracting wheel. Thus C and C^1 are the inlets or intakes, with the motion of the abstracting wheel as shown in fig. 4; if the direction of the motion be changed to the opposite direction, then F F^1 will be the inlets. But by changing the relative position of the inlets and outlets of the two chambers—placing H^1 in the position of H, and *vice-versâ*—the intakes and deliveries will be reversed. The water-line of the abstracting wheel being that of the meter, any variation will equally, in action, affect the two wheels; a volume changing with the varying capacity of the meter wheel being abstracted and returned to the common inlet.

The second part of the invention relates to the constructing of a meter-wheel, with the improved wheel as a new "inner wheel." One form of this application is illustrated in fig. 4; the inlet and outlet gas being in every case separated by the construction of the combined wheel. The "hollow cover" of the abstracting wheel is, of course, removed. The relative positions of the "inner" and major wheel may be arranged as with the combined wheels—that is to say, the gas may be abstracted from the outer case (the common outlet), and delivered into a filling chamber of the major wheel; or it may be abstracted from an emptying chamber, and delivered into the "hollow cover" (the common inlet). Also the gas may be abstracted from an emptying chamber, and delivered into a filling one. In the first case, the abstracting wheel being placed at the back of the combined wheel, the inlets or intakes will be at the back and outside of the major wheel; the outlets or deliveries being just through the rising partition of a filling chamber. In the second case, the abstracting wheel is placed at the front of the combined wheel, and the deliveries take place in the "hollow cover;" the inlets of the abstracting wheel being open to the emptying chambers of the major wheel, the gas is abstracted from them. In the third case, the abstracting or inner wheel is placed entirely within the major wheel; the gas being abstracted from an emptying chamber and delivered into a filling one. The chambers of the abstracting wheel must be soldered perfectly sound to the partitions through which they pass, to below the low-water line; and each chamber of the abstracting wheel must be also perfectly sound, and only in communication with the chambers subject to its action.

Igniting the Charge in Gas-Engines.—Cordingley, I. & T. W., of Trowbridge. No. 25,275; Dec. 29, 1894.

This invention in connection with igniting the combustible charge in gas-engines, consists in forming a baffling-block with ports of certain dimensions, and an inverted thimble operated automatically by the compression in the cylinder. The thimble covers and uncovers (or baffles) the flame travelling from the ignition-tube to the cylinder; so that ignition can only take place at certain required times, and premature explosions are prevented. Instead of the baffle-block and inverted thimble, a quadrant valve may be attached to the cylinder, and caused to open by the piston and close by the air-valve.

Coin-Freed Gas-Meters.—Wright, F., of Old Queen Street, Westminster. No. 1325; Jan. 19, 1895.

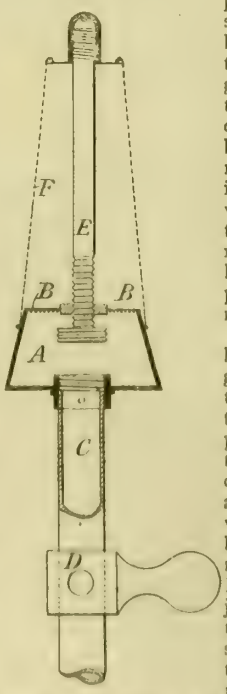
The arrangement of this coin-freed gas-meter was described and illustrated in the JOURNAL for Oct. 22 last (pp. 823, 826). The claim made for the invention being for the use in coin-freed fluid meter apparatus of a wheel or disc geared to the meter counter, and having through it holes to receive coins. On the one side of the disc is a stop-valve for the fluid, closed by weight or a spring; and on the other side is a plunger or pusher in line with the valve-stem, but incapable of moving it. The arrangement is such that, when no coin occupies the hole facing the plunger, the valve-stem is in the hole; the valve being closed. But when a coin is pushed into the hole—extruding the valve-stem—the valve is opened; the disc is allowed to rotate; and the valve is kept open till another hole comes in line with the stem. As a modified arrangement, a reciprocating plate having a hole for the coin is substituted for the rotating wheel or disc.

Incandescent Gas-Mantles.—Taylor, A. and W. S., of Glasgow. No. 1577; Jan. 23, 1895.

This invention in relation to incandescence gas-lighting has for its objects: (1) The production of mantles of greater durability, and at much less cost, than those at present in use; and (2) to provide a burner of the Bunsen type, arranged to supply gas and air for heating the mantle to incandescence, and yet adapted to be used as an ordinary gas-jet in the event of the mantle being injured or removed.

The mantle is made from "a knitted, woven, or other meshed or open fabric of cotton, linen, or other fibre," shaped to the usual conical or tapered tubular form, or of hollow globular or other shape; the fabric being treated by immersion in, or coating with, reagents containing bromine, chromium, uranium, and calcium, and serving as a support therefor—the fabric being consumed by burning in the usual way, while the salt or earthy matter remains and becomes incandescent by the combustion of the gas within the mantle.

Under one modification, the mantle fabric is dipped in a weak solution of hydro-bromic acid, 40 per cent.; ammonium bichromate, 40 per cent.; uranium acetate, 10 per cent.; and potash alum, 10 per cent. Thereafter it is immersed in a strong solution of calcium carbonate, or of calcium carbonate and magnesium carbonate, in the proportion of about 60 per cent. of the former salt to 40 per cent. of the latter. The top and bottom parts of the mantle may be further treated by immersion in, or coating with, manganous oxide and manganic hydrate in admixture. After drying, the mantle may be rendered flexible, and preserved against breakage, by immersion in, or coating with, "any suitable medium as ordinarily practised." After burning off the preserving medium, and with it the vegetable or other fibre remaining in the mantle, the residue upon which the burning gas acts to raise it to incandescence is largely composed of lime and other inexpensive ingredients. Phosphoric acid, acetic acid, or ammonium chloride may be substituted for hydrobromine acid.



The patentees propose to employ a special burner of the form illustrated; having the usual gas and air mixing chamber A, with perforated top B for the passage of the mixed gas and air, to produce a non-luminous flame of high temperature; the mixing chamber being attached to the end of a gas-supply pipe C, formed with orifices for the admission of air, but fitted with a gas-tight sleeve D for cutting off the air supply when desired. Through the top of the chamber A is screwed a tube E, which serves as the means for supporting the mantle F over the Bunsen flame, and in which is fitted a flat flame jet burner covered by a cap. The lower end of the tube E is adapted to fit a corresponding screw-thread on the gas-supply pipe C entering the chamber A, or (as shown) this screw-thread may be formed in the lower end of the chamber. When the mantle F is in use with the Bunsen flame, the flat flame burner tube is screwed up out of the gas supply pipe, so that gas and air freely enter the mixing chamber; but in the event of the mantle being damaged or removed, this tube is screwed down to fit in or on the gas supply pipe E. The air-inlet orifices in the gas-supply pipe are thus closed by the sleeve; and the gas passes without admixture with air through to the flat flame, so as to afford an ordinary luminous flame.

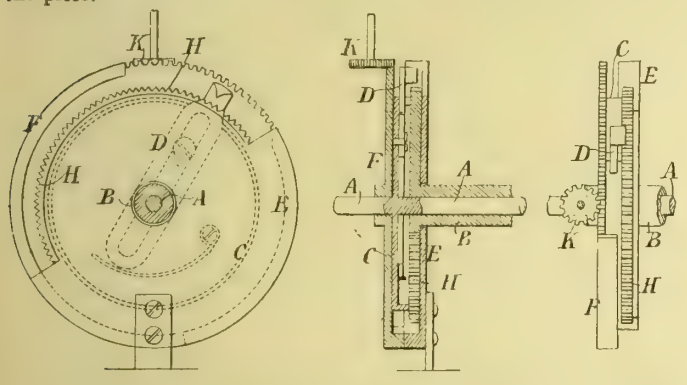
Refractory Bodies for Use in Incandescent Burners.—Kroll, O., of Berlin. No. 2732; Feb. 7, 1895.

In order to overcome the disadvantages usually manifested in incandescent mantles as ordinarily manufactured—rapid deterioration after a short time resulting from the shrinking and scaling of the incandescent body—the patentee proposes to employ zircon and magnesia in the mantle in extremely thin layers. The effect of this, it is claimed, is to form a mantle of very fine porous framework, which, by its rough fibrous surface, "is able to send forth more rays of light than any of the commonly-known smooth bodies."

The chemical compounds employed are: 20 per cent. of chlorate of potash (KCl); 40 per cent. nitrate of baryta (BaO, NO_5); and 40 per cent. carbonate of baryta (BaO, CO_2). These materials are brought into solution by means of nitric or muriatic acid, and then evaporated to dryness. The residue is exposed for days together to an extreme white heat (all air being throughout excluded), and is then ready for use for the impregnation of any woven material selected for the framework of the mantle. Small quantities of the rare earths usually employed for incandescent mantles may, if desired, be added to the above-named mixture.

Adjusting Gear for Coin-Freed Meters.—Wright, F., of Old Queen Street, Westminster. No. 3266; Feb. 14, 1895.

This invention relates to gearing of coin-freed meters, by which the quantity of gas supplied for a coin can be adjusted to suit variations in the price.



A is a spindle worked by the meter—as, for instance, the spindle of the first index of the counter. B is a sleeve loose on the spindle, and connected by worm or other gear to the coin-freed mechanism (which may be of any kind). C is a disc fixed on the spindle, and having an arm D fitted to slide radially on it, and urged outwards by a spring. The outer end of the arm D is thickened, and has one side shaped as a tooth. E is a disc, loose on the sleeve B, but fixed on the framing of the meter. F is another disc, which, by means of a pinion K gearing with a toothed part of its circumference, can be partly turned around the spindle, and can be held in any desired position. Both the discs E and F have at their peripheries inwardly projecting flanges, cut away for half the circumference. H is a toothed wheel fixed on the sleeve B.

The operation of the apparatus is as follows: As the counter-spindle A revolves, it carries round the disc C and arm D, the tooth of which, being held engaged with the teeth of the wheel H by the flange of the disc E or F, causes the sleeve B to revolve, and drive the coin-freed mechanism. But when, after revolving a certain distance, the end of D escapes from under the flange of E or F, its tooth becomes disengaged from H, and A goes on revolving without driving B, until the end of D again passes under the flange of E or F, which causes its tooth to engage again with, and drive the wheel H. Thus every revolution of the spindle A causes a less or greater fraction of a revolution of the sleeve B, according as the disc F is set with a greater or less interval between its flange and the flange of E. Consequently the coin-freed mechanism driven by B requires a greater or less number of revolutions of A, and therefore the passage of a greater or less quantity of fluid, to receive the movement necessary to give effect to the action of the introduced coin.

As an example of the application of the apparatus to a coin-freed gas-meter, the patentee assumes that every revolution of A registers a passage of 2 cubic feet; that the wheel H has 120 teeth; and that the sleeve B has to make 10 revolutions for the passing of one penny through the coin-freed mechanism. If the disc F be set so that the end of its flange coincides with the end of the flange of E, then the tooth is held engaged with the wheel H during the whole revolution of A. Consequently the penny will purchase 20 cubic feet—the product of 10 revolutions of A by the 2 cubic feet delivered at each revolution. If now the disc F be turned round relatively to E, so that there is between the ends of their flanges a gap uncovering 60 of the teeth of H, then, as the tooth is during half a revolution of A disengaged from H, it will require 20 revolutions of A to cause 10 revolutions of B; and consequently the penny will purchase 40 cubic feet. By turning F to intermediate positions, various quantities, between the minimum of 20 and the maximum of 40 cubic feet, can be delivered for a penny.

Sun-Burner Gas-Lamps.—Thomas, W. J., of Denmark Hill, Camberwell. No. 9914; May 20, 1895.

This invention relates to enamelled metallic cones, domes, gas-burners, and deflectors for use in connection with non-regenerative gas-lamps of the sun-burner type, whereby the light "is greatly increased, ventilation is procured, and the products of the gas are disposed of, combined with either heated or cold air inlets."

According to one part of these improvements, the burners are arranged externally in and around a closed receiver or chamber (as described in patent No. 5102 of 1888). Inside the closed receiver under the cones or pyramids inverted, which form a separate chamber at the lower part of the receiver, is placed, at a suitable distance, a dome or cone (with its apex upwards), supported by a small rod or stud fixed into the screw-plug in the bottom portion of the receiver. This dome or cone, which can be made of metal, steatite, or asbestos, has the advantage that any particle of dust or carbon that may pass through into the receiver, and through the cone or pyramid, cannot return, as the cone with its apex upwards causes the dust or carbon to descend into the bottom of the receiver, and forms an additional baffler or guard against the deposits blowing into the burner orifices.

The burner used consists of a long hollow tube of steatite or soapstone, pierced as usual with gas-orifices cased in a steel or metal casing screwed externally at one end, and combined with a shield or deflector of angular shape, placed at the underside of the jet, so as to project higher than the steatite jet, and cause the flame to spread out and prevent cold air currents striking against it.

Incandescent Gas-Burners for Indoor and Outdoor Use.—Deimel, F., of Berlin. No. 16,642; Sept. 5, 1895.

These improvements have for their object "not only the production of a full and uniform heating flame approximating as nearly as possible to the shape of the incandescence mantle, but also the protection of the flame against gusts of wind and the like, and the protection of the mantle itself, with increased lateral and direct supply of air."

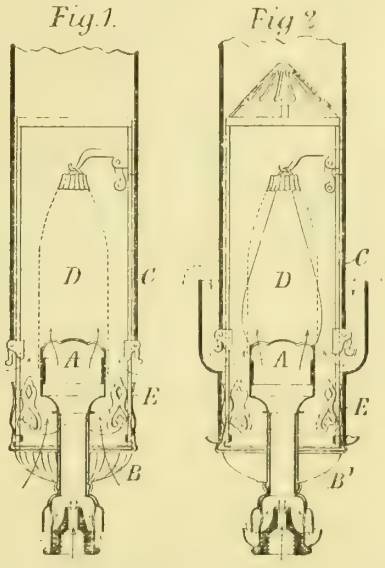


Fig. 1 shows the arrangement for use in closed spaces; and fig. 2 the same burner arranged for the open air.

The burner-head A is closed by a domed plate, which in its peripheral domed part is formed with slits which, "for effecting a gentle flowing together of the laminæ of gaseous mixture issuing therefrom," are either formed as "successive epicycloidal curves," or they may have a straight oblique form. The gaseous mixture receives by this means, in combination with the domed form, an "outward directed upward" motion, so as to form a full flame approximating as nearly as possible to the form of the mantle (as indicated at fig. 2) accompanied by a short rotary motion, independently of the fact that by the peripheral curvature, the outlet-orifices are substantially increased in size without enlarging the diameter of the burner-head.

For protecting the flame against one-sided increased air-currents, and for preventing the flame from striking back into the air-admission holes of the mixing chamber, there is provided a downward extending shield, the lower edge of which, in the burners used in the open air (fig. 2), is surrounded by an inverted shield. The air must, in this case, first pass over the upper edge of the lower shield, and then from the latter under the shield and through the openings into the mixing chamber.

With the burner as at fig. 1, the air for combustion passing to the mantle enters from below through the burner-cage B into the lamp-glass C, and also laterally direct to the mantle D, as indicated by the arrows. If the flame is to be protected against disturbing air-currents from below, as in street-lamps, there is employed in place of the burner-cage with openings shown at B (fig. 1), a closed burner-cage B^1 (fig. 2); and the air supply to the mantle D is effected solely by the raising of the chimney-glass C. This raising of the chimney is effected by a device which is either inserted in the burner-gallery E, or it can be fixed to the burner-cage B^1. The device consists of vertical rods connected together at the top and bottom by rings, and inserted into the burner-gallery. A cap having openings protects the mantle D against objects that may fall into the glass; while the supports in combination with the top ring prevent the possibility of the mantle being damaged on fitting on the glass.

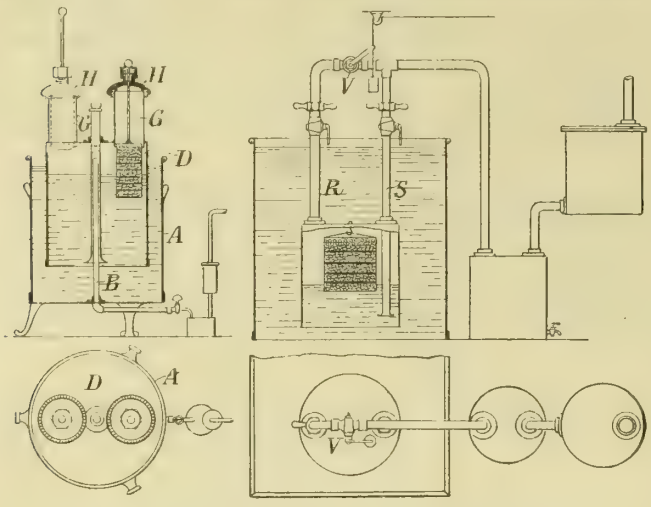
The supports carry adjustable clamps, fixed by means of their eccentric levers, and serving as the support for the glass. One of the supports can be fitted with an adjustable carrier for the mantle, which allows not only of the use of the raising device for burners of different heights, but also enables it to be raised or lowered relatively to the burner-head.

As by the raising of the glass C, for the lateral and direct admission of air to the mantle D, an opening is formed which leaves the lower part of the mantle unprotected, it is necessary to guard against lateral gusts of wind by means of a cylindrical shield made of transparent material, which surrounds the lower edge of the chimney-glass in such a manner that the external air can only enter the cylinder C from above on its way to the mantle, as shown by the arrows in fig. 2.

Acetylene Gas Generating Lamp.—Kaestner, C., of Halle-on-Saale, Germany. No. 18,824; Oct. 8, 1895.

Two forms of the "automatic gas-generating acetylene lamp" are shown in the engravings—fig. 1, a partial sectional view of a single lamp; and fig. 2, a gas-generator (with holder) for use on a large scale.

Upon the vessel A is mounted another vessel B; and from the latter water flows (through a bent pipe D, in which is a cock N and a non-return valve) on to a layer of felt E. Under the felt is a plate F, provided with a funnel-shaped extension, forming an outlet G. The opening in G is of a size to correspond with the consumption of gas by the



lamp, and in such a manner that only a single drop can form at this place. The felt is therefore provided for the purpose of straining the water, and thereby preventing the aperture in the funnel G from becoming stopped up by dust, &c. The apparatus is connected to a gas-holder J (fig. 2) for the purpose of supplying a large number of burners. But in this case it is advisable to provide two generators, in order that gas may be formed continuously. The conduit from the generator to the holder may either be shut off by a cock M, or back flow of the gas may be prevented by means of a non-return valve P. The receptacle for the calcium carbide is provided at its lowest point with a screw cap or plug for cleaning, &c. When the water comes in contact with the calcium, the acetylene gas formed rises through the pipes H; and when the cock C is open, it flows into the burner K, which is formed with extremely fine holes, in order to prevent the flame smoking.

Gas-Lamps for Theatres, Public Buildings, &c.—Tollerton, J., of Leeds. No. 20,208; Oct. 26, 1895.

The patentee proposes a special construction of "sunlight gas-lamps, so as to increase their ventilating power, as well as their lighting power." The usual clusters of ring burners are employed, with reflectors above them, so arranged as to leave an air-space between any two reflectors, in order to provide an uninterrupted exit of vitiated air and products of combustion at the central outlet. The tops of the reflecting chambers are also perforated, with the same object.

Gas and like Engines, and a Method of Mixing and Volatilizing the Gases used.—Kane, T., of Chicago, U.S.A. No. 20,305; Oct. 28, 1895.

This invention relates specially to that class of engines in which hydrocarbon oils are used for the purpose of enriching a certain amount of air to make an explosive mixture. The object of the invention is to provide such an engine, adapted "to vaporize the hydrocarbon liquid, perfect the mixture of the gases and air, and the volatilization of the explosive mixture within the cylinder, so as to cool the cylinder after each explosion of the mixed vapour and air, thus increasing the efficiency of the engine and economy of construction."

APPLICATIONS FOR LETTERS PATENT.

24,068.—Sturgess, G. F., "Gas-burners and a method of igniting the Bunsen burner." Dec. 16.

24,073.—Robertson, J. C., and Wallace, J. A., "Illuminant to be used in connection with gas and kerosene lamps and candles and the like." Dec. 16.

24,088.—Synnock, W., and Gosling, G., "Production and automatic distribution of acetylene gas." Dec. 16.

24,097.—Herring, W. R., and Graham, M., "Charging inclined retorts." Dec. 16.

24,113.—Pulling, A. R., and Rivolta, F. J., "Freeing and maintaining such freedom of water from pipes during frosty weather, or shutting off the flow during repairs to pipes." Dec. 16.

24,133.—Beechey, C. G., "Coin freed or actuated gas-meters and analogous apparatus." Dec. 17.

24,171.—Darby, J. H., "Manufacture of ammonium salts." Dec. 17.

24,196.—Pym, E. B., and Gore, J., "Manufacture of acetylene gas." Dec. 17.

24,207.—Neumann, A., "Igniting devices for gas-jets, and manufacturing the same." Dec. 17.

24,383.—Cutler, S., "Gas liquor separators." Dec. 19.

24,384.—Cutler, S., "Oil atomizer for gas carburettors." Dec. 19.

24,437. The Anglo-Swedish Trading Association, Limited., and Wolfert, O. E., "Electrical and other gas lighters and extinguishers." Dec. 20.

24,463. Riordan, T. V., "Mediums for igniting coal gas, and in the application of such mediums to gas burners." Dec. 20.

24,464. Schulz, F. L., "Gas lamp wherein several incandescent gas burners are united." Dec. 20.

24,485. Haydon, G., Urry, F. H., and Sommerville, G., "Coin-freed gas (and the like) meters." Dec. 21.

24,505. Taylor, A., "Mantles for incandescence gas lighting." Partly communicated by W. S. Taylor. Dec. 21.

24,527.—Lamplough, F., and The Automatic Heat Regulator Company, Limited., "Atmospheric burners automatically controlled." Dec. 21.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The Prices of Ammoniacal Liquor and Sulphate of Ammonia.

Sir,—Allow me to thank you for your courteous reference in this week's Journal to my complaints and criticism of your "Current Sales of Gas Products" reports. I am sorry to find that my speculations are thereby confirmed—that your aim is to quote the prices at which time-contracts are or could be made. Although most of the liquor sales are, as you state, made over a period, yet I still venture to hold the opinion that, had you found it possible to give weekly a fairly accurate standard of the week's actual deliveries, your reports would have afforded a more useful guide to local gas authorities. The difficulties in the way, you clearly indicate.

Average prices having prevailed in the past, your records of contract levels have answered satisfactorily as a measure of weekly deliveries. But present prices being extreme, if not abnormal, speculative contract standards misrepresent the values of the week's deliveries of liquor.

I cannot but admit that your position is unassailable. Recognizing the prevailing custom, you cannot be expected to record values measured by another and a different scale. However keen my disappointment at your inability to accept my suggestion, my thanks are nevertheless due for your clear and explicit statements, since they cannot fail to make evident the justice of my appeals for modifications of the existing contracts, previously alluded to, and which were made on the assumption that your quotations were based on the actual values of the weekly deliveries of liquor.

King's Lynn, Dec. 27, 1895. H. C. Brown, Ph.D., F.I.C.

The Relative Prices of Crude Naphtha and Benzols.

Sir,—I have read Mr. Simon's letter in your Journal of the 17th inst.; and as I believe I am the oldest tar distiller now living (having commenced business in 1851), might I suggest the following to your readers.

Since Perkins discovered mauve in 1856, and the discovery of other aniline colours which followed soon after, I have had very considerable experience in the refining of crude naphthas—being one of the first makers of benzol commercially, at which time it was sold at 21s. per gallon. I have also dealt in them largely both as a buyer and seller, as they are collected from the tar-stills, both for spot deliveries and by contracts running over a given period; and I have always found that crude yielding 30 per cent. distillate at a temperature of 120° C. is not a test in itself of the value, or the estimate of the quantity of benzol it contains. Buyers invariably test the samples by practical methods, based on experience, to ascertain in the first place the loss by treatment with rectified sulphuric acid and caustic soda and water washings, which varies much in different samples—say, from 12 to 20 per cent. By fractional distillation, benzol, toluol, solvent and heavy naphthas are separated, leaving creosote in the still.

I think if Mr. Simon will go farther into the question, he will find the benzol much less than he anticipated. It is quite true that 90 per cent. benzol has advanced to the price named. But we must not overlook the fact that solvent and heavy naphthas, and also creosote, have not increased in value; and these form a considerable bulk of the crude. It will, therefore, be seen at once that Mr. Simon's argument does not hold good.

The apparent low price of 30 per cent. crude naphtha may, to some extent, depend upon the quantity under contract previous to the rise in benzols. But as these contracts run out, I think sellers will have a good chance of getting better prices, so soon as refiners are again in the market to renew.

Great Yarmouth, Dec. 24, 1895. Joseph Turner.

P.S.—It must also be borne in mind that there are several makes of crude naphtha which show 30 per cent. at 120° C., but actually contain very little 90 per cent. benzol; so that the increase in value on this is really very trifling.—J. T.

The Extensions at the Plymouth Gas-Works.

Sir,—I am loth to occupy your columns with personal matters; but I cannot allow the letter from Mr. West, in your last issue, to pass unchallenged. He impugns the accuracy of my figures, and puts forward others to support his contention. I abide by my statement in its entirety. Anyone who chooses can test my figures by referring to the balance-sheets of the Plymouth Gas Company for the years ending March 31, 1890 and 1895, respectively. They will be found absolutely correct.

Wakefield, Dec. 26, 1895 H. Townsend.

[By a clerical error, the amount of the deficit on sulphate at the end of Mr. West's letter appearing last week was given as £12,000 instead of £1200.—Ed. J. G. L.]

Explosions of Domestic Boilers.

Sir,—I have read the correspondence in the Journal on the subject of the circular letter recently issued by the Board of Trade to water companies in regard to domestic boiler explosions. In the absence of legislative enactment, I assume that any recommendation to owners of such boilers can only take the form of a suggestion, and if that should have the effect of saving men, women, and children from the danger and suffering caused by these explosions, why should not the suggestion be made?

In response to the Board of Trade letter, I have issued, in the district of the Water Company of which I am Secretary, a public notice, and sent one to each person who is known to have such a boiler in use. I thought it a right thing to apprise persons who are often oblivious of the danger to which they are exposed, and to suggest the best known means of prevention.

I enclose a copy of the notice above alluded to, which you are at liberty to make any use of that you think proper.

Deal Water-Works, Dec. 27, 1895. W. R. HAMMOND.

[ENCLOSURE.]

The Board of Trade having called the attention of the Deal Water-Works Company to the large number of explosions which have occurred, during periods of severe frost, from boilers used for domestic purposes, and the Board being advised that most of these casualties might be avoided by the adoption of simple precautions to prevent the freezing of the water in the pipes, or to relieve any excess of pressure which may arise in the event of the water becoming frozen, and having requested the Water Company before the approach of winter to make their customers and the ratepayers acquainted with the precautions that should be taken, I have been in communication with Lavington E. Fletcher, Esq., the Engineer-in-Chief of the Manchester Steam Users' Association, with the result that the following suggestions are now made :—

1.—In the case of low-pressure circulating boilers, a small safety-valve should be fixed to the boiler to relieve the pressure that may arise therein in case of stoppage in the pipe.

2.—In the case of high-pressure circulating boilers, there is a difficulty in applying safety-valves; and there is no way of securing these boilers against explosion but that of keeping up the fire, and keeping not only the boiler but the entire range of pipes hot, so as to maintain the circulation throughout as long as the frost lasts.

3.—If the fire has to be lighted during frosty weather, it should be carefully ascertained whether the temperature steadily rises throughout the entire range of pipes; if not, circulation is impeded, in consequence of which pressure may accumulate, and explosion ensue.

The Water Company desire to impress upon their customers and the ratepayers the necessity of adopting precautionary measures to minimize, as far as possible, the serious consequences that may arise from the recurrence of boiler explosion.

[Our readers will see, by a paragraph which appears in another column, that the Grand Junction Water Company have also issued some suggestions on this matter to their customers.—ED. J. G. L.]

LEGAL INTELLIGENCE.

Alleged Frauds upon the Bristol Gas Company.

The Magistrates at the Bristol Police Court were engaged for several hours yesterday week in investigating a case in which Henry Harris, a well-known ironmonger and gas-fitter, of Bristol, was charged with having stolen, from the Bristol Gas Company, 5000 cubic feet of gas on June 13 to 18, 1887, and 500 cubic feet on June 10 and 11 last. The prosecution was represented by Mr. F. Weatherly, and the defendant by Mr. C. Salter. Before opening the case, Mr. Weatherly applied that the date in the second charge might be altered to June 17, as the person who laid the information fixed the date from memory, and had made a mistake. This was not really a fresh case, as what the Company were going to allege was a continuous taking of gas. It was agreed that the case should proceed, and that Mr. Salter should reserve his right to ask for an adjournment if he should think fit to do so. In laying his case before the Court, Mr. Weatherly stated that Mr. Harris was a respectable citizen, and a successful man of business. The Company only obtained the information upon which they proceeded in November last; and, after taking precautions not to launch a prosecution hastily against a respectable citizen, they felt it their duty to bring the case before the Bench, and ask them to consider whether the prisoner should not be committed to take his trial before a jury. Mr. Harris used his own gas-meter, which was fixed in a cellar under his shop. A man named Gummer, who was discharged from his employ in June of the present year, having been apprenticed to him in 1886 for five years, informed them that about the winter of 1887 he saw another apprentice, named Cooper (who had since died) making what he described as a composition pipe with brass unions; and on the day on which the contrivance was made, it was fixed on the meter inlet and outlet pipes. From that day until he was discharged, Gummer constantly had occasion to go into the cellar, and saw the fraudulent connection upon the meter, and also (which was very significant) some sacking put upon it. Three other witnesses, all of whom had been in Harris's employ, would testify to having seen the connection. There were 12 gas-jets in the workshop, 12 elsewhere, and 24 outside the shop—48 in all; and since 1885, there had been a considerable drop in the amount of gas paid for by Harris. Evidence confirming Counsel's statement was given by Mr. J. Phillips, the Secretary of the Gas Company, and by William Gummer, Charles Harris, Arthur Sutton, and Henry Crinks, gas-fitters and plumbers, who had been in Harris's employ. The case was adjourned until to-day; the defendant being admitted to bail in his own recognizances in the sum of £300.

The Costs in the Dublin Litigation.—Another scene in the litigation between the Dublin Corporation and the Alliance Gas Company was recently enacted before the Master of the Rolls; application being made by Mr. C. O'Connor, on behalf of the Corporation, for permission to appeal against an order of the Taxing Master certifying the costs to be paid by them, amounting to £1670. The items specially objected to related to the fees of expert witnesses and the special fees for the preparation of the briefs. The Solicitor-General opposed the application; pointing out that the Taxing Master had already reduced the solicitors' charges in respect of the latter matter. He contended that it was too late now to raise the question; and the Court declined to accede to the application. Referring to this subject on the 22nd inst., the Dublin *Sunday World* remarked that in the estimate for next year only £1777 is provided for; and evidently no account has been taken of the costs of the Corporation—probably £1000 more—nor of those for both sides in another action with the Company in which the Corporation were defeated. These total up to a further sum of £1000, or nearly 1d. in the pound kept out of sight of confiding ratepayers.

MISCELLANEOUS NEWS.

ELECTRIC LIGHTING NOTES.

The electric lighting scheme of the Swansea County Council has developed into a triple one—viz., electric lighting, refuse destruction, and tramway working by electricity. This comprehensive project, which, it is believed, will place Swansea in the proud position of being "one of the foremost towns of the country," has been explained to the County Council by Alderman Martin. The report, which we have before us, however, gives no account of his statement respecting the main branch of the scheme and the refuse destruction. In connection with the tramway scheme, the Council are proposing to incur some financial responsibility. They intend to expend £10,400 in paying off debentures which were in the hands of the Tramway Company; and they will also have to advance £21,600 to enable the Company to provide motor cars. By doing this, the Council will obtain a good customer for power during the daytime. The terms for a supply, which have been practically agreed upon with the Company, are: For a minimum consumption of 400,000 units per annum, they are to be charged at the rate of 2d. per unit, decreasing to 1¾d. and 1½d. for a minimum consumption respectively of 600,000 and 700,000 units. As an engine will have to be running during the day, the Company can (so says Alderman Martin) be supplied with power without extra charge. If they take 400,000 units, this will represent a revenue of £3333, which, it is expected, will cover all the station charges and everything but interest and sinking fund; and, consequently, they will be able "to sell electricity, at a profit, to the ratepayers and business men at a price which gas could not touch"—in fact, the price at which the Council seem to confidently reckon to supply current is not at present touched by any town in the kingdom. Some of the worthy councillors must have listened to this statement with open-mouthed wonderment; and no doubt, at the close of the meeting, they heartily congratulated each other on the fact that it had been left to them to be the pioneers of cheap electric supply. Following up what took place at the meeting, Alderman Martin moved the adoption of the minutes of the Committee who have the matter in hand; but Mr. Davies wished for the consideration of the question to be deferred until the Committee brought up complete estimates of the entire scheme. He moved an amendment to this effect, which was seconded by Alderman Leeder, who saw in the rapid adoption of incandescent gas-lights by shopkeepers a barrier to the anticipated success of electric lighting. Several members had something to say upon the subject; but there was no particular point in their observations. The amendment was defeated; and the minutes were confirmed. Nothing further, however, will be done in regard to the scheme until a public meeting has been held.

Electric current was first supplied from the Bolton Corporation electricity works in the autumn of 1894, since which time the undertaking has undergone a continuous process of development. Recently there has been added to the plant a direct-driven alternator and a compound vertical engine; and the Committee have under consideration the erection of further similar machinery to prepare for the 1896 season. Special plant is also being laid down at the station by which a constant twenty-four hours' service will be maintained, without increasing the staff. At present, there is a cessation in the supply from midnight to six in the morning. It is interesting to note that there are now nearly 8500 lamps on the mains; being an increase since the opening day of about 6000 lamps. The capacity of the existing plant at the generating station is 6500 lights, but never more than 65 per cent. of the 8500 lamps now connected are alight simultaneously.

At the last monthly meeting of the Preston Town Council, a discussion took place in regard to a proposal on the part of the Town Hall Committee to light the Public Hall and Town Hall by electricity, at an estimated cost of £2024. Mr. Copeland, in moving the adoption of the Committee's minutes, said the Preston Electric Lighting Company had offered to supply the light at 4½d. per unit. Mr. Hall, who opposed the scheme, argued that the figures of the Committee were formed on a wrong basis, and that practically the Council were asked to spend £61 to meet a gas bill of £78 per annum. There was, in his opinion, something radically wrong in the figures as to the candle power of the gas-lights at the Public Hall and the Town Hall; and if the Council spent £2024 over the electric light, they would have absolutely 4983-candle power less than there was at present. Gas at 3½d. per 100 cubic feet was equal to 360 candles; whereas electricity at 4½d. per unit would give only 288 candles. The electric light might be good enough for those who could afford it; but the £2024 would be better employed if it were devoted to essential things, and not to buying luxuries. Mr. Healey contended that, apart from the cost of installation, the electric light would be as cheap as, or even cheaper than gas, besides being a better illuminant. Alderman Edelston said the installation of the new light seemed to be terribly expensive; at any rate, the sum was too large to be voted at once. Mr. Thompson had a strong opinion that the Corporation should have electricity works of their own; but he had to confess that the terms offered by the Electric Lighting Company dispelled his views on that point. Alderman Davies said that to spend about £2000 when they had gas-fittings in the halls named, without any information as to improved gas lighting, would be a mistake. The Corporation book showed that the consumption of gas in the Town Hall was 4571 cubic feet an hour—or equal to 3·60 candles per burner per hour, which would give the estimated number of candles at 16,455, as compared with 9142 candles as stated by the Committee. When the Committee proposed to put in 11,474 candles as a substitute for the present lighting, it meant giving that number of candles against 16,455, and not against 9142 as suggested. This practically meant providing less light. As to the cost, the Electric Lighting Company, by their own showing, admitted electricity to be 60 per cent. dearer than gas. He reminded the Council that the Preston Gas Company, with the exception of the Railway Companies, were the largest ratepayers in the town, being rated at £10,334. Other speakers followed, and ultimately the matter was referred back to the Committee for further consideration—the voting being 21 to 9.

Saltash is disappointed. A month ago, it was dazzled by the prospect of an immediate installation of the electric light, and the illumination of its ancient streets in a manner at once brilliant and cheap. As already recorded (*ante*, p. 1097), the Corporation accepted a tender for lighting the street-lamps by electricity at the sum of £2 10s. per lamp. Difficulties have, however, arisen with reference to the contract. A local paper, characterizing the proceedings of the local authorities as "most extraordinary," says the tender of an undischarged bankrupt was first accepted; but when the contract was produced for signature, it was found to have been drawn up in the name of his wife. Again and again efforts were made to secure the acceptance of the tender. But the difficulties were insurmountable; and at last it was wisely decided to allow the matter to drop. The only course now open to the Council is to accept the tender of the Gas Company, and continue the present system of lighting.

In another little Cornish town, the electric lighting prospects are more encouraging. Mevagissey, which has just adopted the Lighting Act, is going in for the electric light. A Company has been formed, with a capital of £1100, the shares have all been taken up, and arrangements are being made for the installation of the light. Among the customers will be the Harbour Trustees.

The poll of the ratepayers of Fareham on the question of purchasing the undertaking of the Fareham Electric Lighting Company, or the paying of the damages (£3800) awarded in the recent law-suit for non-fulfilment of contract, took place last Saturday week. The poll was taken on the new list, on which there are rather more than 1400 names; but of these not one-half availed themselves of the ballot. The result was that 431 were in favour of the purchase of the works, and 235 preferred the payment of the damages—giving a majority of 196 in support of the former course.

Another fatality in connection with electric lighting has to be recorded this week; Herr Sommer, the Chief Engineer of the municipal electric lighting works at Frankfort, having been killed by a discharge of electric current of the strength of about 3000 volts.

DARLINGTON GAS, ELECTRICITY, AND WATER SUPPLY.

Strong Opposition to the Improvement Bill.

The Statutory Meeting of ratepayers of Darlington for the purpose of discussing the Bill which is being promoted by the Town Council was held yesterday week, and was largely attended. The various provisions of the Bill, covering a number of schemes of improvement, were explained by the Mayor (Mr. J. J. Wilkes). Part 4, he stated, related to the gas supply. It was proposed to acquire certain land to the north-east of the present gas-works for extensions, and also for the erection of an electric lighting station, which was a matter for future consideration. In Part 5, which referred to the water supply, scarcely any of the clauses could be obtained without an Act of Parliament. The proposals were generally for the better management of the works, and a better supply of the commodity which they had to sell to the inhabitants of the town. It was proposed by Part 7 to extend the time during which they could exercise powers with regard to the supply of the electric light. Alluding to the question of rates, his Worship mentioned that, at the end of December, repayments in connection with the gas and water undertakings would be reduced equal to 5¾d. in the pound; but owing to the way in which the books were made up, this would not come into the revenue until 1897-8. At the end of 1896, an amount would be paid off in connection with the gas and water works and the covered market equal to slightly more than 10½d. in the pound; and this would come into effect at the beginning of 1898. This made a total of nearly 1s. 5d., which was a very handsome amount; and the only thing they could regret was that it did not come into operation a little earlier. In the Bill, it was proposed to take powers to borrow £50,000 on water-works account, £50,000 on gas-works account, and £30,000 for electric lighting. With respect to the first two amounts, he only wished they were twice as much, because they were two great trading departments of the Corporation, and whatever profit they made went into the municipal coffers, and assisted in the reduction of the rates. The clauses of the Bill were freely criticized; the speakers in support having a hostile reception at the hands of a certain section. A motion to adjourn the meeting was proposed amidst much clamour; and eventually the Mayor declared it adjourned for a week.

It seems from an article in the *Northern Echo* that the opponents at the meeting created quite a bear-garden scene; and they have been deservedly reproved, in severe terms, by our contemporary. Dealing with the necessity for additional plant at the gas-works, the *Echo* says that there is an impression that the expenditure under this head is only asked for in order to be able to supply the proposed extended area of the borough—*i.e.*, of Blackwell, Haughton-le-Skerne, and Cockerton. This is not so. If no extension of the borough takes place, the new plant will still be needed, or the operations of the Gas Committee be seriously crippled. "Gas making," it is pointed out, "is one of the paying businesses of the Corporation. And it may be noted by those who possibly never thought it over before that the whole of the money which has been spent on the gas-works—all the thousands of pounds of redemption and interest—has come, not out of the pockets of the ratepayers, but out of the pockets of the gas consumers, and more still, that the Gas Committee out of their profits have handed over to the Finance Committee towards lessening the rates of the town an average of £2000 a year. We submit that to interfere to check this source of revenue is suicidal. Water, again, is one of the necessities of life and another of the commodities which the Corporation vends; and to restrict its hand when told that an extension of borrowing power is absolutely required for assuring us an efficient water supply, is even more to be deprecated than interference in the case of gas. As regards electric lighting, if a profit is to be made by introducing it, by all means let that profit flow into the treasury of the town, and not into the pockets of a few capitalists. We say the men who are in opposition to these clauses of the Bill, or to those clauses which deal with town and sanitary improvements, are as short sighted in their generation as the opponents of railways in theirs, and are doing their best to belittle the intelligence of the town and mar its progress."

THE POSITION OF THE BRITISH WATER-GAS INDUSTRY.

The Ordinary General Meeting of the Amalgamated Water-Gas Companies, Limited, is to be held to-day, at the Great Northern Hotel, Leeds. The report of the Directors to be presented on the occasion gives an interesting account of the progress of the undertaking, as will be found from the following extracts:—

The Company was incorporated on Sept. 27, 1893, with the object (*inter alia*) of taking over as going concerns and amalgamating the undertakings of the British Water-Gas Syndicate, Limited, the North British Water-Gas Syndicate, Limited, and the Yorkshire and Lancashire Water-Gas Company, Limited. It took over the whole of their assets and liabilities. To meet these liabilities and the expenses of liquidation of the Vendor Companies, it had chiefly to rely upon the amount to be produced by the instalment of 10s. per share due from the shareholders of the North British and of the Yorkshire Companies, both of which were largely in debt to the British Syndicate. It was understood that the shareholders of all the Vendor Companies would be relieved of any further demand in respect of the remaining liability on the shares. The Directors of each of the Vendor Companies nominated a Director of the Amalgamated Company, in accordance with the Articles of Association; it being understood that at the first general meeting all the Directors would retire, and the shareholders be invited to appoint Directors of their own choice. The Directors nominated were Mr. T. Procter, Mr. Samson Fox, and Mr. J. Mitchell, who then asked Mr. F. G. Worth to join the Board, and to act as Managing-Director. To this he consented, on the understanding that he would retire with the other Directors. Mr. Mitchell, who was a staunch believer in water gas, and erected plant for incandescent lighting both at Mitchell Main Colliery and at his private residence, died in April last.

The Vendor Companies in November and December, 1893, passed resolutions for voluntary winding up. Notice was at once given to the respective Liquidators by the Board of the Amalgamated Company that they were ready to allot the fully-paid shares to which the shareholders in the Vendor Companies were by agreement entitled—viz., 199,993 fully-paid shares of £1 each. Seven shares were allotted to the subscribers to the Memorandum and Articles of Association, making up the total to 200,000. Unfortunately, a few shareholders in the North British Syndicate had combined to oppose the amalgamation of the Vendor Companies; and the legal proceedings taken by dissentients caused the Liquidators of those Companies to delay carrying out the contract.

The statutory meeting of the Amalgamated Company was held on Dec. 22, 1893, and an ordinary general meeting on Dec. 29, 1894, to comply with the requirements of the Companies' Acts; the only members on the register being the subscribers to the Memorandum and Articles of Association and the Directors. The Directors were advised that they must continue to hold office until their successors were appointed by the full body of the shareholders, after the completion of allotment. It is only lately that it has been possible to complete the allotment and the issue of certificates to the shareholders of the Vendor Companies entitled to participate in the distribution.

The Directors, from the date of formation of the Company, have been unceasing in their efforts to get the contract completed; and it is solely litigation which has stood in the way. The few dissentients have caused the expenditure of thousands of pounds. Had they been successful in their action, the balance of the instalments due on the shares of the Vendor Companies could have been called up. Under the circumstances, it has been an extremely difficult and arduous task for the Directors, and especially for the Managing-Director, to provide for the liabilities of the Vendor Companies. But this has now been accomplished, after the actions brought by the dissentients had been dismissed with costs. The possibility of a further call being made upon the shareholders, in respect of their holdings in the Vendor Companies, is thus averted. But litigation has entailed an enormous waste of time and money which would otherwise have been available for business purposes, and has thrown back, since the beginning of 1893, the interests of the general body.

The business of the Company has been almost at a standstill, as, even when the actions in the High Court were disposed of, there were threats of fresh proceedings from the same quarters; and the Liquidators, under advice, felt unable to carry out the provisions of the contract without first obtaining the sanction of the Court at various stages—thus further delaying matters.

To facilitate the operations of the Company, the Directors of all the Vendor Companies agreed to waive the bulk of the fees to which they were entitled; and, with one exception, none of them have since been paid. The owner of the Uddingston property (Mr. James Reid Stewart), in lieu of insisting on payment of the purchase price of £15,000, overdue to him from the British Syndicate, agreed to allow that liability to be transferred to the Company, and further agreed that, conditionally on interest being paid, he would not ask for payment of the principal for a period of five years. None of the Directors are taking fees; and for some time past, the Managing-Director has relinquished his claim to salary, and has continued his services to the Company as a Director without remuneration. The Uddingston revenue account showed in 1894 a profit of nearly £900; but the past year has unfortunately resulted in a loss.

With regard to the financial position of the Company, the amount brought from the profit and loss account in the balance sheet (£9110) includes some liabilities of the Vendor Companies. The sum of £6564 12s. 8d., shown in the balance-sheet as due to certain creditors, includes the estimated cost of liquidation of the three Vendor Companies and a provision for law costs. It also includes £2500 outstanding balance of claim of the Directors of the North British Syndicate, for fees for which they waived payment by the Liquidator, in order that the money might be used for reducing the liabilities taken over by the Company. Several of the liabilities have, however, been met since the date to which the balance-sheet is made up (Sept. 30).

Had the contract entered into with the Vendor Companies been carried out without opposition, the cash balance, after paying all liabilities, should have left sufficient funds to enable the Company to

complete the contract at Messrs. Spencer's plant, and, on showing the further successful application of water gas in different directions, to lay the foundation of a profitable undertaking. It must, however, unfortunately be assumed that, consequent upon the opposition, there will be practically no working capital left.

The question then arises whether there are still sufficient prospects of a successful issue to the undertaking to warrant further investment. The Directors believe such prospects exist in the patents already owned by the Company. Beyond this, they hope to be able to acquire several recent improvements in the use of water gas as an illuminant. They hope, further, that they may be able to secure for the Company an option of acquiring an interest in a new discovery, cognate to the business of the Company, which it is expected will prove of considerable commercial value. The Directors were not at the date of the report (Dec. 21) in a position to make a more definite statement in relation to these matters; but they anticipated being able to do so at the extraordinary general meeting to be held after the ordinary meeting to-day to decide the question of further capital.

THE GAS SUPPLY OF BROOKLYN AND MONTREAL.

Consolidation of the Brooklyn Gas Companies.

The Brooklyn *Eagle* for the 24th ult. contained the following remarks on the subject of the recent consolidation of the Gas Companies supplying that city:—

The consolidation of all the Brooklyn Gas Companies is at last an accomplished fact. The majority of the stockholders in the old Companies have exchanged their securities for the new; and there has been quite a lot of trading in them. There does not seem to be anything now which can prevent the new Company from carrying out the ideas which have been in the minds of some of the largest capitalists for the last dozen years—that is, the manufacture of gas for Brooklyn under the management of one Company, with all the accompanying economies. There is no need for going over ancient history in local matters. The majority of people remember the gas war of about twelve years back, when what is known in business circles as the Standard Oil crowd, with the Fulton Municipal Company, raided the territory of every other Company in the city until they cried for mercy, and secured it by contributions of peace offerings substantial in character. It is also recalled that, after the war was over, gas securities regained their proper value; and the same crowd which had caused their depreciation, and bought them when low, sold them out; and the profit of their venture in Brooklyn has been variously estimated at from one to two millions of dollars. Judging from the present rate at which the securities of the new Gas Company are advancing, the remembrance of former profits will be wiped out by the magnitude of the sum which will be made out of this deal.

It will be remembered, by people familiar with gas matters in this city, that on Sept. 1, 1894, the Beckton Construction Company, which was the vehicle by means of which J. Edward Addicks tried to bring about a consolidation of gas interests in this city, sold out one-half of its holdings in several of the Brooklyn Companies. There were 1185 shares of Metropolitan, 20,016 of Brooklyn, 3094 of Citizens', 375 of Fulton Municipal, and 125 of People's. The lump sum paid for these securities was given out as being $785,000. The cheque which was paid over, if the statements which were made at the time are correct, was drawn by Mr. H. H. Rogers, who has managed about all the gas deals in which the Standard Oil people have been interested as individuals. Anyone who is nimble with a pencil can figure out the market value of the securities of the new Company which this crowd has received for those stocks alone. Taking the bonds at 107 and the stock at 84, it totals up to the tidy sum of $1,835,300. The difference between the price paid and the present market value is $1,050,000. No one for a moment supposes that the stocks which were secured from the Beckton Company were all that the crowd held. It is well known that they were in the market during a large part of last fall, and all the winter and this spring; and it was generally conceded that the majority of the stock in every one of the Companies, with the exception of the Nassau and the Williamsburgh, was controlled by the same people. It is, therefore, probably quite accurate (as a man pretty well posted in gas matters said) that, even at present prices, their profits are between three and four millions. The prospects of their securing even greater returns are excellent, for there seems a very good chance of the stock moving higher than it is at present.

The way that people are figuring on the proposition is somewhat after this fashion: The output of all the Companies last year for which pay was received was 3500 million cubic feet. The profit made by a Company like the Williamsburgh, Nassau, or Fulton Municipal, who have works of the best kind and a large output, is nearly 50 c. per 1000 cubic feet, which gives net earnings of $1,750,000. The fixed charges on the $15,000,000 of bonds which the new Company have issued is $750,000; and the net income therefore is, according to that method of figuring, $1,000,000.

Others go even further, and say that, taking the output last year at 3500 million cubic feet, it should be larger this year by 10 per cent., because of natural growth, and because there is now no reason why the new Company should not canvass actively for business. Heretofore it has been the custom of each of the Companies not to do any canvassing, for fear of starting up a little gas war. It should also be possible to secure payment for a great deal more gas, because a delinquent customer now has no alternative but to pay up or go without gas. The operating expenses and cost of manufacture should also be less, because of the economies secured by consolidation. They take the margin of profit at only 40 c. per 1000 cubic feet, and figure out the same results—that there will be $1,000,000 to be divided into dividends.

On the other hand, it is a source of mystery to the conservative investor how Companies which heretofore paid out in dividends and fixed charges about $750,000 can by consolidation do more than twice as well. The explanation given of this by the people who think that Brooklyn union gas is a good thing is that the Companies did earn very nearly that amount, but that they were all afraid to make public their earnings for fear of inducing a raid from some other Company, or a strike by the legislators at Albany; and each one felt the necessity of saving its strength for a day when trouble might arrive. In addition to this, they say that the new Company has several hundred thousand dollars worth of real estate to sell as soon as there is a good market for it.

The New Gas Contract for Montreal.

The following are some of the points in the agreement lately entered into between the authorities of Montreal and the Montreal Gas Company for the supply of gas in that city for the next ten years: The Company are to furnish all the gas-lamps and the gas therefor that the city may require during the existence of the contract for lighting the streets, lanes, and public places of the city, at the rate of $17 per lamp per annum, and on the same conditions as in the previous contract. The Company bind themselves to supply and furnish gas for lighting, heating, cooking, and manufacturing purposes within the limits of the city during a period of ten years, to be computed from the 1st day of May last (1895), such gas to be coal gas made from Canadian or bituminous coal, with a small proportion of coal oil for illuminating purposes, and of an illuminating power of not less than 21 sperm candles, at a price which shall not exceed $1·20 per 1000 cubic feet, generally furnished and supplied by the Company for lighting purposes during the above-named period, and of $1 per 1000 cubic feet generally furnished and supplied during that period by the Company for cooking, heating, and manufacturing purposes, on prompt payment. Nevertheless, in order to facilitate the use of gas to the poorer class of people, the Company are to be bound to furnish gas for cooking purposes, with the privilege of two gas-meters for lighting purposes, at $1·05 per 1000 cubic feet, furnished and supplied by means of automatic regulator burners to all the taxpayers of the city paying a rent not exceeding $150 a year. During the existence of the contract, the said authority are not to permit the laying of gas-pipes in the streets and lanes of the city. The city are to have the right to provide for the inspection of the gas and meters furnished by the Company, and to this end to appoint an inspector, who shall also have the power of regulating the pressure of the gas, and shall for that purpose have free access at all times to the works of the Company.

METROPOLIS WATER SUPPLY.

The Quality of the Water in November.

The returns furnished to the Registrar-General by the London Water Companies regarding the water supply in the Metropolis during November, show that the average daily supply amounted to 203,454,828 gallons, as compared with 189,709,339 gallons in the corresponding month of 1894. The number of services being 823,457, the rate was 247 gallons to each service. Of the entire bulk of water sent out, 106,376,477 gallons were drawn from the Thames, and 97,078,351 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: Taking the average amount of organic impurity in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·6; Tottenham, 1·2; East London (deep well), 1·5; Colne Valley, 1·7; New River, 2·7; Chelsea, 3·7; East London (river supply), 4·3; Grand Junction, 5·3; West Middlesex, 5·9; Lambeth, 6·8; and Southwark, 6·9. The unfiltered river waters contained the following proportions: Thames at Hampton, 10·4; New River Cut, 4·2; Lea at Angel Road, 6·6. The Thames at Hampton was, on Nov. 18, very turbid and brown in colour. It was of very bad chemical and bacterial quality. As delivered by the five Companies, however, drawing from this river, the water was in every case efficiently filtered, and, with two exceptions, of most excellent bacterial quality. By reason of large storage capacity, by which flood water had been avoided, the Chelsea Company were also enabled to deliver water of good chemical quality. The bacterial improvement effected by the various Companies is expressed by the following percentage numbers: Chelsea, 99·93; West Middlesex, 99·96; Southwark, (No. 4 filter well) 99·81, (No. 8 filter well) 98·93; Grand Junction, (general filter well at Hampton) 98·37, (general filter well at Kew Bridge) 99·89, (south filter well at Kew Bridge) 99·91; and Lambeth, 99·97. The New River Cut, before entering the subsidence and storage reservoirs, was, on Nov. 20, turbid and yellow in colour. It was of fairly good chemical, but inferior bacterial quality. By passing through the storage reservoirs, the number of bacteria in a given volume was reduced to nearly one-fourth; and, after efficient filtration, this water was delivered to consumers in excellent chemical and bacterial condition for dietetic purposes. Bacterially it was improved before delivery to the extent represented by the following percentage numbers: General filter well, 99·45; No. 4 filter well, 99·45; No. 6 filter well, 99·9. The water taken from the Lea by the East London Company at Angel Road on Nov. 20 was turbid and pale brown in colour, and of inferior quality both chemically and bacterially, although it was in both these respects much better than the Thames at Hampton. After storage for 15 days, more or less, the number of bacteria per cubic centimetre was reduced to less than one-half; and, after efficient filtration, this water was delivered to consumers in good chemical and excellent bacterial quality—the bacterial improvement being represented by the following percentage numbers: No. 1 Essex well, 99·32; No. 2 Essex well, 99·80; and West Middlesex well, 99·60. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were of excellent quality for dietetic purposes, and the supplies of the Kent and Colne Valley Companies were perfectly clear and bright without filtration; but that of the Tottenham Local Board of Health was slightly turbid, and that of the East London Company very slightly turbid. The Colne Valley Company's water had been softened before delivery, and was thus rendered suitable for

washing. Seen through a stratum 2 feet deep, the Kent and Colne Valley waters were clear and colourless; the Tottenham, slightly turbid and colourless; the East London (deep well), very slightly turbid and colourless; the New River, clear and very pale yellow; the Chelsea and East London (river supply), clear and pale yellow; the West Middlesex and Grand Junction, yellow and clear; and the Southwark and Lambeth, deep yellow and clear. The bacterioscopic examination of the raw river waters before and after storage, and of the supplies delivered by the various Companies, and collected on Nov. 18, 19, and 20, yielded the results contained in the following table:—

Description.	No. of Microbes per Cubic Centimetre.	Temperature in Deg. C.
Raw and Stored River Waters.		
Thames at Hampton, Nov. 18	29,260	8·6
Thames, after storage for 14·7 days (Chelsea Company), Nov. 18	500	9·0
Thames, after storage for 6 days (Lambeth Company), Nov. 18	13,140	8·9
West Middlesex Company's water (passing on to filters 1–5), Nov. 19	2,900	8·3
Grand Junction Company's water at Kew, passing on to filters 3, 4, 5, 6, and 7, Nov. 19	840	8·9
Grand Junction Company's water arriving at Kew from Hampton, Nov. 19	1,160	9·0
New River Cut, before passing through reservoirs, Nov. 20	5,800	7·3
New River Cut, after passing through reservoirs, before filtration, Nov. 20	1,520	8·2
River Lea at Angel Road (East London Company), Nov. 20	10,040	7·6
River Lea, after storage for 16 days (East London Company), Nov. 20	4,080	8·2
Filtered River Water as Supplied.		
Thames—		
Chelsea Company's general filter well, Nov. 18	20	9·6
West Middlesex Company's general filter well, Nov. 19	12	8·2
Southwark Company's No. 4 filter well, Nov. 18	56	8·7
Southwark Company's No. 8 filter well, Nov. 18	312	9·2
Grand Junction Company's general filter well at Hampton, Nov. 18	476	8·5
Grand Junction Company's general filter well at Kew Bridge, Nov. 19	32	8·8
Grand Junction Company's south filter well at Kew Bridge, Nov. 19	28	9·0
Lambeth Company's general filter well, Nov. 18	8	9·0
Lea—		
New River Company's general filter well, Nov. 20	32	8·1
New River Company's No. 4 filter well, Nov. 20	32	7·6
New River Company's No. 6 filter well, Nov. 20	5	8·2
East London Company's No. 1 Essex well, Nov. 20	68	7·9
East London Company's No. 2 Essex well, Nov. 20	20	8·0
East London Company's Middlesex well, Nov. 20	40	7·6
Deep-Well Waters.		
Kent Company's new well at Deptford, Nov. 19	4	11·3

In their report to the Official Water Examiner (Major-General A. de Courcy Scott, R.E.) on the composition and quality of the water supplied in London during November, as ascertained by tests of samples taken daily on behalf of the Water Companies, Messrs. Crookes and Dewar say: Of the 182 samples examined, three were recorded as clear but dull; the remainder being clear, bright, and well filtered. We have to record a large excess of rainfall in November; the quantity measured at Oxford being 4·17 inches, as compared with 2·31 inches (the average for 25 years)—showing an excess of 1·86 inches. The rain was chiefly confined to the first half of the month; three-fourths falling during the first fifteen days. There were thirteen days on which no rain fell. It is satisfactory to be able to report that the Thames-derived waters show a marked improvement in quality when the analyses for the past month are compared with the results for the corresponding period of last year. The autumnal floods invariably cause a slight increase of colour; and the organic carbon is correspondingly raised. Our bacteriological examinations give the following numbers of colonies per cubic centimetre:—

Thames water, unfiltered	7400
Do. from the clear-water wells of the five Thames-derived supplies—	
Highest	120
Lowest	41
Mean	88
New River water, unfiltered	5000
Do. from the Company's clear-water well	70
River Lea water, unfiltered	2000
Do. from the East London Company's clear-water well	52

These results show a very high efficiency in the methods of filtration employed by the Water Companies, and that the quality of the supply is excellent.

The Lighting of Seaton.—Dissatisfaction is felt at Seaton, Devon, with the manner in which the local gas supply is managed. A fortnight ago the gas failed, and the town was in darkness. The local paper which refers to the incident says nothing as to the cause, but alludes to it as "another" failure of the gas supply, and urges the ratepayers to consider the advisability of taking over the gas-works.

NEW YORK WATER SUPPLY.

Auxiliary Reservoirs and the New Croton Aqueduct.

The present water supply for New York City is derived, as most of our readers are aware, from the storage and delivery of rain falling in the Croton Valley, which has a watershed extending north-easterly about 34 miles from the southern extremity of Manhattan Island to about 61 miles from it, and having an average width of about 11 miles, and a total area of about 362 square miles. Of this area, about 360 square miles is available for supply. The old Croton Dam across the Croton River had a length of 270 feet and a height of 50 feet, and an impounding capacity of 2000 million gallons. It supplied the city through the old brick and stone subterranean aqueduct, which delivered as much as 96 million gallons a day. This supply becoming insufficient, it was determined, in 1883, to construct an additional conduit, and to increase the impounding and storage works so as to provide for a much larger delivery of water in dry seasons, and to allow for the probable increased consumption due to the city's growth. The second conduit, built of masonry mostly in tunnel, with a cross-sectional area of 156 square feet, a length of 163,003 feet, and a calculated capacity for a maximum delivery of 318 million gallons per diem, was called, for distinction, the "New Croton Aqueduct." It was completed in July, 1890, and was soon delivering all the available additional supply of some 35 million gallons a day, which made a total of about 131 million gallons a day. This supply was found inadequate for the uses and wastage of a city which then had about 1,515,000 inhabitants, and in many houses in the higher districts of which the pressure varied 30 or 40 feet daily between the hours of the greatest and the least draft. To provide against the then imminent water famine, the construction of auxiliary storage works was, and has been since, vigorously prosecuted. These, when completed, are expected to provide for the requirements of the next 20 years, and store and deliver a maximum quantity of 2800 million gallons a day, even through excessively dry years. The need for them is demonstrated by the present condition of the water supply of the city, as shown by the paragraph which appeared a short time ago in the JOURNAL. This provision is to be effected by the great $4,000,000 dam now across the lower part of the Croton River itself, which was begun in 1893, and is expected to be finished in 1900, with a height of 245 feet over the lowest foundations, a total length of about 1800 feet, and a storage capacity of about 32,000 million gallons, and also by the completion of the system of auxiliary dams and reservoirs on the other principal streams of the watershed which are tributary to the Croton River, and which will have a combined storage capacity of about 15,000 million gallons. The principal reservoirs are at Sodom, Carmel, Amawalk, Purdy's, and Brewster's. They all are completed, or nearly so. The one at Purdy's impounds the Titicus River, to form a reservoir having a capacity of 7200 million gallons and a maximum depth of 121 feet. The work was designed by the Chief Engineer (Mr. A. Fteley, M.Am.Soc.C.E.). The contract for the dam was let for about $1,000,000. The work presented many interesting features of design and construction, which have lately been described and illustrated in the *Engineering Record*. The contract involved, in round numbers, about 566,000 yards of earth excavation, 38,800 yards of rock excavation, 425,000 yards of earth embankment (included in the 566,000 yards of earth excavation), 2000 yards of concrete, 113,000 yards of rubble, and 8050 yards of dimension and cut stone. Besides these quantities, the actual classification included 18,000 square feet of face work for rubblestone masonry, 8200 square feet of fine hammered (six-cut) face dressing, 10,000 square feet of rough-pointed face dressing, 600 cubic yards of brick masonry, 15 cubic yards of brick masonry laid in asphaltum mortar, 3000 cubic yards of riprap laid, 8000 cubic yards of broken stone laid, 11,400 cubic yards of dry masonry and paving, 600,000 feet of permanent timber placed and fastened, 10,000 superficial square yards of sodding, 73 tons of cast-iron hub and spigot straight pipe, 144 tons of special castings, 20 tons of wrought iron, two 48-inch stopcocks, and 640 lineal feet of ornamental iron fence. All sodded or seeded surfaces are covered with soil at least 6 inches in thickness. The embankments for the dam all start from a well-prepared base, stepped on sloping ground, and are carried up in horizontal layers not exceeding 6 inches in thickness. They were kept at an approximately uniform height on both sides of the masonry during construction. Dry rubble masonry and paving laid without mortar were used for walls, for the slopes of the dam embankments, and at some other places.

Reference has already been made to the new Croton aqueduct; and it may be of interest to append some particulars in regard to it. It was designed to carry from the Croton dam to New York City the additional water supply procured by the development of the storage system in the Croton Valley. Its diameter of 14 feet is proportioned to the rest of the supply system. Tunnelling was adopted on account of the high value of the ground along the line; and the location was separated from that of the old surface aqueduct between the same terminals so as not to encounter the probably disintegrated rock near the foot of the hills. It deviates from a straight line only for the purpose of intersecting a few transverse valleys, so as to secure an opportunity to empty its contents through them. For the first 25 miles, the aqueduct has a descent of 0·7 inch per mile; and the water flows through it as in an open channel. The next seven miles it is depressed, and acts under pressure like a pipe at a maximum depth of more than 100 feet in many places, and 320 feet at the crossing under the Harlem River. The rock encountered was mostly gneiss, and in two or three places limestone. The invert of the inlet at the Croton dam was made 140 feet above tide-level, so as to permit of easy emptying at different points on the line. The circular cross-section originally designed was changed to a horseshoe shaped form (with extreme height and width of 14·53 and 13·6 feet respectively) of equivalent area, which facilitates excavation and masonry work and general convenience, and permits laying the invert when the rest of the work is done. The section of the upper part of the aqueduct is uniform, except where a short inverted syphon of circular area 14 ft. 3 in. diameter crosses

under a swamp. For seven miles under pressure, the aqueduct has a uniform circular section 12 ft. 3 in. diameter, except under the Harlem River, where the diameter is reduced to 10 ft. 6 in., in order to increase the velocity of flow, and diminish the deposition of silt. Of its total length of 163,003 feet, 125,164 feet of the aqueduct has a horseshoe-shaped section, 1135 feet is a 14 ft. 3 in. circle, 34,780 feet is a 12 ft. 3 in. circle, and 1300 feet is a 10 ft. 6 in. circle—all inside dimensions; the thickness and form of brick rings and backing varying to correspond with the pressure and character of the excavation. Near shaft No. 30, where the elevation of the ground is much below hydraulic grade and the rock dangerously disintegrated, the aqueduct was lined with cast iron, to increase its strength and water-tightness. Of the entire length, 29·75 miles were built in tunnel, 34,954 feet of which were supported by timbering; and 1·12 miles were built in open trench. There are eight lines of 48-inch iron pipe, having a total length of 71,170 feet.

At the Harlem River crossing, the 12 ft. 3 in. circular aqueduct approaches on an incline a shaft (No. 25), the bottom of which was excavated to the level of the intended invert of the river tunnel. The indications of test drift, however, determined the changing of the tunnel to a considerably lower grade; and the shaft was continued parallel to the upper section, and with an offset of about 20 feet—forming a convenient landing in the approach tunnel. From the foot of this shaft, the river tunnel was excavated through solid rock at a depth of nearly 300 feet below the surface of the river, and at atmospheric pressure. The New York shaft is No. 25 of the aqueduct line, and extends nearly 20 feet below the bottom of the tunnel to form a sump into which the syphon drains. The aqueduct tunnel on this side connects with the shaft at a level about 140 feet above the connection with shaft No. 24, and permits the construction of a blow-off to the river from the shaft below the level of its invert. Shaft No. 25 is double, consisting of two parallel 12 ft. 3 in. cylinders, one of which is for the aqueduct service, and the other, having a sump, contains a pair of alternating 1390-gallon bailing buckets operated by a steam-engine for emptying the syphon, which has been twice successfully accomplished in a few hours. The aqueduct and bailing-shafts are connected near the bottom by a 1 ft. 8 in. by 2 ft. 6 in. door, commanded by a solid composition metal gate moving in grooves, and operated by a stem 3½ inches square, which is journalled every 12 inches, and set in a 3-feet iron pipe with a ladder. The aqueduct shaft, up to a point 60 feet below high-water mark in the river, and the bailing-shaft and shaft No. 24, are lined with cast iron, and sealed by double manholes at or near their tops. A 20-inch blow-off pipe is laid on the tunnel invert from the top of the incline to the bottom of shaft No. 24, up which it passes through the masonry filling between the cast-iron lining and the rock excavation. It leaves the shaft at a point about 3·61 feet below high water, and is laid in a timbered and bricked tunnel that terminates in a vault, which contains two 36-inch and one 20-inch gates, a branch-pipe for the city service, and a small drainage gate. Beyond this vault the pipe emerges with a diameter of 36 inches in the Harlem River. A clean-out handhole is located in the pipe near the bottom of the shaft. The head of the pipe at the top of the incline is embedded in the invert masonry, which is fitted with stop-plank grooves. The pipe is intended both for use for emptying and for a feed to the service-mains. Each chamber of shaft No. 25 has, about 5 feet above the river, connection with a 48-inch blow-off pipe with two gates. At the adjacent shaft (No. 26), an overflow has been provided with stop-planks; and the surplus water will be discharged thence into the river through a 48-inch pipe. The features and the scale of this syphon are very unusual in water-works construction; and, on account of the excessive pressure, great care and a full knowledge of the structure and its appurtenances are required for opening the shafts. An open stand-pipe extending above the hydraulic grade is connected to shaft No. 25, to prevent danger of a vacuum.

The inlet of the aqueduct at Croton Lake is contained in a massive masonry structure, and consists of a submerged 14-feet circular opening protected by a timber drop-gate, accessible through a shaft, and available for emergency. A brick-lined 14-feet tunnel 624 feet long connects the inlet and main gate-house with all the machinery for regulating the flow of water—including the connections for the new Croton dam and the old and new Croton aqueduct; requiring in all 38 large gates ultimately. Thorough drainage of the gate-house is facilitated by a bailing-pump worked by a turbine. Heavy stop-planks, mechanically controlled, additionally command the various inlets; and any one chamber may be emptied while all the others remain full.

The structures auxiliary to the aqueduct comprise, besides the above described gate-house and river crossing, three blow-off gate-houses, each containing four gate openings and machinery. One gateway in each house is fitted with a temporary timber bulkhead until the large drop-gate is provided to close the whole section of the aqueduct. The gates now in place have a great width, to permit of very rapid emptying of the aqueduct. The terminal gate-house in New York City receives the ends of the old and new aqueducts, and delivers their waters through iron pipes (eight of 48 inches diameter for the latter) to the Central Park reservoir and to the city mains directly. These pipes and their connections are controlled by 26 gates, which enable either aqueduct to be connected with its own pipes or those of the other system. The gate-house at the Central Park reservoir forms the outlet of the four 48-inch pipes in which the new aqueduct virtually terminates. There were 42 shafts excavated for the construction of the aqueduct. A number of them are left open, and connect with head-houses, containing hoisting apparatus; others are closed by cast-iron covers with manholes. Some have been filled up; and a few that are under pressure have an iron lining in the upper part, and are closed below the hydraulic grade by double manholes secured with gibs and keys. Several shafts are entirely lined with iron. Experiments have shown a maximum flow of 300 million gallons in 24 hours through the aqueduct; and at one time water was wasted through the blow-off gates at the rate of 240 million gallons in 24 hours.

The principal construction quantities are in cubic yards: Tunnel excavation, 1,351,995; earth excavation, 333,000; rock excavation, 240,000; brick masonry, 323,000; rubble masonry, 528,000; concrete, 45,000; and cut stone outside of superstructures, 8200. There were 24,000 tons of 48-inch cast-iron pipe. The elevations of the aqueduct inverts are 140 feet at Croton gate-house, and 123·24 feet at the beginning of the first incline. The high-water line at the Central Park reservoir is 119·16 feet. The maximum pressure in the aqueduct when full is 55 lbs. per square inch. The cost per lineal foot varied from $90·99 to $123·25; and it was $14·24 for a single line of 48-inch pipe.

The construction of the aqueduct for some seven miles under pressure is a bold innovation in municipal hydraulics. The masonry used is porous; and the rock encountered was known to be full of fissures. Hence percolation from the inside of the aqueduct was obviously anticipated under the pressure heads that rose to more than 100 feet. Experiments were made to determine what coating on the interior brick surface would best diminish or prevent it; and a light wash of portland cement applied with whitewash brushes was adopted throughout the pressure sections, and found satisfactory. Experiments on the treated surface indicated that a total percolation of a million gallons in 24 hours could have been expected in the pressure tunnel. But subsequent gauging showed it to be only 228,500 gallons; while 4,000,000 gallons percolated into the tunnel from the outside in its upper 25 miles of high-level section.

Owing to the deep subterranean location of much of the aqueduct work, the cramped positions occupied by the workmen, the impure air they breathed, &c., the tendency to slight work was increased; and the presence of large empty spaces shielded by transverse walls clearly indicated the disposition of the contractors, while the restricted powers of the engineers and their exacting technical duties precluded their exercise of a controlling or continuous supervision of the construction. Much difficulty was necessarily experienced in securing enough satisfactory inspectors, as many as 222 of whom were required at one time; and bad work was done at many points of the tunnel, where it was wholly concealed by the brickwork lining and excavation walls. From the beginning of the masonry work, the engineers had difficulty in enforcing the requirements of the contracts, and in securing the dismissal of improper foremen, &c. The time allowed for construction was originally 33 months. It was extended to 40 months; and the 29¾ miles of aqueduct was put in service 66½ months after the beginning of construction.

The preliminary calculations of estimated flow gave 318 million gallons in 24 hours; but the measured volume was subsequently found to be nearly 300 million gallons maximum. Series of observations were taken under different conditions of depth by a special meter inserted at a manhole, and arranged to record the velocity at numerous fixed points covering the whole cross-section of the flowing stream. A weir was also established at the Croton dam; and the upper nine miles of the aqueduct was used as a measuring chamber. But the results were found to be less accurate than those of the meters. The total cost up to Jan. 1, 1895, was $19,759,574.

Dinner to the Employees of the Hexham Gas Company.—The Hexham Gas Company entertained their employees to dinner on Christmas Eve, at the Company's offices. Mr. Herbert Lees, the Secretary and Manager, occupied the chair; and the vice-chair was filled by Mr. John A. Young (the foreman). After dinner, a toast list, interspersed with songs, &c., was gone through; and a most enjoyable evening was spent. Mr. H. Schofield proposed "The Chairman and Directors of the Company" in an appreciative speech. A feeling of goodwill between employers and employed was strengthened by this event.

The Condition of the Margate Water-Works.—Referring to the article on "The Finances of the Margate Corporation Water Department" which appeared in the JOURNAL for the 10th inst., our local correspondent says: "The subject of the borough water supply, and the revenue derived therefrom, continues to excite a considerable amount of attention at Margate. The resolution of the Town Council to adopt Mr. Mansergh's recommendation to thoroughly survey the available sources of supply, at a cost of about £300, has accentuated the interest, and in some cases aroused feelings of uneasiness; it being felt to be certain that the town will have to face the expenditure of a large sum in extending and improving the existing arrangements. When the matter was under discussion at the recent special meeting of the Town Council, Alderman Wootton stated that ever since the undertaking had belonged to the Corporation, it had been worked at an annual loss. The subsidies in some years had been as much as £2000, the total amount of subsidies paid out of the local funds up to the present being £7829 for ten years' working. When it is remembered that ten years ago the Water Company, with a capital of £22,000, worked the undertaking at a profit, the figures supplied by Alderman Wootton (and presented to the ratepayers for the first time by him) are indeed eloquent, and should serve as a wholesome warning to those local authorities who are agitating for the acquisition of water undertakings. At Margate, the Water Department has been slaughtered for the benefit of the Drainage Department; and so far has this policy been carried out, that the Borough Engineer (Mr. A. Latham) has been unable to get the machinery and plant maintained in a proper condition. Indeed, to such an extent has this policy predominated, that Messrs. Thornwill and Warham, the makers of the pumping-engines at the Dane works, having been requested to examine them in consequence of a breakdown, felt it incumbent upon them to draw attention to the mismanagement, and to report that the engines had not received 'constant and skilled attention.' They added that the cause of the bad condition of the plant was due to the engineer-in-charge having other duties which necessitated his absence at times from the station, and of its being left in charge of incompetent persons. As is usual in such cases, no one knows where the blame should be put for the development of such a serious state of affairs. The Engineer claims, and no doubt rightly, that he is not responsible, as his reports and requests have not been acted upon; while the Water Committee are necessarily an irresponsible and constantly-changing body. It is certain, however, that whoever may be responsible for the neglect of valuable machinery and the starving of the labour-sheet, it is the outcome of a line of policy often pursued in respect of municipalized works, but never in connection with efficiently managed undertakings where the directors regard their duties as a matter of business and public requirement, and not as a question of 'trimming' opinions to catch votes at election time."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Of the year 1895, what shall I write? Generally speaking, it has not been an eventful year for the gas industry. There have been no new discoveries of consequence in the processes or appliances for the manufacture of gas; the labour world has been quiescent, even almost to docility, in all except the engineering trade; prices for nearly all commodities have been moderate, in some instances altogether cheap; and, taken all round, the business passing has been fairly good. Out of these conditions, one would naturally spell prosperity; and I daresay that, unless in the case of anyone who may have been specially circumstanced, there are few who will dispute that the year has been one of increased business, if not of greatly increased profits. The cost of coal—which is the principal factor in determining the price of gas—has not receded from the contract prices of 1894, but rather otherwise; although, as a matter of fact, the staple commodity has been procured at less cost than was the case during the Scotch miners' strike of that year. The price of gas is generally lower than it was then; and the rates obtained for residuals—particularly in the later months—have been disappointingly low. These all affect profits; and it is highly probable that, were balance-sheets made up dealing with the twelve month of 1895, it would be found that in most instances, though the volume of business was very sensibly larger, the amount of surplus revenue was not in proportion. These are, however, but passing features of trade; the increased outputs may be regarded as permanent, and are to be hailed with satisfaction as giving the opportunity for realizing better returns in future periods.

The year opened with the announcement of the result of the Falkirk gas arbitration. The price fixed was a high one, and somewhat staggered the purchasers. But it must be said of them that they soon came to realize that it was neither a ruinous nor an unjust price; and they have since shown their capacity for successfully conducting a gas undertaking by the extensive improvements they have introduced. They have, when labour and materials were cheap, remodelled their principal works. They have also introduced the Peebles process for enrichment, and Hislop's regenerative system of firing, by which they are now able not only to produce gas at less cost, but also to dispense with the smaller of their two works, which is now advertised for sale. Since then there have been several proposals by corporations to acquire the local gas undertakings. The Town Council of Dunfermline have adopted the Burghs Gas Supply Act, and confirmed its adoption; but objection to the step has been made by 20 ratepayers, and a plebiscite is to be taken to settle the question. The Police Commissioners of Millport have adopted the Act; it has been talked of in Largs and Brechin; and a proposal for a transfer of the local Gas Company to the Corporation of Stirling is at present under the consideration of a Committee.

The Town Council of Rothesay have resolved, on account of want of room, to remove their works to a new site which they have secured on favourable terms; and they are about to proceed with the actual work. The removal of the Perth Gas-Works has, for the same reason, become desirable, if not necessary; and the proposal has been seriously entertained, and is likely to be heard of soon again.

Extensions have been carried out at Hamilton, where gas of 24-candle power is being sold at as low a price as 2s. 1d. per 1000 cubic feet; and also at Forfar. At Edinburgh, an important installation of stoking machinery on the Arrol-Foulis system has been introduced at a cost of £6470; and the retort-house has been re-roofed at a cost of £3400. In connection with the Edinburgh works, the chimney, which was the tallest gas-works chimney in the world—being 329 feet high—has been condemned, and is now standing a useless pile; having been superseded by a temporary chimney, which will do duty till the new one is completed.

Of new gasholders, the Corporation of Aberdeen have brought into use one of four million cubic feet capacity, which is the second largest in Scotland, and which, up to the present time, holds the position of having been erected at the cheapest rate per 1000 cubic feet capacity of any large holder in existence—a circumstance which is largely due to the well-directed energy of Mr. A. Smith, the Engineer and Manager. The Corporation of Glasgow are engaged in the erection of a new holder at their Tradeston works, which is to be of slightly less capacity than their six million holder, erected there a year or two ago. The Dumbarton Corporation have also brought into use a new holder, which was constructed to designs by Mr. J. M'Gilchrist, their Engineer and Manager. New holders are being constructed at Hamilton and Gourock, in connection with the latter of which it is notable that it is the first in which the powers of the Amendment Act of 1893, giving the Sheriff of a county authority to dispense with the consent of owners and occupiers of property within 300 yards of the proposed site of a holder, was exercised.

In June, the annual meeting of the Incorporated Gas Institute was held in Edinburgh, under the Presidency of Mr. R. Mitchell, Engineer and Manager of the Edinburgh Gas Works, and proved a highly successful gathering. The North British Association of Gas Managers were no less successful with their annual meeting, which this year was held at Melrose.

The ranks of the brotherhood of gas managers have not, to my recollection, been thinned by death during the year; but a notable figure has passed, or is about to pass, from active work among them, through the resignation by Mr. T. Whimster, of the post of Engineer and Manager to the Perth Gas Commissioners. Mr. Whimster has been for more than 50 years connected with the gas supply of Perth. He goes into retirement with the sympathy and regret of all who knew him. He is succeeded by Mr. Andrew Wilson, son of Mr. T. Wilson, Manager of the Coatbridge Gas Company. Another change took place in the transference of the services of Mr. J. Donaldson from Cambuslang, near Glasgow, to Tonbridge, in Kent.

In the matter of water-works, the most extensive business consisted of the passing, practically unopposed, of an Act empowering the Edinburgh and District Water Trust to take in an augmented water supply from the Talla stream, which is one of the head waters of the River Tweed. The source of supply was only agreed to after several years of agitation; but now that it has been sanctioned, the work is already in progress. The Falkirk and Larbert Water Trust have intimated a Bill for next session of Parliament for the augmentation of the water supply of their district. In Arbroath, the Police Commission adopted a report by Mr. J. Wilson, of Edinburgh, recommending that a gravitation water supply should be procured, in preference to extending their present supply from wells. But the ratepayers, at the municipal election, rejected the supporters of Mr. Wilson's scheme, with the result that the resolution to adopt it has since been rescinded; and it has been resolved to endeavour to get more water by extending the wells and pumping machinery.

Of electric light, it is not necessary to say much. The Edinburgh installation, which was inaugurated at the beginning of April, is claimed to have turned out a great success. Glasgow, Aberdeen, and Dundee already possessed installations of electric lighting; but in neither of them has there been the same success claimed. In Coatbridge, where an electric lighting company laid down plant under the ægis of Lord Kelvin, the motive power for the working of which was to be producer gas, the experiment has proved a failure; and producer gas has been relinquished in favour of steam. I am told this is accounted for by the fact that it takes three times as much producer gas to work an engine as it would require of coal gas. Anyone acquainted with the business can calculate on which side the economy lies. I am not aware of any other new installation of electric lighting than that of Edinburgh. In several places it is spoken of; but there is not at present a single Corporation, except that of Ayr—in which town an installation is all but completed—who are looking seriously at the subject. The Corporation of Paisley have, in fact, resolved to take no action under a Provisional Order which they obtained in 1891, and which must now be held to have lapsed. I had almost forgotten to say that the two insignificant places of Fort William and Pitlochry are probably to be lighted by electricity. But these will not affect the balance much; and there is thus every probability that the gas supply of Scotland will not be greatly changed by anything new in the electric lighting way in 1896.

A curious hitch has occurred in the arrangements for the taking of the plebiscite of the ratepayers of Dunfermline, upon the question of whether or not the Burghs Gas Supply Act should be adopted. The Gas Act, which was passed in 1876—four years subsequent to the passing of the Ballot Act—directs that the poll shall be taken "in the manner prescribed in regard to polls of householders taken with reference to the adoption of the General Police and Improvement (Scotland) Act, 1862." The procedure provided for in the latter statute is open voting; and the hours of polling are from 9 a.m. to 4 p.m. By the Burgh Police (Scotland) Act, 1892, the Act of 1862 and the amending Act of 1868 (which substituted a £4 for a £10 franchise) were repealed; and the question arises whether the procedure which the first measure prescribed is now non-existent. The 1892 Act, however, affords no guidance as to how a plebiscite is to be taken; and it does not repeal the Gas Act. The whole matter has been under the consideration of the Law Committee of the Town Council; and the feeling seems to be that should the modern form of voting be resorted to, objections might be raised and the proceedings invalidated, whereas if the strict letter of the Gas Act were adhered to, a large number of those now qualified to vote in municipal elections would not be allowed to exercise the privilege. It is evident that the 1862 and the 1868 Acts must be read together. But even with the £4 franchise, it would only be male householders whose names appear on the valuation roll—not the voters' roll—who would be entitled to vote. Landlords who are not occupiers, and also ladies, would thus be disfranchised. It has been decided to take the opinion of Mr. J. B. Balfour, Q.C., late Lord Advocate for Scotland, on the subject. The difficulty would appear to arise through the omission to repeal the provision of the Burghs Gas Supply Act of 1876 when the 1892 Act was passed. It does not appear very clear how procedure under the Police Acts of 1862 and 1868, which have been repealed, could be followed. In that case, the machinery for taking the vote under the Act of 1876 having been abolished, it would seem to the lay mind that no vote can be taken; but it is purely a question of law. The most awkward point in the matter is the fact that the 1876 Act did not adopt voting by ballot, which had been in existence for some years; and this seems to point to the fact that the old, and now abolished, form was intentionally retained.

This has been a period of fog and darkness such as I do not remember. The gas consumption for the past month must have been very large. In Glasgow, in the end of last week, there was much fog; and on the morning of last Saturday Mr. Foulis, the Gas Engineer, stated that on the preceding day the output from the city gas stations amounted to 29 million cubic feet—a record output for the Corporation.

There is at present an industrial exhibition being run in the east-end of Glasgow. It is, of course, lighted by electricity; and in connection with the installation there is an important novelty, in respect that the generating plant is driven by gas-engines constructed according to the patent of Messrs. Burt and M'Ghee—the makers being the Acme Engineering Company, of Glasgow. The peculiarity of these engines is that they are coupled direct to the dynamos, and work up to a speed of 380 revolutions per minute, giving a horse power of 150 indicated. They work without a hitch. The engines have four cylinders, each 12 inches in diameter, working a double-throw crank; two cylinders working tandem to each crank. Two of the engines, it is reported, have been ordered by the Belfast Corporation for working electric lighting plant in that city.

The Edinburgh Corporation are in danger of being intoxicated with electricity. This week the Electric Light Committee—who are now the Lighting Committee of the city—agreed to submit to the Council a scheme for the extension of the street lighting installation in various directions; the number of lamps included in it being 135, and the capital cost £2678. This, at £18 per lamp, the sum which it is proposed to charge, means an annual outlay of £2400 for street lighting. There is already a charge of £5000 for this purpose; so that the ratepayers will be called upon to pay over £7000 a year for the lighting of a few thoroughfares, which is just about half what the total lighting of the city by gas cost a few years ago. Only the leading thoroughfares are getting the new light. Of course, residents there secure it largely

at their neighbours' cost; and thus the motto of the Committee would seem to be:—

> Let struggling side-street traders' profits die,
> But, oh! adopt our electricity.

The Committee have given instructions for the removal of the gas-lamps in Princes Street, as being now unnecessary. This may be right enough, though a little risky; but taken along with the fact that there is no mention of any extension of incandescent gas lighting in the streets, I am afraid it points in the direction of there being a degree of one-sidedness in the matter of public lighting which ought not to exist. In Glasgow, the Corporation are increasing the incandescent gas lighting. They have now extended it along the whole length of the important south-side thoroughfare of Eglinton Street. It is evident that they wish to give both systems of lighting fair play, and are prepared to promote the one which is most suitable and most economical.

There is a proposal at present for the extension of the Renfrew Corporation Gas-Works; and in connection with the proposal, the suggestion has been made that, instead of extending them, the Corporation of Glasgow should be approached and asked to supply gas in the town at Glasgow prices. This is next to impracticable. In the first place, it is not likely that the Corporation of Glasgow would undertake to supply gas in an out-township at the same rate as in the city; and, in the next place, there is the capital of the Renfrew gas undertaking—standing, according to the latest return I have, at £5750—which would have to be disposed of. Before the Corporation of Renfrew could give up their exclusive right to supply gas in the burgh, they would either have to wipe out that sum, which would be a loss to the burgh, or the Corporation of Glasgow, before they could acquire right to supply gas in the burgh, would have to take it over—neither of which is probable. If there were a proposal for a general amalgamation, such a scheme might be carried out; but I do not think that is even in the air yet.

The Greenock Gas Trust had the subject of the purchase of coal and oil before them in a somewhat peculiar manner last week. The minutes of the Gas Committee recommended that a Sub-Committee of seven should have power to negotiate for the purchase of coal and oil and the sale of residual products, as the condition of the markets might determine during the year. This was a very large order on the confidence of the Corporation; and it was naturally opposed. Instead, however, of meeting the innovation with a direct front, the opposing proposal was merely that the Sub-Committee should have power to make inquiry about coal and oil, and to report; and that they have the control of the sale of residual products. The proposal of the Committee was adopted by nine votes to seven; but there was a good deal of confusion among the members—so much, indeed, that seven of them declined to vote—and notice of a motion to rescind the appointment of the Sub-Committee was given. The motion should certainly be rescinded. It is not, generally speaking, a workable scheme. It might do with the present Sub-Committee; but before a year elapses there might be a change in the composition of the Sub-Committee, and the scheme gives too much power into the hands of a practically irresponsible Committee to be safe.

The income from the sale of the gas residuals made at the gas-works of the Glasgow Corporation shows a very decided falling-off in the present financial year, which began on June 1, 1895. During the five months ending Oct. 31, the revenue from residual products amounted only to £50,995, as compared with £60,056 in the corresponding five months of the financial year 1893-4. These figures prove that the decrease of revenue at Oct. 31 amounted to £9061. If the same rate of decrease goes on over the whole of the current financial year, there may be a falling off in revenue from this source of income of something like £20,000 when the next balance is made up by the Treasurer.

The gas-works at Earlston are after all likely to be acquired by the Police Commissioners. The owners of the works and the Commissioners appeared to have difficulty in coming to terms; but it is now announced that the owners are prepared to sell at £750, and that the Commissioners are to make an effort to accept the offer. The works were to have been closed on the 31st inst.; but if an agreement be come to, as is likely, the gas supply will be continued.

The Gas and Electric Lighting Committee of the Aberdeen Town Council met on Tuesday, and opened twelve tenders for the supply of an engine and exhausters for the gas-works. The offers were remitted to Mr. Smith, the Manager, for a report. Two days later the Commttee met and agreed to let the contract to Mr. G. Waller, of London, at the price of £584. It was reported that sanction had been given to the Committee by the Secretary for Scotland for further borrowing powers in connection with the electric lighting installation of the Corporation. They are evidently in want of money there, particularly in the matter of public lighting, which, as in Glasgow, is not so good as it might be. The Corporation are adopting the method, as an experiment in one or two streets, of stringing the arc lamps across the roadway; but I do not expect that this will improve matters. The lamps are too far apart; but, worse than that, they are not very effective for street lighting. There is too much darkness on the under side of the globe—nearly one-third of the whole diameter, I should say, is dark—which has the result of making only one or two degrees of the circle give out effective lighting. The remaining upper part of the globe is quite bright; but the light is lost in space. The inhabitants, I presume, pay for the lighting of their own streets, and not of other worlds; and I am not surprised that there should be dissatisfaction with the street lighting.

The Arbroath Town Council met in committee yesterday to consider the representations made to them last week by representatives of the £3500 Harbour bondholders. After discussion, the meeting instructed the Town Clerk to reply to Messrs. Miln and Dalgarno, as representing the bondholders, that they did not at present see their way to do anything in regard to the bonds or the interest thereon. If further action is to be taken, therefore, it must be in the Law Courts.

Balmoral Castle is to be lighted by electricity, for which the electricians may well say "let us be truly thankful." Hitherto Royal favour has not leaned in the direction of the latest gift of Providence to the gas-ruined population of these isles; and it may be that when Mr. W. H. Preece a year or two ago announced that electricity was to be the poor man's light, he did so in despair of nobbling the wealthy. Now, however, that the Sovereign has come to their aid, who is prepared to say what amount of advertisement her action will be made to carry? The motive power is to be derived from a tributary of the Dee, named the Gelder; and as the Court does not reside at Balmoral during the winter months, the arrangement will be quite feasible, as the works will not be interfered with by frost during Her Majesty's stay. In the meantime, it is only the ball-room which is to be lighted by electricity, at a cost of about £1400; but it is said—and here the old feature of the electric light man shines out—"ultimately, no doubt, all the rooms of the Castle will be supplied."

Another great announcement on the same subject comes from Pitlochry. I stated a week or two ago that Professor George Forbes, the hero of the Niagara Falls electric adventure, had formulated a scheme for the lighting of the village of Pitlochry with electricity generated by some of the natural waterfalls in the neighbourhood; and that it was hoped that the local Gas Company would take up the scheme. The Company have considered it, which is scarcely credible; but then one does not know all the local circumstances. The Directors met the other day, and resolved to give Professor Forbes a retaining fee of £50 to show his plans. The proposal is to utilize the Falls of Tummel to drive a turbine of 200-horse power; and the expectation is that the whole scheme will be completed for £2000. The immensity of the scheme does not make anyone stand aghast; but the proposal that the residents in Pitlochry should interfere with the Falls of Tummel is a little disturbing. What would Pitlochry be without its falls? To take them away would seem to be something like "killing the goose that lays the golden eggs;" but the pity is that the unsophisticated will not find that out till the egg is gone.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 28.

Sulphate of Ammonia.—Throughout the week, the market has been quiet; but there has been a fair amount of buying, and prices have been about maintained. The quotations are £8 10s. to £8 12s. 6d. f.o.b. at the ports. In the forward position, there has been considerable inquiry; but, notwithstanding the low prices quoted, buyers do not seem keen of operating. No doubt the low range of prices of all nitrogenous and ammoniacal material has much to do with the attitude of buyers towards sulphate of ammonia; but it should be pointed out that sulphate of ammonia is relatively the cheapest, and should be well worth attention. White nitrate of soda works out at over 8s. per unit on the ammonia basis, but sulphate is only worth about 7s. per unit; thus showing a substantial margin in favour of the latter.

Nitrate of Soda is steady at 7s. 7½d. per cwt. for ordinary quality, and 7s. 9d. per cwt. for refined. The position of cargoes afloat is unchanged.

LONDON, *Dec.* 28.

Tar Products.—This market is quite demoralized by the holidays. Very little new business has transpired; and the tendency of buyers is to wait until the turn of the year before concluding forward purchases. Benzols do not retain their briskness, and are quoted weaker. Solvent naphtha is in steady demand; and there is considerable inquiry for crude naphtha, and, in one or two instances, high prices have been paid for forward contracts, evidently in the hope that benzols will yet see higher values. This is somewhat unlikely, as, though the advance in price has not yet deterred gas manufacturers from continuing the use of benzol for the enriching of gas—as, even with the increased price of benzol, its use does not cost more than 1d. per candle, which makes it still the cheapest enricher—the season will soon be over; and the German production is being largely increased from coke-ovens. There is still a good inquiry for carbolic acid, both liquid and crystals. Anthracene is firm, but other products are somewhat neglected.

The following prices have been obtained during the week: Tar, 18s. 6d. to 24s. Pitch, nominal, 33s. 6d., west coast; 37s., east coast. Benzols, nominal, 90's, 2s. 3d.; 50's, 2s. Solvent naphtha, 1s. 4d. for shipment; 1s. 6d. for home consumption. Toluol, 1s. 10d. Crude 30 per cent. naphtha, 10d. Creosote, 1¼d. Naphthalene, pressed, 45s.; drained, 27s. 6d. Cresylic acid, 1s.; crude, 10d. Carbolic acid, 60's, 1s. 9d.; 75's, 2s. Anthracene, "A," 1s.; "B," 9d. to 10½d. The prices here quoted are usually subject to discount.

Sulphate of Ammonia continues weak; and the market is entirely in the hands of buyers. Sales have been made during the week at the following rates: Beckton, £9; London, outside makes, £8 12s. 6d.; Hull, Leith, and other east-coast ports, £8 11s. 3d.; west-coast ports, £8 10s. to £8 12s. 6d., less 3½ per cent. f.o.b.; while the value of gas liquor is taken at 6s. to 7s. per ton for 10-oz. liquor.

THE LANCASHIRE COAL TRADE DURING 1895.

(From Our Own Correspondent.)

Perhaps the most noticeable feature in the coal trade of Lancashire during the past year has been the exceptionally low point to which prices for all the poorer qualities of round coal have fallen. This has been owing to the excessive supplies offering in the market, notwithstanding the pits generally have been working shorter time than has been known for a good many years past. The inferior descriptions of round coal have not been so low for the last eight or ten years; and common coal pits during the greater part of the year have scarcely been working half time—many of them not more than two to three days per week. The higher qualities, suitable for house-fire purposes, have relatively scarcely been in any better position; prices for these having also ruled very low all through the year—commencing on the basis of about 10s. 6d. to 11s. per ton for best Wigan Arley; 9s. 6d. to 10s. for Pemberton four-feet and seconds Arley; and 7s. 6d. to 8s. for common house-fire coals. They improved upon these figures about 6d. per ton during the exceptionally severe weather which characterized the first

three months of the year. The ensuing summer, however, with a marked (almost complete) absence of demand for house-fire purposes, brought prices down quite 1s. per ton below these figures; and although there was some recovery with the opening of winter inquiries, the year closed with best Wigan Arley not averaging more than 10s. to 10s. 6d. per ton, Pemberton four-feet and seconds Arley 9s. to 9s. 6d., and common house-fire qualities 7s. to 7s. 6d.—or about 6d. below even the exceptionally low figures ruling at the opening of the year. The very unsatisfactory state of the house-fire coal trade, coupled with the excessively low prices which colliery proprietors had to take to effect clearances of the inferior qualities of round coal, necessarily very early on in the year induced considerable anxiety on the part of colliery owners with regard to the usual gas-coal and locomotive fuel contracts. Last year a sort of combination was attempted, with a view of settling some basis for prices, and thus preventing undue competition for these contracts. But the arrangement proved altogether a failure—some of the leading colliery owners complaining that it had only been made use of to keep them out of many of the contracts. This year one or two of the largest Lancashire colliery concerns evidently determined that they would run no risk of being cut out of this season's contracts; and when inquiries for gas contracts began to appear in the market during April, it was at once manifest that there was to be an exceedingly keen competition to secure them. At the very outset, tenders were sent in based upon reductions of 1s. to 1s. 3d. per ton upon the prices which were ruling for the previous year's contracts. One or two contracts were placed on the basis of 6s. 6d. per ton at the pit for good screened Wigan four-feet, and 7s. to 7s. 3d. for partially screened Arley. But as the season progressed, prices were gradually cut down until the average basis on which contracts were placed represented about 6s. to 6s. 3d. per ton for Wigan four-feet, and 6s. 6d. to 6s. 9d. for partially screened Arley. One or two important contracts which were placed late on in the season were accepted at about 3d. per ton under even these very low figures, which represented a giving way of quite 1s. 6d. upon the prices obtained last year, which ranged from about 7s. per ton for the commoner, to 8s. and 8s. 6d. for the better qualities of screened gas coal. Locomotive fuel contracts were this year settled at about 6d. under last season's prices; the average basis being 6s. 3d. per ton at the pit mouth. In the common qualities of round coal, suitable for iron-making, steam, and general manufacturing purposes, except that the extra pressure during the first three months for house-fire consumption helped to take off the market some of the surplus supplies, steam and forge coals have all through the year continued a complete drug, with prices, as already stated, touching perhaps the lowest point since 1886-7. During the earlier part of the year, common round coals were fetching from 6s. 6d. to 7s. per ton at the pit; but with the falling off in requirements for house-fire consumption, and only a very limited demand for general manufacturing purposes, the excessive supplies offering in the market compelled sellers to take exceedingly low prices to effect clearances. Upon ordinary inland sales it became difficult to get more than 6s. per ton at the pit for good qualities of steam and forge coal; while for shipping orders, 5s. 6d. was readily taken, with needy sellers in some cases at as low as 5s. per ton. Even the revival of activity in the iron trade and other branches of industry during the latter part of the year, has had no really appreciable effect in improving the position as regards the lower qualities of round coal; the increasing requirements for manufacturing purposes having so far only very partially overtaken the excessive output. With the close of the year, 6s. to 6s. 6d. per ton at the pit still represent about the average figures for inland sales of good qualities of steam and forge coals, with 5s. 6d. to 6s. very generally taken for shipment. With regard to engine classes of fuel, the better qualities of slack—supplies of which have necessarily fluctuated with the demand for round coal—have been fairly steady; 4s. 6d. to 5s. per ton at the pit mouth representing an average basis, from which there has been comparatively little variation. For the commoner sorts, however, prices have been irregular. At the commencement of the year, about 3s. 6d. to 3s. 9d. and 4s. per ton was obtained for ordinary common slack; but with plentiful supplies coming upon the market, very low prices were in many cases taken for contracts, and there were sellers in the market at as low as 2s. 9d. to 3s. per ton. The closing pit-prices were from about 3s. per ton for inferior, to 3s. 6d. for good, ordinary Lancashire slack.

COAL TRADE REPORTS.

From Our Own Correspondents.

Northern Coal Trade.—The week has been broken by the holidays; but the effect has been to lessen the production, and to allow a fuller demand to accumulate, so that the work at the pits has been better. In steam coal, there is not yet full work generally; but the position is a little better than it was. The price of best Northumbrian steam coal is still 8s. per ton f.o.b.; and steam smalls are 3s. 9d. There are now negotiations for contracts for the next few months; but it is rather doubtful what the rates really will be. Household coals meet with a steady demand; but it is below that which is usual at this time of the year. For shipment, the price varies from 10s. to 11s. per ton f.o.b. In gas coals, the deliveries continue at their highest point; and most of the collieries are fully at work, with a demand that will tax the output for a month or so to come. For single cargoes, the price is still 6s. 6d. to 7s. per ton f.o.b. Smithy coals meet just at present with only a moderate inquiry; and manufacturing coals are dull, several of the factories being idle for a fortnight, as is frequently the case here at the holidays. In other branches of the coal trade, there are not many alterations to notice. Coke is very steady; and for export the price ranges from 14s. 6d. to 14s. 9d. per ton f.o.b. There is a rather better demand for coke from the north-western furnaces; and the local consumption is above the average. Coke makers here are therefore fully employed; and the price is a little better than it was a few months ago. Gas coke is steady, and several large contracts for sales to manufacturers have been made over next year, at prices which are substantially the same as those that ruled the present contracts. The facility for shipping gas coke to the Continent is one reason why the makers here command good prices.

Scotch Coal Trade.—Trade has been quiet, so many workmen being idle on account of the engineers' strike in the west leading to longer holidays being taken or enforced. Prices remain unaltered. Shipments last week amounted to 146,548 tons—an increase as compared with the quantity in the preceding week of 9577 tons, and as compared with the corresponding week of last year of 11,898 tons. For the year to date, the total shipments have amounted to 7,329,832 tons—an increase over the quantity last year of 2,080,835 tons.

Increased Carbonizing Plant at the Torquay Gas-Works.—A new retort-house, which increases the manufacturing capacity of the carbonizing plant by nearly 50 per cent., has just been erected at the works of the Torquay Gas Company at Hollacombe. Coal-breaking and charging and drawing machinery has been introduced, with the result that a great saving in manual labour has been effected. The Company also contemplate the introduction of prepayment meters.

The Public Lighting of Brighton.—At the last meeting of the Brighton Town Council, a resolution was passed instructing the Town Clerk to inform the Brighton and Hove Gas Company of the intention of the Council to determine on the 30th of June next the existing agreement for the lighting by gas of the public lamps in the borough, and authorizing him to enter into negotiations with the Company for a new agreement, reserving power to the Council to discontinue the lighting of any lamps on a month's notice being given at any time.

The Middlesex County Council and the Southwark and Vauxhall Water Bill.—Our readers may remember that, among the notices of intended applications to Parliament which appeared in the JOURNAL on the 3rd inst., there was one of a Bill, to be promoted by the Southwark and Vauxhall Water Company to empower them to construct two new pumping-stations at Harefield, which will be connected with conduits to and through this and other villages as far as Richmond Bridge, at which point the Company's main crosses the Thames. The conduit will be 16 miles long. The Middlesex County Council view this project with alarm; and they are going to join the London County Council in opposing it. The Parliamentary Committee of the Middlesex Council declare that the object of the Bill is to "convey Middlesex water into Surrey;" and they feel that, if the scheme is carried into effect, the Thames will be frequently dry. Sir F. Dixon Hartland, M.P., characterizes the Bill as the worst he has seen.

The Public Lighting Contract at Canterbury.—At the last meeting of the Canterbury Town Council, the question of the gas lighting contract again came up for discussion; the Canterbury Gas and Water Company having refused to defray the cost of placing twenty meters on lamps in various parts of the city. The Committee now recommended that the meters should be furnished and erected by the Corporation. Alderman Cross said this would entail a cost of £4 17s. 6d. per meter; and he strongly objected to such an expense being incurred, more especially as it was only a few years ago that £700 (of which the Gas Company paid £400) was expended on meters which had now been taken away. He contended that the Corporation were paying too much for gas, and said he relied on figures supplied by the City Surveyor in respect of the charges in other towns of similar size. Alderman Hart said the Secretary of the Gas Company had informed him that the figures were fallacious and incorrect. The Surveyor said he would risk his reputation on their correctness. Eventually, Mr. Lukey proposed, Mr. Sanderson seconded, and it was resolved, that the tender of the Company for £3 10s. per lamp be accepted; the burners to be equal to consuming 5 feet of gas per hour. The old contract was £3 12s. per lamp.

Abolition of Soot by Gas-Stoves: A Sweep's Complaint.—One of the most remarkable results in connection with the enormous extension of the prepayment meter system in large towns, is the present scarcity of soot. Where people burn gas to a large extent for heating and cooking purposes, there has necessarily been a decrease in the consumption of coal and other soot-producing fuel—to the benefit, of course, of the householder and to the public at large, but to the sorrow of the coal-dealer and the chimney-sweep. Indeed, one of the latter fraternity in the South-East of London puts to the credit of "penny-in-the-slot" meters the loss of more than half his trade. He asserts that whereas about this period of the year he could sell at least 500 sacks of soot for agricultural purposes, he is not now able to supply more than 50 or 60 sacks; so that he will have considerable difficulty in fulfilling the contracts he entered into when soot was almost too plentiful, because it "let down" the prices to a very low point. He anticipates that next year will be much worse, because many people have had their chimneys swept several times this year who will henceforward only require the services of the sweep about once a year; while the quantity of soot obtained per chimney per annum will not be equal to what was obtained in a single sweeping (four times a year) prior to the increase in the number of users of gas-stoves.

The Public Lighting of Crayford.—At the last meeting of the Crayford District Council, the Clerk reported that the West Kent Gas Company had offered to light the public thoroughfares all night at a cost of £4 2s. 6d. per lamp per annum, and erect standards at £3 each—this sum to include the provision of mains and service-pipes where necessary. The Chairman proposed that this offer be accepted. Mr. Miles seconded the motion. Mr. Battison moved that the matter be referred to the Lighting Committee, as he did not think the Company had quoted a reasonable rate; their tender for erecting the columns being £25 above any of the other tenders. Mr. Peill seconded the amendment. Mr. Brewer asked if the Lighting Committee had considered the question of oil lighting. The Chairman replied that oil lighting was too antiquated and inconvenient. Mr. Brown said the Committee had considered the various systems of lighting very carefully and minutely; and they could not recommend oil. Mr. Miles said all the members knew that in the neighbouring town of Erith they had oil lighting. At Erith, the oil lamps went out on windy nights; and the place was practically in darkness. Indeed, when the oil-lamps were at their best they only served to make the darkness more visible, for they could scarcely be seen from one to another. In the end, the motion was carried; there being only two votes against it.

Another Trial of the Yeadon Retort at Leeds.—At their last meeting, the Leeds Corporation Gas Committee decided to have another series of trials with the Yeadon revolving retort, to further test its advantages for distilling coal, and also for revivifying gas lime.

The Illuminating Power of Leeds Gas.—At a recent meeting of the Leeds Corporation Gas Committee, a letter was read from the Clerk to the Justices calling attention, at the request of the Justices' Committee, to the low illuminating power of the gas for the past month, according to the report of Mr. Buckley, the Inspector. The Committee decided to send to the Magistrates a copy of Mr. Fairley's report upon the illuminating power, giving more satisfactory results of tests for the same period.

The Purchase of the Clonmel Gas-Works by the Corporation.—At an extraordinary meeting last week of the Clonmel Corporation, a resolution was proposed sanctioning an application by the Parliamentary Committee to the Provincial Bank for a loan of £14,000 for the purchase of the gas-works; the money to be advanced by way of overdraft, bearing interest at the rate of 4 per cent. Alderman Higgins said he was glad this business, which was of great importance to the town, was being completed in such a satisfactory manner. All that remained to be done was to get the deed of transfer executed; and the Corporation could go into possession. The resolution was passed unanimously.

Cromer Gas Company.—The annual general meeting of this Company was held on Monday last week—Mr. G. Breeze in the chair. The accounts showed a profit of £631, as compared with £688 last year. Taking into account the diminution of income caused by the reduction in the charge for gas and the lower price received for residuals, and by the expenditure of £100 in the enlargement of existing mains, the Directors considered the year's results contrasted favourably with those of the previous twelve months. The profit added to the outstanding balance brought up the total of the profit and loss account to £1024; and, after the transfer of £200 to the reserve fund, and the payment of bank interest and the interest on debenture stock, there remained a balance of £678, from which the Directors recommended the payment of a dividend at the rate of 6 per cent. per annum free of income-tax, leaving a balance of £258. The Chairman said the reduction in the price of gas had cost them one-twelfth of their income; and, under such circumstances, it was very satisfactory that they were able to recommend a dividend of 6 per cent. They thought the time had come for the enlargement of the trunk main to the town; and it was proposed to carry out the work in the coming spring. He moved the adoption of the report; and it was unanimously agreed to.

The Progress of the Hinckley Gas Undertaking.—In the brief announcement which appeared last week of the advance in the salary of Mr. G. Helps, the Manager of the Hinckley Gas-Works, we did not give him all the credit which is his due for the progress made in the gas undertaking of the District Council in the short time he has been connected with it. The extent of this progress will be shown by the following figures: In the year ending Sept. 30, 1893, the quantity of gas sold was 30,018,000 cubic feet, of the net value, in round figures, of £5155; and there was a sum of £522 arrears outstanding. In the year ending Sept. 30 last, the sales reached 39,277,000 cubic feet (a rise of 9,259,000 feet), of the net value of £6725; while the arrears had been brought down to £279. The revenue had in the two years increased by £1568, while the arrears had been reduced by £243. But this is not all. In the first-named year, the net value of the residual products, &c., sold was £1775; and the arrears amounted to £806. At the end of September last, their net value was £2213; while the arrears were only £178—a rise in the one case of £438, and a fall in the other of no less than £628. The Gas Committee had these figures before them when the decision was come to to recognize in a substantial manner the good management which had produced them.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1340.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Oct.	10½	Alliance & Dublin 10 p. c.	10	22½—23½	..	4 9 5
100,000	10	"	7½	Do. 7 p. c.	10	16½—17½	..	4 5 8
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107—109	..	4 11 9
200,000	5	14 Nov.	6½	Bombay, Limited	5	6¾—7¼	..	4 9 8
40,000	5	"	6½	Do. New	4	5—5½	..	4 14 7
380,000	Stck.	14 Aug.	12	Brentford Consolidated	100	268—273	..	4 7 11
180,000	"	"	9	Do. New	100	210—215	..	4 3 9
220,000	Stck.	27 Sept.	11	Brighton & Hove Original	100	227—232	..	4 14 10
933,500	Stck.	29 Aug.	5	Bristol	100	124—126	..	3 18 1
320,000	20	27 Sept.	11½	British	20	54½—55½	..	4 1 1
50,000	10	29 Aug.	11½	Bromley, Ordinary 10 p. c.	10	22½—23½	..	4 17 10
51,510	10	"	8½	Do. 7 p. c.	10	19—20	..	4 5 0
328,750	10	14 Nov.	4	Buenos Ayres (New) Limited	10	7¼—8¼	..	4 17 1
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	102—104	..	5 15 5
150,000	20	11 July	8½	Cagliari, Limited	20	30—32	..	5 3 3
550,000	Stck.	16 Oct.	13½	Commercial, Old Stock	100	323—326	..	4 2 4
165,000	"	"	10½	Do. New do.	100	251—255	..	4 2 4
160,762	"	16 Dec.	4½	Do. 4½ p. c. Deb. do.	100	147—152	..	2 19 2
800,000	Stck.	15 Dec.	13	Continental Union, Limited.	100	263—268	−5	4 17 0
200,000	"	"	10	Do. 7 p. c. Pref.	100	210—215*	..	4 13 0
535,000	Stck.	29 Aug.	5½	Crystal Palace Ord. 5 p. c. Stk	100	127—132	..	3 19 6
486,090	10	26 July	11	European, Limited	10	25½—26½	..	4 3 0
351,060	10	"	11	Do. Partly paid	7½	17—18	..	4 14 3
5,646,590	Stck.	14 Aug.	12¾	Gaslight & Coke, A, Ordinary	100	295—300	..	4 5 0
100,000	"	"	4	Do. B, 4 p. c. max.	100	107—112	..	3 11 5
665,000	"	"	10	Do. C, D, & E, 10 p. c. Pf.	100	287—292	..	3 8 6
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	135—140	..	3 11 5
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	200—205	..	3 13 2
1,300,000	"	"	7	Do. H, 7 p. c. max.	100	193—198	..	3 10 9
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	287—292	..	3 8 6
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	169—173	..	3 9 4
1,061,150	"	16 Dec.	4	Do. 4 p. c. Deb. Stk.	100	135-140*	..	2 17 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	145-150*	..	3 0 0
908,000	"	"	6	Do. 6 p. c. do.	100	200-205*	..	2 18 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	232—236	−1½	5 1 8
75,000	5	16 Dec.	6	Malta & Mediterranean, Ltd.	5	6—6½*	..	4 12 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	113—116	..	4 6 2
541,920	20	14 Nov.	5	Monte Video, Limited	20	16½—17½	..	5 14 3
150,000	5	28 Nov.	8	Oriental, Limited	5	7¼—8¼	..	4 16 11
60,000	5	12 Sept.	7	Ottoman, Limited	5	5—5½	..	6 7 3
166,870	10	14 Feb	2	Para, Limited	10	1¼—1¾	..	11 8 6
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	105—110	..	5 9 1
500,000	100	9 Dec.	6	2nd Do.	100	100—105	..	5 14 3
150,000	10	10 Oct.	7	San Paulo, Limited	10	11—12	..	5 16 8
500,000	Stck.	29 Aug.	15½	South Metropolitan, A Stock	100	377—382	+2	4 1 2
1,350,000	"	"	12	Do. B do.	100	308—313	..	3 16 8
308,685	"	"	13	Do. C do.	100	325—330	..	3 18 9
800,000	"	11 July	5	Do. 5 p. c. Deb. Stk.	100	175—178	..	2 16 2
60,000	Stck.	12 Sept.	11½	Tottenham & Edm'nton, "A"	100	250—255	..	4 10 2
				WATER COMPANIES.				
746,021	Stck.	26 June	10¾†	Chelsea, Ordinary	100	297—302	..	3 7 10
1,719,514	Stck.	16 Oct.	7	East London, Ordinary	100	215—220	..	3 3 7
654,740	"	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	157—162	..	2 15 6
700,000	50	16 Dec.	6½	Grand Junction	50	112 117*	+2½	2 15 6
708,000	Stck.	29 Aug.	12†	Kent	100	310—315	..	3 16 2
1,043,800	100	26 June	7½†	Lambeth, 10 p. c. max.	100	247—252	..	2 17 8
406,200	100	"	7½	Do. 7½ p. c. max.	100	210—215	..	3 7 6
330,000	Stck.	27 Sept.	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
500,000	100	14 Aug.	12⅞	New River, New Shares	100	380—390	..	3 3 7
1,000,000	Stck.	26 July	4	Do. 4 p. c. Deb. Stk.	100	143—148	..	2 14 2
902,300	Stck.	16 Dec.	6	S'thwk & V'xhall, 10 p. c. max.	100	150—155*	..	3 17 5
126,500	100	"	6	Do. D 7½ p. c. do.	100	139—142*	..	4 4 6
1,155,066	Stck.	16 Dec.	10	West Middlesex	100	283—293*	..	3 8 3

*Ex div.

† Next dividend will be at this rate.

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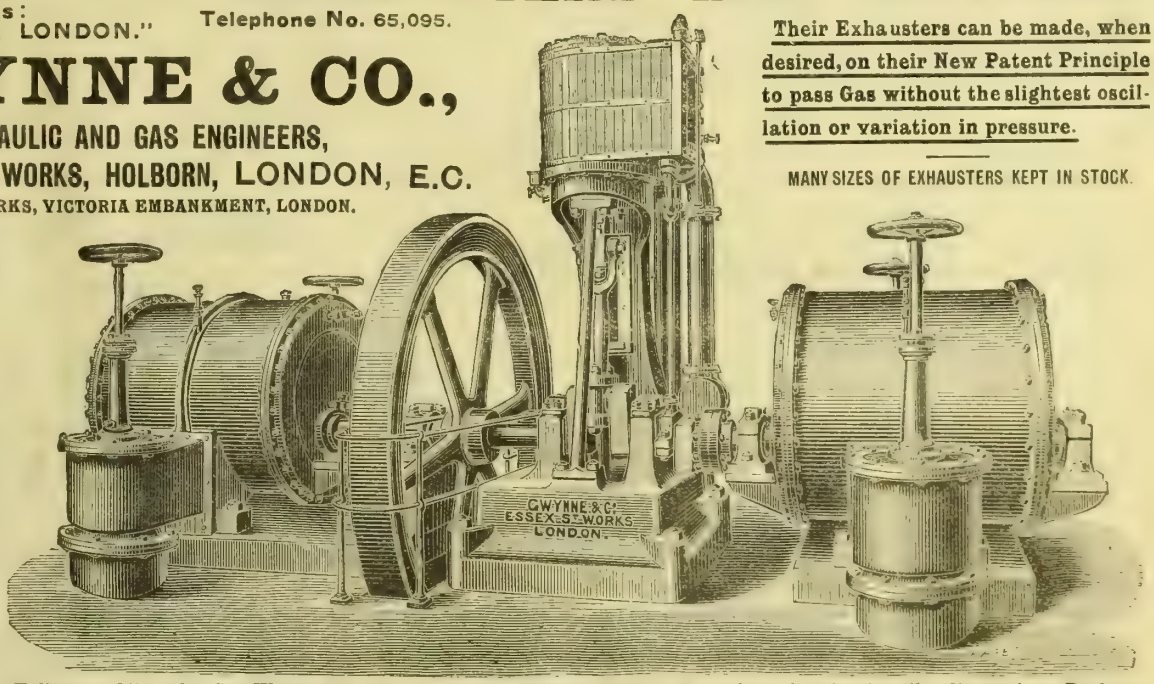

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Wellington, Salop,
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